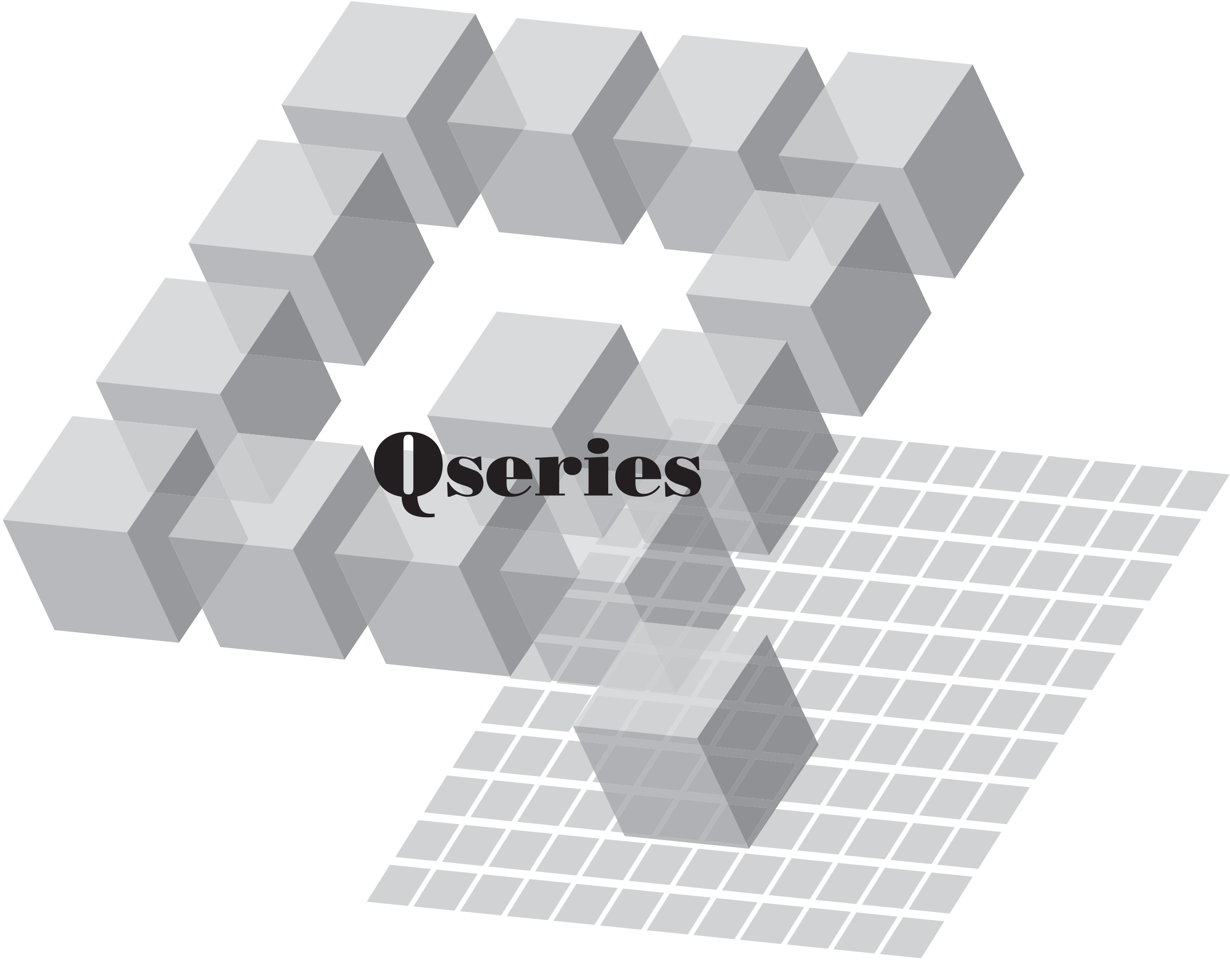
MITSUBISHI

Mitsubishi Programmable Controller

MELSEC Q series

MELSEC-Q QD77MS Simple Motion Module User's Manual

Positioning Control



MODEL
-QD77MS2
-QD77MS4
-QD77MS16

● SAFETY PRECAUTIONS ●

(Please read these instructions before using this equipment.)

Before using this product, please read this manual and the relevant manuals introduced in this manual carefully and pay full attention to safety to handle the product correctly. The precautions given in this manual are concerned with this product only.
Refer to the Users manual of the CPU module to use for a description of the PLC system safety precautions.
In this manual, the safety instructions are ranked as "DANGER" and "CAUTION".

⚠DANGER	Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury.
⚠CAUTION	Indicates that incorrect handling may cause hazardous conditions, resulting in medium or slight personal injury or physical damage.

Depending on circumstances, procedures indicated by ⚠ CAUTION may also be linked to serious results.
In any case, it is important to follow the directions for usage.

Please save this manual to make it accessible when required and always forward it to the end user.

For Safe Operations

1. Prevention of electric shocks

⚠DANGER

- Never open the front case or terminal covers while the power is ON or the unit is running, as this may lead to electric shocks.
- Never run the unit with the front case or terminal cover removed. The high voltage terminal and charged sections will be exposed and may lead to electric shocks.
- Never open the front case or terminal cover at times other than wiring work or periodic inspections even if the power is OFF. The insides of the module and servo amplifier are charged and may lead to electric shocks.
- Completely turn off the externally supplied power used in the system before mounting or removing the module, performing wiring work, or inspections. Failing to do so may lead to electric shocks.
- When performing wiring work or inspections, turn the power OFF, wait at least ten minutes, and then check the voltage with a tester, etc. Failing to do so may lead to electric shocks.
- Be sure to ground the module, servo amplifier and servomotor (Ground resistance: 100 Ω or less). Do not ground commonly with other devices.
- The wiring work and inspections must be done by a qualified technician.
- Wire the units after installing the module, servo amplifier and servomotor. Failing to do so may lead to electric shocks or damage.
- Never operate the switches with wet hands, as this may lead to electric shocks.
- Do not damage, apply excessive stress, place heavy things on or sandwich the cables, as this may lead to electric shocks.
- Do not touch the module, servo amplifier, servomotor connector or terminal blocks while the power is ON, as this may lead to electric shocks.
- Do not touch the built-in power supply, built-in grounding or signal wires of the module and servo amplifier, as this may lead to electric shocks.

2. For fire prevention

⚠CAUTION

- Install the module, servo amplifier, servomotor and regenerative resistor on incombustible. Installing them directly or close to combustibles will lead to fire.
- If a fault occurs in the module or servo amplifier, shut the power OFF at the servo amplifier's power source. If a large current continues to flow, fire may occur.
- When using a regenerative resistor, shut the power OFF with an error signal. The regenerative resistor may abnormally overheat due to a fault in the regenerative transistor, etc., and may lead to fire.
- Always take heat measures such as flame proofing for the inside of the control panel where the servo amplifier or regenerative resistor is installed and for the wires used. Failing to do so may lead to fire.
- Do not damage, apply excessive stress, place heavy things on or sandwich the cables, as this may lead to fire.

3. For injury prevention

⚠CAUTION

- Do not apply a voltage other than that specified in the instruction manual on any terminal. Doing so may lead to destruction or damage.
- Do not mistake the terminal connections, as this may lead to destruction or damage.
- Do not mistake the polarity (+ / -), as this may lead to destruction or damage.
- Do not touch the heat radiating fins of module or servo amplifier, regenerative resistor and servomotor, etc., while the power is ON and for a short time after the power is turned OFF. In this timing, these parts become very hot and may lead to burns.
- Always turn the power OFF before touching the servomotor shaft or coupled machines, as these parts may lead to injuries.
- Do not go near the machine during test operations or during operations such as teaching. Doing so may lead to injuries.

4. Various precautions

Strictly observe the following precautions. Mistaken handling of the unit may lead to faults, injuries or electric shocks.

(1) System structure

⚠CAUTION

- Always install a leakage breaker on the module and servo amplifier power source.
- If installation of an electromagnetic contactor for power shut off during an error, etc., is specified in the instruction manual for the servo amplifier, etc., always install the electromagnetic contactor.
- Install the emergency stop circuit externally so that the operation can be stopped immediately and the power shut off.
- Use the module, servo amplifier, servomotor and regenerative resistor with the correct combinations listed in the instruction manual. Other combinations may lead to fire or faults.
- Use the CPU module, base unit, and Simple Motion module with the correct combinations listed in the instruction manual. Other combinations may lead to faults.
- If safety standards (ex., robot safety rules, etc.,) apply to the system using the module, servo amplifier and servomotor, make sure that the safety standards are satisfied.
- Construct a safety circuit externally of the module or servo amplifier if the abnormal operation of the module or servo amplifier differs from the safety directive operation in the system.
- In systems where coasting of the servomotor will be a problem during the forced stop, emergency stop, servo OFF or power supply OFF, use dynamic brakes.
- Make sure that the system considers the coasting amount even when using dynamic brakes.
- In systems where perpendicular shaft dropping may be a problem during the forced stop, emergency stop, servo OFF or power supply OFF, use both dynamic brakes and electromagnetic brakes.
- The dynamic brakes must be used only on errors that cause the forced stop, emergency stop, or servo OFF. These brakes must not be used for normal braking.
- The brakes (electromagnetic brakes) assembled into the servomotor are for holding applications, and must not be used for normal braking.

⚠CAUTION

- The system must have a mechanical allowance so that the machine itself can stop even if the stroke limits switch is passed through at the max. speed.
- Use wires and cables that have a wire diameter, heat resistance and bending resistance compatible with the system.
- Use wires and cables within the length of the range described in the instruction manual.
- The ratings and characteristics of the parts (other than module, servo amplifier and servomotor) used in a system must be compatible with the module, servo amplifier and servomotor.
- Install a cover on the shaft so that the rotary parts of the servomotor are not touched during operation.
- There may be some cases where holding by the electromagnetic brakes is not possible due to the life or mechanical structure (when the ball screw and servomotor are connected with a timing belt, etc.). Install a stopping device to ensure safety on the machine side.

(2) Parameter settings and programming

⚠DANGER

- Set the parameter values to those that are compatible with the module, servo amplifier, servomotor and regenerative resistor model and the system application. The protective functions may not function if the settings are incorrect.
- The regenerative resistor model and capacity parameters must be set to values that conform to the operation mode and servo amplifier. The protective functions may not function if the settings are incorrect.
- Set the mechanical brake output and dynamic brake output validity parameters to values that are compatible with the system application. The protective functions may not function if the settings are incorrect.
- Set the stroke limit input validity parameter to a value that is compatible with the system application. The protective functions may not function if the setting is incorrect.
- Set the servomotor encoder type (increment, absolute position type, etc.) parameter to a value that is compatible with the system application. The protective functions may not function if the setting is incorrect.
- Use the program commands for the program with the conditions specified in the instruction manual.
- Set the sequence function program capacity setting, device capacity, latch validity range, I/O assignment setting, and validity of continuous operation during error detection to values that are compatible with the system application. The protective functions may not function if the settings are incorrect.

⚠DANGER

- The input devices and data registers assigned to the link will hold the data previous to when communication is terminated by an error, etc. Thus, an error correspondence interlock program specified in the instruction manual must be used.
- Use the interlock program specified in the intelligent function module's instruction manual for the program corresponding to the intelligent function module.

(3) Transportation and installation

⚠CAUTION

- Transport the product with the correct method according to the mass.
- Use the servomotor suspension bolts only for the transportation of the servomotor. Do not transport the servomotor with machine installed on it.
- Do not stack products past the limit.
- When transporting the module or servo amplifier, never hold the connected wires or cables.
- When transporting the servomotor, never hold the cables, shaft or detector.
- When transporting the module or servo amplifier, never hold the front case as it may fall off.
- When transporting, installing or removing the module or servo amplifier, never hold the edges.
- Install the unit according to the instruction manual in a place where the mass can be withstood.
- Do not get on or place heavy objects on the product.
- Always observe the installation direction.
- Keep the designated clearance between the module or servo amplifier and control panel inner surface or the module and servo amplifier, module or servo amplifier and other devices.
- Do not install or operate modules, servo amplifiers or servomotors that are damaged or that have missing parts.
- Do not block the intake/outtake ports of the servo amplifier and servomotor with cooling fan.
- Do not allow conductive matter such as screw or cutting chips or combustible matter such as oil enter the module, servo amplifier or servomotor.
- The module, servo amplifier and servomotor are precision machines, so do not drop or apply strong impacts on them.
- Securely fix the module, servo amplifier and servomotor to the machine according to the instruction manual. If the fixing is insufficient, these may come off during operation.
- Always install the servomotor with reduction gears in the designated direction. Failing to do so may lead to oil leaks.

⚠CAUTION

- Store and use the unit in the following environmental conditions.

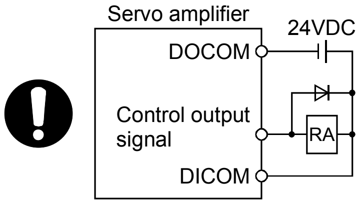
Environment	Conditions	
	Module/Servo amplifier	Servomotor
Ambient temperature	According to each instruction manual.	0°C to +40°C (With no freezing) (32°F to +104°F)
Ambient humidity	According to each instruction manual.	80% RH or less (With no dew condensation)
Storage temperature	According to each instruction manual.	-20°C to +65°C (-4°F to +149°F)
Atmosphere	Indoors (where not subject to direct sunlight). No corrosive gases, flammable gases, oil mist or dust must exist	
Altitude	1000m (3280.84ft.) or less above sea level	
Vibration	According to each instruction manual	

- When coupling with the servomotor shaft end, do not apply impact such as by hitting with a hammer. Doing so may lead to detector damage.
- Do not apply a load larger than the tolerable load onto the servomotor shaft. Doing so may lead to shaft breakage.
- When not using the module for a long time, disconnect the power line from the module or servo amplifier.
- Place the module and servo amplifier in static electricity preventing vinyl bags and store.
- When storing for a long time, please contact with our sales representative.
  Also, execute a trial operation.
- Make sure that the connectors for the servo amplifier and peripheral devices have been securely installed until a click is heard.
  Not doing so could lead to a poor connection, resulting in erroneous input and output.
- When fumigants that contain halogen materials such as fluorine, chlorine, bromine, and iodine are used for disinfecting and protecting wooden packaging from insects, they cause malfunction when entering our products.
  Please take necessary precautions to ensure that remaining materials from fumigant do not enter our products, or treat packaging with methods other than fumigation (heat method). Additionally, disinfect and protect wood from insects before packing products.
- The module and the servo amplifier must not be used with parts which contain halogen-series flame retardant materials (such as bromine) under coexisting conditions.

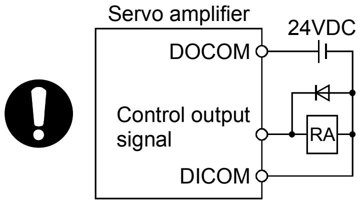
(4) Wiring

⚠CAUTION

- Correctly and securely wire the wires. Reconfirm the connections for mistakes and the terminal screws for tightness after wiring. Failing to do so may lead to run away of the servomotor.
- After wiring, install the protective covers such as the terminal covers to the original positions.
- Do not install a phase advancing capacitor, surge absorber or radio noise filter (option FR-BIF) on the output side of the servo amplifier.
- Correctly connect the output side (terminal U, V, W). Incorrect connections will lead the servomotor to operate abnormally.
- Do not connect a commercial power supply to the servomotor, as this may lead to trouble.
- Do not mistake the direction of the surge absorbing diode installed on the DC relay for the control signal output of brake signals, etc. Incorrect installation may lead to signals not being output when trouble occurs or the protective functions not functioning.



For the sink output interface



For the source output interface

- Do not connect or disconnect the connection cables between each unit, the encoder cable or PLC expansion cable while the power is ON.
- Securely tighten the cable connector fixing screws and fixing mechanisms. Insufficient fixing may lead to the cables combing off during operation.
- Do not bundle the power line or cables.
- Use applicable solderless terminals and tighten them with the specified torque.
  If any solderless spade terminal is used, it may be disconnected when the terminal screw comes loose, resulting in failure.

(5) Trial operation and adjustment

⚠CAUTION

- Confirm and adjust the program and each parameter before operation. Unpredictable movements may occur depending on the machine.
- Extreme adjustments and changes may lead to unstable operation, so never make them.
- When using the absolute position system function, on starting up, and when the module or absolute value motor has been replaced, always perform a home position return.
- Before starting test operation, set the parameter speed limit value to the slowest value, and make sure that operation can be stopped immediately by the forced stop, etc. if a hazardous state occurs.
- Before starting the operation, confirm the brake function.

(6) Usage methods

⚠CAUTION

- Immediately turn OFF the power if smoke, abnormal sounds or odors are emitted from the module, servo amplifier or servomotor.
- Always execute a test operation before starting actual operations after the program or parameters have been changed or after maintenance and inspection.
- Do not attempt to disassemble and repair the units excluding a qualified technician whom our company recognized.
- Do not make any modifications to the unit.
- Keep the effect or electromagnetic obstacles to a minimum by installing a noise filter or by using wire shields, etc.

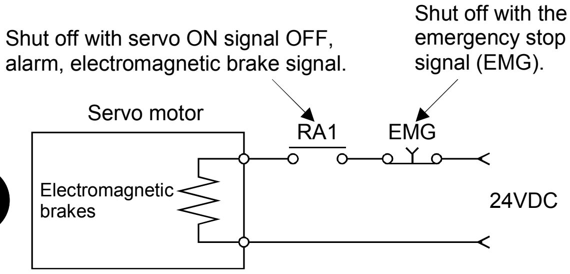
  Electromagnetic obstacles may affect the electronic devices used near the module or servo amplifier.
- When using the CE Mark-compliant equipment design, refer to the "EMC Installation Guidelines" (data number IB(NA)-67339) and refer to the corresponding EMC guideline information for the servo amplifiers and other equipment.
- Note that when the reference axis speed is designated for interpolation operation, the speed of the partner axis (2nd axis, 3rd axis and 4th axis) may be larger than the set speed (larger than the speed limit value).
- Use the units with the following conditions.

Item	Conditions
Input power	According to each instruction manual.
Input frequency	According to each instruction manual.
Tolerable momentary power failure	According to each instruction manual.

(7) Corrective actions for errors

⚠CAUTION

- If an error occurs in the self diagnosis of the module or servo amplifier, confirm the check details according to the instruction manual, and restore the operation.
- If a dangerous state is predicted in case of a power failure or product failure, use a servomotor with electromagnetic brakes or install a brake mechanism externally.
- Use a double circuit construction so that the electromagnetic brake operation circuit can be operated by emergency stop signals set externally.



- If an error occurs, remove the cause, secure the safety and then resume operation after alarm release.
- The unit may suddenly resume operation after a power failure is restored, so do not go near the machine. (Design the machine so that personal safety can be ensured even if the machine restarts suddenly.)

(8) Maintenance, inspection and part replacement

⚠CAUTION

- Perform the daily and periodic inspections according to the instruction manual.
- Perform maintenance and inspection after backing up the program and parameters for the module and servo amplifier.
- Do not place fingers or hands in the clearance when opening or closing any opening.
- Periodically replace consumable parts such as batteries according to the instruction manual.
- Do not touch the lead sections such as ICs or the connector contacts.
- Before touching the module, always touch grounded metal, etc. to discharge static electricity from human body. Failure to do so may cause the module to fail or malfunction.
- Do not directly touch the module's conductive parts and electronic components.
  Touching them could cause an operation failure or give damage to the module.
- Do not place the module or servo amplifier on metal that may cause a power leakage or wood, plastic or vinyl that may cause static electricity buildup.
- Do not perform a megger test (insulation resistance measurement) during inspection.
- When replacing the module or servo amplifier, always set the new module settings correctly.

⚠CAUTION

- When the module or absolute value motor has been replaced, carry out a home position return operation using one of the following methods, otherwise position displacement could occur.

  1) After writing the servo data to the Simple Motion module using programming software, switch on the power again, then perform a home position return operation.
- After maintenance and inspections are completed, confirm that the position detection of the absolute position detector function is correct.
- Do not drop or impact the battery installed to the module.
  Doing so may damage the battery, causing battery liquid to leak in the battery. Do not use the dropped or impacted battery, but dispose of it.
- Do not short circuit, charge, overheat, incinerate or disassemble the batteries.
- The electrolytic capacitor will generate gas during a fault, so do not place your face near the module or servo amplifier.
- The electrolytic capacitor and fan will deteriorate. Periodically replace these to prevent secondary damage from faults. Please contact with our sales representative.
- Lock the control panel and prevent access to those who are not certified to handle or install electric equipment.
- Do not mount/remove the module and base or terminal block more than 50 times (IEC61131-2-compliant), after the first use of the product. Failure to do so may cause malfunction.
- Do not burn or break a module and servo amplifier. Doing so may cause a toxic gas.

(9) About processing of waste

When you discard module, servo amplifier, a battery (primary battery) and other option articles, please follow the law of each country (area).

⚠CAUTION

- This product is not designed or manufactured to be used in equipment or systems in situations that can affect or endanger human life.
- When considering this product for operation in special applications such as machinery or systems used in passenger transportation, medical, aerospace, atomic power, electric power, or submarine repeating applications, please contact your nearest Mitsubishi sales representative.
- Although this product was manufactured under conditions of strict quality control, you are strongly advised to install safety devices to forestall serious accidents when it is used in facilities where a breakdown in the product is likely to cause a serious accident.

(10) General cautions

- All drawings provided in the instruction manual show the state with the covers and safety partitions removed to explain detailed sections. When operating the product, always return the covers and partitions to the designated positions, and operate according to the instruction manual.

● CONDITIONS OF USE FOR THE PRODUCT ●

(1) Mitsubishi programmable controller ("the PRODUCT") shall be used in conditions;

i) where any problem, fault or failure occurring in the PRODUCT, if any, shall not lead to any major or serious accident; and

ii) where the backup and fail-safe function are systematically or automatically provided outside of the PRODUCT for the case of any problem, fault or failure occurring in the PRODUCT.

(2) The PRODUCT has been designed and manufactured for the purpose of being used in general industries.

MITSUBISHI SHALL HAVE NO RESPONSIBILITY OR LIABILITY (INCLUDING, BUT NOT LIMITED TO ANY AND ALL RESPONSIBILITY OR LIABILITY BASED ON CONTRACT, WARRANTY, TORT, PRODUCT LIABILITY) FOR ANY INJURY OR DEATH TO PERSONS OR LOSS OR DAMAGE TO PROPERTY CAUSED BY the PRODUCT THAT ARE OPERATED OR USED IN APPLICATION NOT INTENDED OR EXCLUDED BY INSTRUCTIONS, PRECAUTIONS, OR WARNING CONTAINED IN MITSUBISHI'S USER, INSTRUCTION AND/OR SAFETY MANUALS, TECHNICAL BULLETINS AND GUIDELINES FOR the PRODUCT.

("Prohibited Application")

Prohibited Applications include, but not limited to, the use of the PRODUCT in;

- Nuclear Power Plants and any other power plants operated by Power companies, and/or any other cases in which the public could be affected if any problem or fault occurs in the PRODUCT.
- Railway companies or Public service purposes, and/or any other cases in which establishment of a special quality assurance system is required by the Purchaser or End User.
- Aircraft or Aerospace, Medical applications, Train equipment, transport equipment such as Elevator and Escalator, Incineration and Fuel devices, Vehicles, Manned transportation, Equipment for Recreation and Amusement, and Safety devices, handling of Nuclear or Hazardous Materials or Chemicals, Mining and Drilling, and/or other applications where there is a significant risk of injury to the public or property.

Notwithstanding the above, restrictions Mitsubishi may in its sole discretion, authorize use of the PRODUCT in one or more of the Prohibited Applications, provided that the usage of the PRODUCT is limited only for the specific applications agreed to by Mitsubishi and provided further that no special quality assurance or fail-safe, redundant or other safety features which exceed the general specifications of the PRODUCTs are required. For details, please contact the Mitsubishi representative in your region.

INTRODUCTION

Thank you for purchasing the Mitsubishi MELSEC-Q series programmable controllers.
This manual describes the functions and programming of the Simple Motion module.

Before using this product, please read this manual and the relevant manuals carefully and develop familiarity with the functions and performance of the MELSEC-Q series programmable controller to handle the product correctly.
When applying the program examples introduced in this manual to the actual system, ensure the applicability and confirm that it will not cause system control problems.

Please make sure that the end users read this manual.

REMARK

- Unless otherwise specified, this manual describes the program examples in which the I/O numbers of X/Y00 to X/Y1F are assigned for a Q series Simple Motion module. I/O number assignment is required for using the program examples described in the manual.
  For I/O number assignment, refer to the following.
  QnUCPU User's Manual (Function Explanation, Program Fundamentals)
  Qn(H)/QnPH/QnPRHCPU User's Manual (Function Explanation, Program Fundamentals)
- Operating procedures are explained using GX Works2.

REVISIONS

∗ The manual number is given on the bottom left of the back cover.

Print Date	∗ Manual Number	Revision
Feb., 2012	IB(NA)-0300185-A	First edition
Sep., 2013	IB(NA)-0300185-B	[Additional function] Driver communication function, Inverter FR-A700 series, Synchronous encoder via servo amplifier, Operation cycle setting for QD77MS2/QD77MS4 [Additional correction/partial correction] Safety precautions, Relevant manuals, Restrictions by the SERIAL No. and version, Parameters, Monitor data, Control data, List of errors, List of warnings, List of buffer memory address, Serial absolute synchronous encoder cable

Japanese Manual Version IB-0300184

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COMPLIANCE WITH THE EMC AND LOW VOLTAGE DIRECTIVES

(1) For programmable controller system

To configure a system meeting the requirements of the EMC and Low Voltage Directives when incorporating the Mitsubishi programmable controller (EMC and Low Voltage Directives compliant) into other machinery or equipment, refer to the Safety Guidelines provided with the main base unit. Also, refer to "Example of measure against noise for compliance with the EMC directive" of the Section 4.3.1 of this manual.

The CE mark on the side of the programmable controller indicates compliance with EMC and Low Voltage Directives.

(2) For the product

To make this product comply with EMC and Low Voltage Directives, refer to Section 4.3.1 "Precautions for wiring".

RELEVANT MANUALS

(1) Simple Motion module

Manual Name <Manual number (model code)>	Description
MELSEC-Q QD77MS Simple Motion Module User's Manual (Positioning Control) <IB-0300185ENG, 1XB947>	Specifications of the QD77MS and information on how to establish a system, maintenance and inspection, and troubleshooting Functions, programming and buffer memory for the positioning control of the QD77MS
MELSEC-Q/L QD77MS/QD77GF/LD77MS/LD77MH Simple Motion Module User's Manual (Synchronous Control) <IB-0300174ENG, 1XB943>	Functions, programming and buffer memory for the synchronous control of the Simple Motion module

(2) CPU module

Manual Name <Manual number (model code)>	Description
QCPU User's Manual (Hardware Design, Maintenance and Inspection) <SH-080483ENG, 13JR73>	Specifications of the hardware (CPU modules, power supply modules, base units, batteries, and memory cards), system maintenance and inspection, and troubleshooting
QnUCPU User's Manual (Function Explanation, Program Fundamentals) <SH-080807ENG, 13JZ27>	Functions, devices, and programming of the CPU module
Qn(H)/QnPH/QnPRHCPU User's Manual (Function Explanation, Program Fundamentals) <SH-080808ENG, 13JZ28>	Functions, devices, and programming of the CPU module

(3) Programming tool

Manual Name <Manual number (model code)>	Description
GX Works2 Version1 Operating Manual (Common) <SH-080779ENG, 13JU63>	System configuration, parameter settings, and online operations (common to Simple project and Structured project) of GX Works2
GX Works2 Version1 Operating Manual (Intelligent Function Module) <SH-080921ENG, 13JU69>	Parameter settings, monitoring, and operations of the predefined protocol support function of intelligent function modules, using GX Works2

(4) Servo amplifier

Manual Name <Manual number (model code)>	Description
SSCNETⅢ/H Interface AC Servo MR-J4-_B(-RJ) Servo Amplifier Instruction Manual <SH-030106, 1CW805>	This manual explains the I/O signals, parts names, parameters, start-up procedure and others for MR-J4-_B(-RJ) servo amplifier.
SSCNETⅢ/H Interface Multi-axis AC Servo MR-J4W2-_B/MR-J4W3-_B Servo Amplifier Instruction Manual <SH-030105, 1CW806>	This manual explains the I/O signals, parts names, parameters, start-up procedure and others for multi-axis AC servo MR-J4W2-_B/MR-J4W3-_B servo amplifier.
SSCNETⅢ Interface MR-J3-☐B Servo Amplifier Instruction Manual <SH-030051, 1CW202>	This manual explains the I/O signals, parts names, parameters, start-up procedure and others for MR-J3-☐B servo amplifier.
SSCNETⅢ Compatible Linear Servo MR-J3-☐B-RJ004(U☐) Instruction Manual <SH-030054, 1CW943>	This manual explains the I/O signals, parts names, parameters, start-up procedure and others for linear servo MR-J3-☐B-RJ004(U☐).
SSCNETⅢ Fully Closed Loop Control MR-J3-☐B-RJ006 Servo Amplifier Instruction Manual <SH-030056, 1CW304>	This manual explains the I/O signals, parts names, parameters, start-up procedure and others for fully closed loop control MR-J3-☐B-RJ006 servo amplifier.
SSCNETⅢ Interface 2-axis AC Servo Amplifier MR-J3W-0303BN6/MR-J3W-☐B Servo Amplifier Instruction Manual <SH-030073, 1CW604>	This manual explains the I/O signals, parts names, parameters, start-up procedure and others for 2-axis AC servo amplifier MR-J3W-0303BN6/MR-J3W-☐B servo amplifier.
SSCNETⅢ Interface Direct Drive Servo MR-J3-☐B-RJ080W Instruction Manual <SH-030079, 1CW601>	This manual explains the I/O signals, parts names, parameters, start-up procedure and others for direct drive servo MR-J3-☐B-RJ080W.
SSCNETⅢ Interface Drive Safety Integrated MR-J3-☐B Safety Servo Amplifier Instruction Manual <SH-030084, ---- >	This manual explains the I/O signals, parts names, parameters, start-up procedure and others for safety integrated MR-J3-☐B safety servo amplifier.

MANUAL PAGE ORGANIZATION

■ The symbols used in this manual are shown below.
The following symbols represent the buffer memories supported for each axis.
(A serial No. is inserted in the "*" mark.)

Symbol	Description	Reference
Pr. ∗	Symbol that indicates positioning parameter and OPR parameter item.	Chapter 5
Da. ∗	Symbol that indicates positioning data, block start data and condition data item.	
Md. ∗	Symbol that indicates monitor data item.	
Cd. ∗	Symbol that indicates control data item.	
QD77MS2	Symbol that indicates correspondence to only QD77MS2.	—
QD77MS4	Symbol that indicates correspondence to only QD77MS4.	
QD77MS16	Symbol that indicates correspondence to only QD77MS16.	

■ Representation of numerical values used in this manual.

- Buffer memory addresses, error codes and warning codes are represented in decimal.
- X/Y devices are represented in hexadecimal.
- Setting data and monitor data are represented in decimal or hexadecimal. Data ended by "H" or "h" is represented in hexadecimal.

(Example) 10.........Decimal
10H......Hexadecimal

TERMS

Unless otherwise specified, this manual uses the following terms.

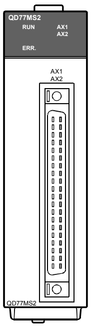
Term	Description
PLC CPU	Abbreviation for the MELSEC-Q series PLC CPU module.
QCPU	Another term for the MELSEC-Q series PLC CPU module.
Simple Motion module	Abbreviation for the MELSEC-Q series Simple Motion module.
QD77MS	Another term for the MELSEC-Q series QD77MS Simple Motion module.
MR-J4(W)-B	MR-J4-□B/MR-J4W-□B servo amplifier series
MR-J3(W)-B	MR-J3-□B/MR-J3W-□B servo amplifier series
Programming tool	Generic term for GX Works2 and MR Configurator2.
GX Works2	Product name of the software package for the MELSEC programmable controllers (Version 1.77F or later).
MR Configurator2	Product name of the setup software for the servo amplifier (Version 1.09K or later).
Intelligent function module	A MELSEC-Q/L series module that has functions other than input or output, such as A/D converter module and D/A converter module
Servo amplifier (drive unit)	Abbreviation for SSCNETⅢ/H and SSCNETⅢ compatible servo amplifier (drive unit).
Manual pulse generator	Abbreviation for manual pulse generator (MR-HDP01) (prepared by user).
OPR	Generic term for "Home position return".
OP	Generic term for "Home position".
SSCNETⅢ/H (Note)	High speed synchronous communication network between QD77MS and servo amplifier.
SSCNETⅢ (Note)	
Servo network	Generic term for SSCNETⅢ/H, SSCNETⅢ.

(Note): SSCNET: Servo System Controller NETwork

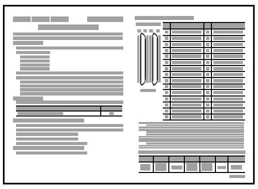
PACKING LIST

The following items are included in the package of this product. Before use, check that all the items are included.

(1) QD77MS2

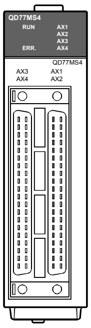


QD77MS2

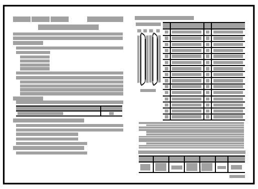


Before Using the Product

(2) QD77MS4

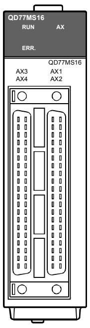


QD77MS4

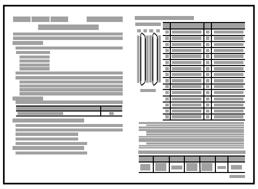


Before Using the Product

(3) QD77MS16



QD77MS16



Before Using the Product

MEMO

Section 1 Product Specifications and Handling

Section 1 is configured for the following purposes (1) to (5).

(1) To understand the outline of positioning control, and the Simple Motion module specifications and functions
(2) To carry out actual work such as installation and wiring
(3) To set parameters and data required for positioning control
(4) To create a sequence program required for positioning control
(5) To understand the memory configuration and data transmission process

When diverting any of the program examples introduced in this manual to the actual system, fully verify that there are no problems in the controllability of the target system.

Read "Section 2" for details on each control.

MEMO

Chapter 1 Product Outline

The purpose and outline of positioning control using the Simple Motion module are explained in this chapter.
Reading this chapter will help you understand what can be done using the positioning system and which procedure to use for a specific purpose.

By understanding "What can be done", and "Which procedure to use" beforehand, the positioning system can be structured smoothly.

1.1 Positioning control

1.1.1 Features of QD77MS

The QD77MS has the following features.

(1) High-speed starting time
High-speed starting time "0.88ms" (QD77MS4 use) during positioning control is achieved.

(2) Wide variety of positioning control functions
The main functions (such as OPR control, positioning control and manual control) which are required for any positioning system and the sub functions which limit and add functions to those controls are supported.

(a) Enhanced OPR control
  1) Additional features of OPR control
     Five machine OPR methods are provided: one near-point dog method, two count methods, one data set method and one scale origin signal detection method. Select an applicable method according to the system.
  2) OPR retry function
     The OPR retry function is provided so that the machine OPR control can be performed from any position, regardless of the machine stop position when the system is powered on.

(b) Wide variety of control methods
Positioning controls, such as position control, speed control, speed-position switching control, position-speed switching control, and other controls, are provided.
  1) Independent control of each axis
     Controls, such as position control and speed control, can be performed independently for each axis at any given timing.
  2) Interpolation control
     Interpolation controls using multiple axes can be performed.
     (2- to 4-axis linear interpolation control, 2-axis circular interpolation control, 2- to 4-axis speed control, etc.)
  3) Speed-torque control
     Speed control and torque control not including position loop can be performed.

(c) Large amount of data
Up to 600 positioning data (combinations of data, such as control system, positioning address, and command speed) per axis can be set.

(d) Continuous processing of multiple positioning data

Multiple positioning data can be processed continuously within one positioning operation.

Continuous positioning control can be executed over multiple blocks, where each block consists of multiple positioning data.

This reduces the number of executions of positioning, management of execution status, and others.

(e) Acceleration/deceleration processing

Two acceleration/deceleration processing methods are provided: trapezoidal acceleration/deceleration and S-curve acceleration/deceleration.

The acceleration/deceleration curve can be selected according to the machine characteristic.

(3) Synchronous control

The synchronous control and electronic cam control can be performed.

(4) Mark detection function

The mark detection to latch any data by the external command signal [DI1 to DI4] can be performed.

(5) High maintainability

Maintainability is enhanced in the QD77MS.

(a) Data retention without battery

Data such as the positioning data and parameters can be stored in the flash ROM inside the QD77MS. This feature allows the module retain the data without a battery.

(b) Module error collection function

The QD77MS notifies error details to the PLC CPU when an error occurs.

Storing the error information in the PLC CPU allows the user to check the error from the programming tool even after the module is powered off or reset.

(6) Support of intelligent function module dedicated instructions

Dedicated instructions such as the positioning start instruction (Axis 1 to Axis 4) and teaching instruction (Axis 1 to Axis 4) are provided.

The use of such dedicated instructions simplifies programs.

The dedicated instructions are fully compatible with the LD77MH/QD75MH.

(7) Setting, monitoring, and testing through GX Works2

Parameters and positioning data for the QD77MS can be set using GX Works2 (Simple Motion Module Setting).
Moreover, using the test function of GX Works2 (Simple Motion Module Setting), users can check the wiring status and the validity of the preset parameters and positioning data by performing test operation before creating a program for positioning control.
The control monitor function of GX Works2 allows user to debug programs efficiently.
The servo parameters can be set easily by using the GX Works2 in combination with the MR Configurator2.

(8) Compatibility with the LD77MH/QD75MH

The proven programs in LD77MH/QD75MH can be used because the QD77MS is compatible with the LD77MH/QD75MH.

(9) Forced stop function

The batch forced stop is available for all axes of servo amplifier by the forced stop input signal of the external input.
"Valid/Invalid" of the forced stop input signal can be selected by the parameters.

(10) Connection between the QD77MS and servo amplifier with high speed synchronous network by SSCNETⅢ(/H)

The QD77MS can be directly connected to the Mitsubishi servo amplifiers of MR-J4-B/MR-J3-B series using the SSCNETⅢ(/H).

(a) Because the high speed synchronous network by SSCNETⅢ(/H) is used to connect the QD77MS and the servo amplifier, or servo amplifiers, saving wiring can be realized. The maximum distance between the QD77MS and servo amplifier, servo amplifier and servo amplifier of the SSCNETⅢ cable on the same bus was set to 50(164.04)[m(ft.)], and the flexibility will improve at the system design.

(b) By the use of SSCNETⅢ cable (Optical communication), influence of electromagnetic noise and others from servo amplifier, etc. are reduced.

(c) The servo parameters can be set on the QD77MS side to write or read them to/from the servo amplifier using the SSCNET communication.

(d) The actual current value and error description contained in the servo can be checked by the buffer memory of the QD77MS.

(e) The communication between the MR Configurator2 and servo amplifiers is possible via the PLC CPU.

(11) Easy application to the absolute position system

(a) The MR-J4-B/MR-J3-B series servo amplifiers and servo motors correspond to the absolute position system. It can be realized only at connecting the battery for absolute position system to the servo amplifier.

(b) Once the OP have been established, the OPR operation is unnecessary at the system's power supply ON.

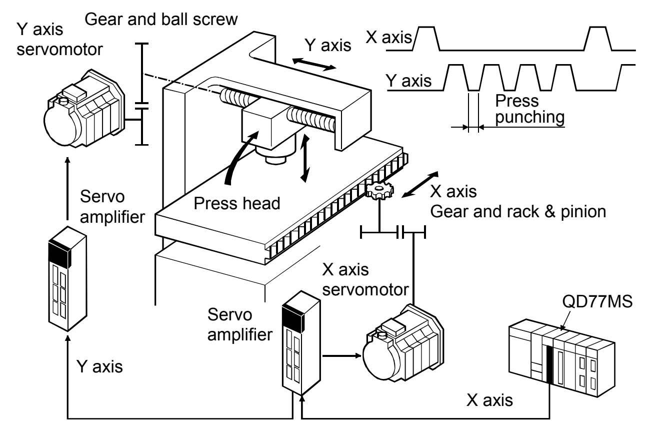
(c) With the absolute position system, the data set method OPR is used to establish the OP. The wiring of near-point dog, etc. is unnecessary.

(d) When the setting unit is "degree", the absolute position system with unlimited length fed can be configured.

1.1.2 Purpose and applications of positioning control

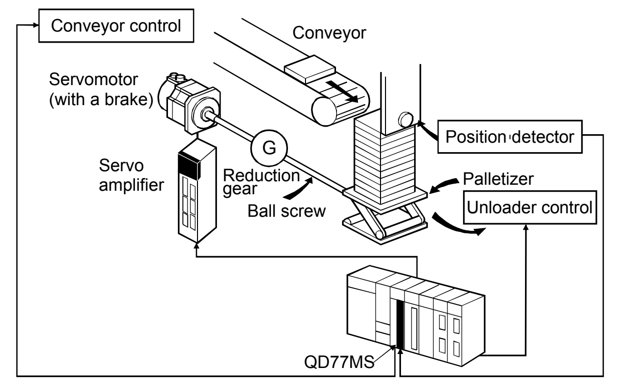
"Positioning" refers to moving a moving body, such as a workpiece or tool (hereinafter, generically called "workpiece") at a designated speed, and accurately stopping it at the target position. The main application examples are shown below.

■ Punch press (X, Y feed positioning)



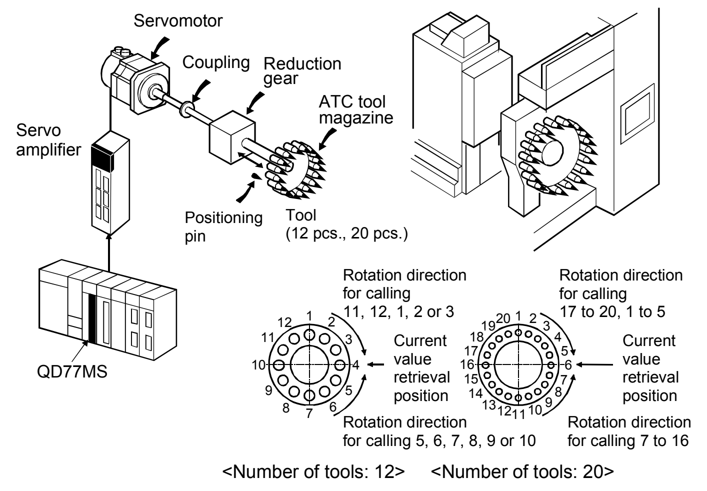
- To punch insulation material or leather, etc., as the same shape at a high yield, positioning is carried out with the X axis and Y axis servos.
- After positioning the table with the X axis servo, the press head is positioned with the Y axis servo, and is then punched with the press.
- When the material type or shape changes, the press head die is changed, and the positioning pattern is changed.

■ Palletizer



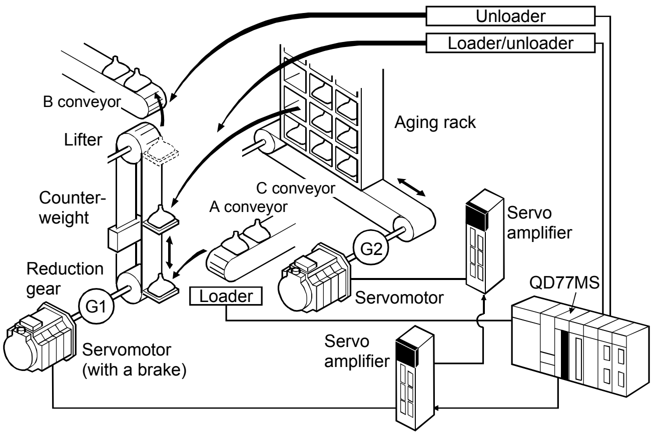
- Using the servo for one axis, the palletizer is positioned at a high accuracy.
- The amount to lower the palletizer according to the material thickness is saved.

■ Compact machining center (ATC magazine positioning)



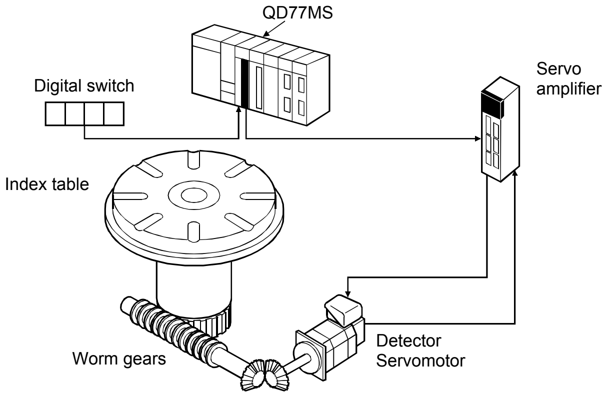
- The ATC tool magazine for a compact machining center is positioned.
- The relation of the magazine's current value and target value is calculated, and positioning is carried out with forward run or reverse run to achieve the shortest access time.

■ Lifter



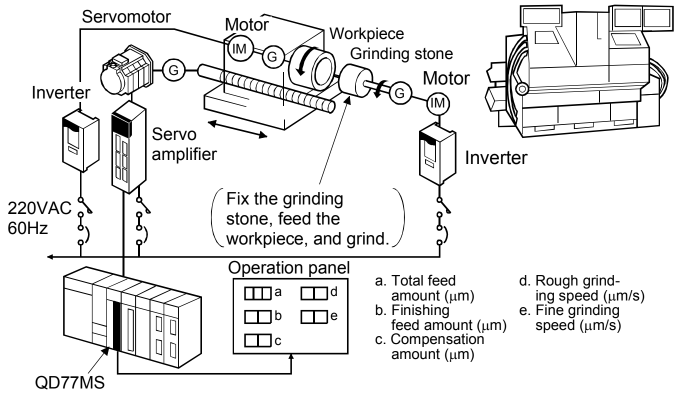
- During the aging process, storage onto the rack is carried out by positioning with the AC servo.
- The up/down positioning of the lifter is carried out with the 1-axis servo, and the horizontal position of the aging rack is positioned with the 2-axis servo.

■ Index table (High-accuracy indexing of angle)



- The index table is positioned at a high accuracy using the 1-axis servo.

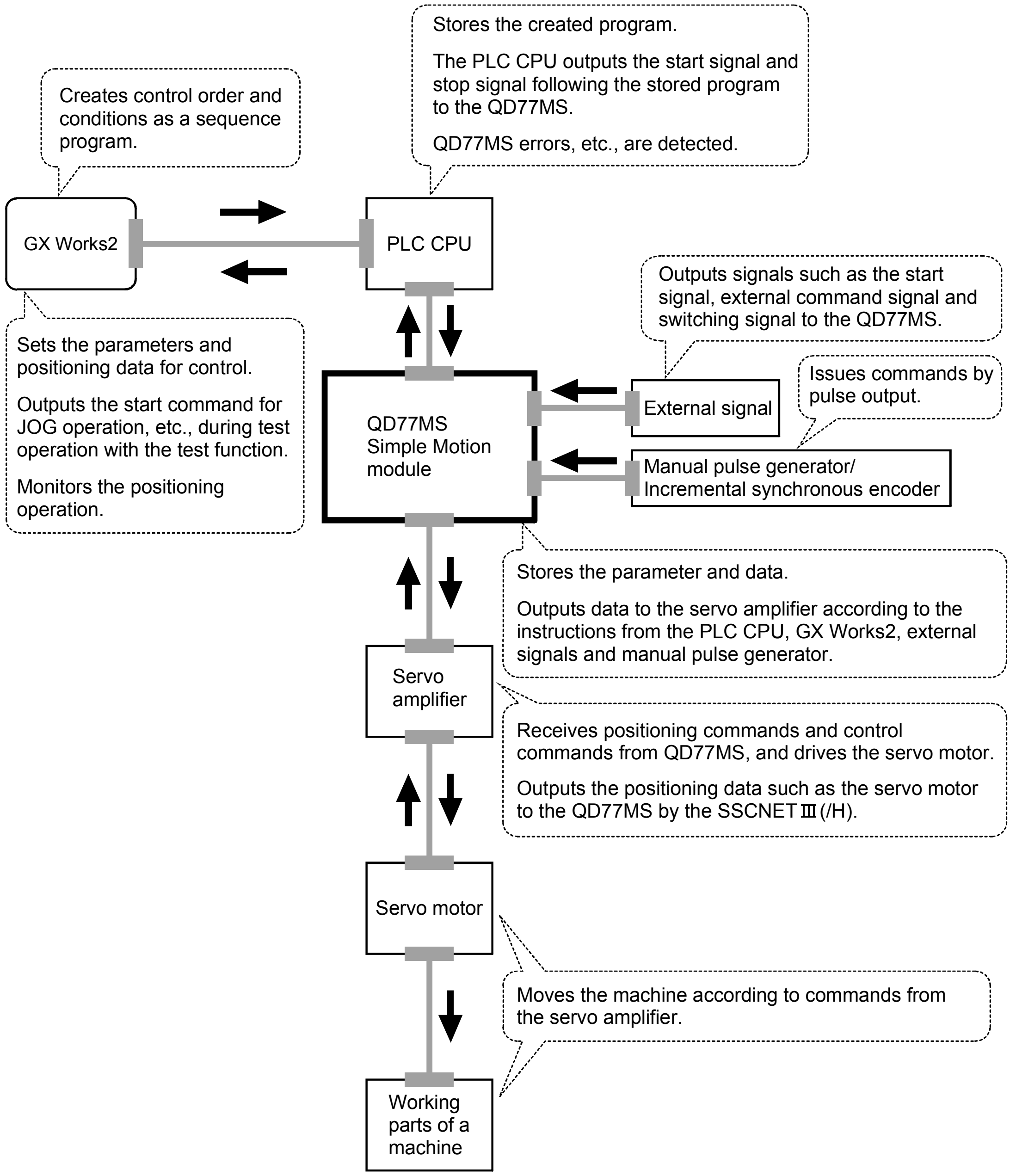
■ Inner surface grinder



- The grinding of the workpiece's inner surface is controlled with the servo and inverter.
- The rotation of the workpiece is controlled with the 1-axis inverter, and the rotation of the grinding stone is controlled with the 2-axis inverter. The workpiece is fed and ground with the 3-axis servo.

1.1.3 Mechanism of positioning control

In the positioning system using the Simple Motion module, various software and devices are used for the following roles.
The Simple Motion module realizes complicated positioning control when it reads in various signals, parameters and data and is controlled with the PLC CPU.



Creates control order and conditions as a sequence program.

Stores the created program.

The PLC CPU outputs the start signal and stop signal following the stored program to the QD77MS.

QD77MS errors, etc., are detected.

Sets the parameters and positioning data for control.

Outputs the start command for JOG operation, etc., during test operation with the test function.

Monitors the positioning operation.

Outputs signals such as the start signal, external command signal and switching signal to the QD77MS.

Issues commands by pulse output.

Stores the parameter and data.

Outputs data to the servo amplifier according to the instructions from the PLC CPU, GX Works2, external signals and manual pulse generator.

Receives positioning commands and control commands from QD77MS, and drives the servo motor.

Outputs the positioning data such as the servo motor to the QD77MS by the SSCNETⅢ(/H).

Moves the machine according to commands from the servo amplifier.

1.1.4 Overview of positioning control functions

The outline of the "overview of positioning control", "overview of independent positioning control and continuous positioning control", "overview of block positioning control" and "overview of acceleration/deceleration processing control" is shown below.

■ Positioning control

An overview of positioning using positioning data is described below.

(1) Linear control

(a) 1-axis linear control

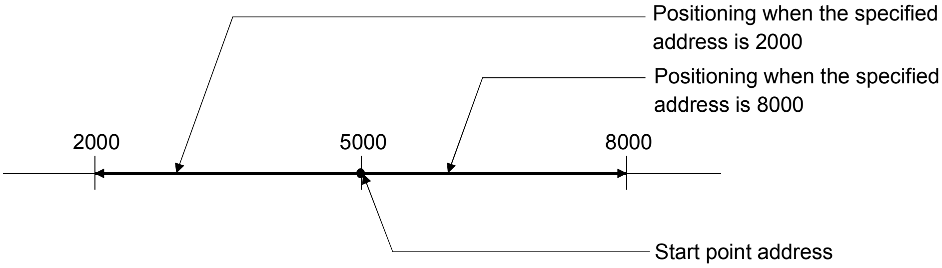
This performs positioning from the start point address (location the axis is presently stopped) defined on the specified axis to the specified position.

[Control using the absolute system]

1) This performs positioning from the start point address to the specified position.
2) The start point address and the specified address determine the movement direction.

[Example]

The following figure shows the operations when the start point address is 5000 and the positioning addresses are 2000 and 8000:

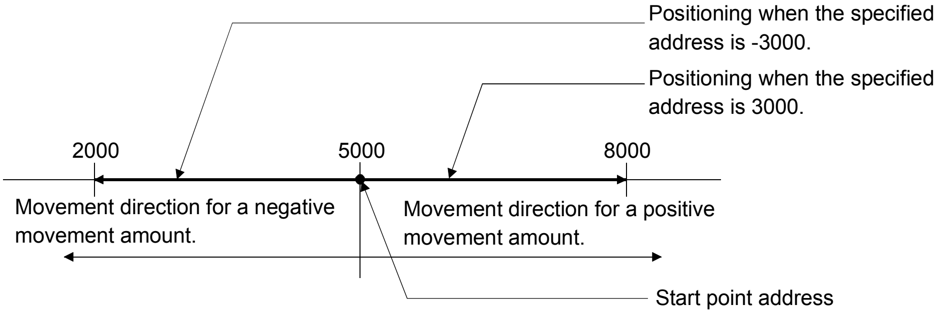


[Control using the increment system]

1) This performs positioning from the specified increment of travel from the start point address.
2) The sign of the travel increment determines the direction of travel.
   - For positive travel increment.......Positioning in the positive direction (direction of address increase)
   - For negative travel increment......Positioning in the negative direction (direction of address decrease)

[Example]

The following figure shows the operations when the start point address is 5000 and the travel increments are 3000 and -3000:



(b) 2-axis linear interpolation control (Note-1)

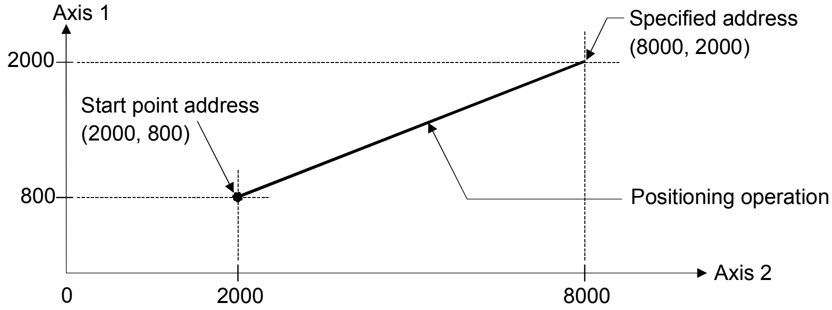
This controls interpolation along a linear locus from the start point address (current stop position) defined by two axes.

[Control using the absolute system]

1) This performs linear interpolation using two axes from the start point address to the specified address.
2) The start point address and the specified address determine the direction of travel.

[Example]

The operation when the start point address is 800 for axis 1 and 2000 for axis 2 and the positioning address specified to 2000 for axis 1 and 8000 for axis 2, is shown below.

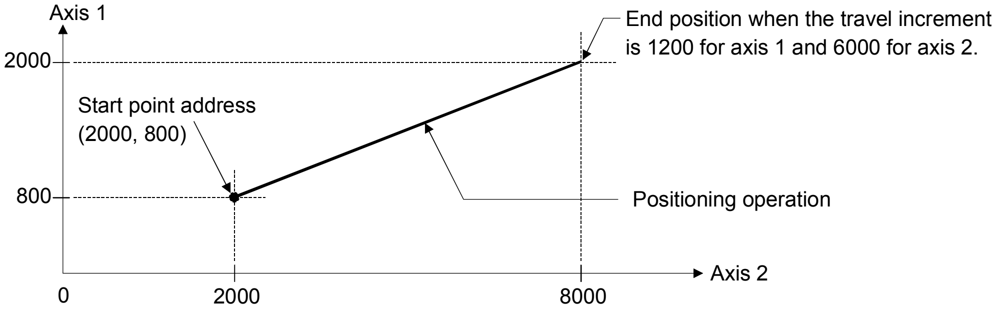


[Control using the increment system]

1) This performs positioning to the composite position of the travel direction and the travel increment specified by each axis from the start point address.
2) The sign of the travel increment determines the direction of travel.
   - For positive travel increment……Positioning in the positive direction (direction of address increase)
   - For negative travel increment……Positioning in the negative direction (direction of address decrease)

[Example]

The operation when the start point address is 800 for axis 1 and 2000 for axis 2 and the positioning address specified to 1200 for axis 1 and 6000 for axis 2, is shown below.



REMARK

(Note-1): The interpolation speed during linear interpolation control can be selected from "composite speed" and "reference axis speed" using the interpolation speed designation method of detailed parameter 1. (Refer to Section 5.2.3 information about setting "Pr.20 Interpolation speed designation method" of the detailed parameter 1.)

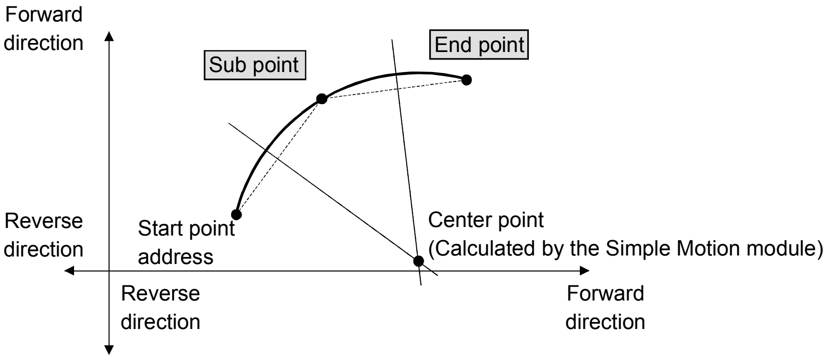
(2) Circular interpolation control (Note-1)

There are two types of circular interpolation controls: circular interpolation with a specified sub point and circular interpolation with the specified center point.

(a) Circular interpolation with a specified sub point

Circular interpolation is performed using the specified endpoint address and sub point (passing point) address.

Two methods are available: absolute system and increment system.

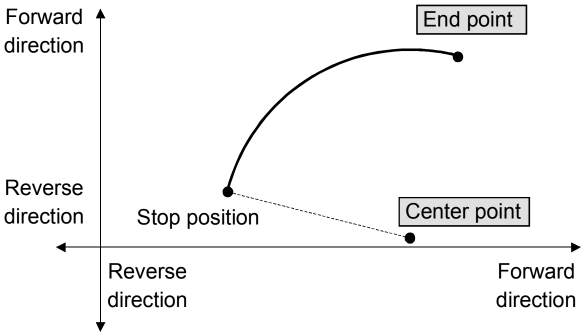


(b) Circular interpolation with the specified center point

Circular interpolation is performed using the specified endpoint address and center point address.

Two methods are available: absolute system and increment system.

Also, the direction of movement can be selected from clockwise or counterclockwise.



REMARK

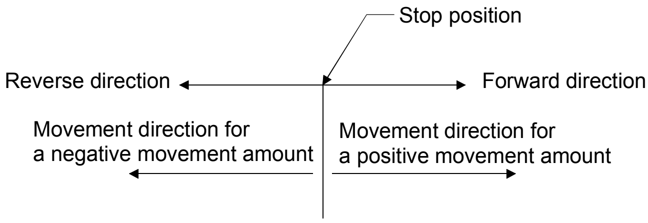
(Note-1): The interpolation speed during circular interpolation control may only be set to "composite speed" for the interpolation speed designation method of detailed parameter 1. (Refer to Section 5.2.3 information about setting "Pr.20 Interpolation speed designation method" of the detailed parameter 1.)

(3) Fixed-feed control

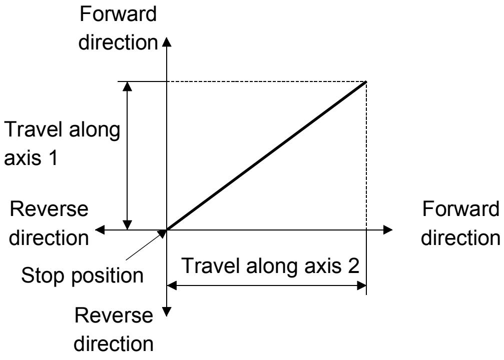
This performs positioning for the specified increment of travel.

Positioning direction

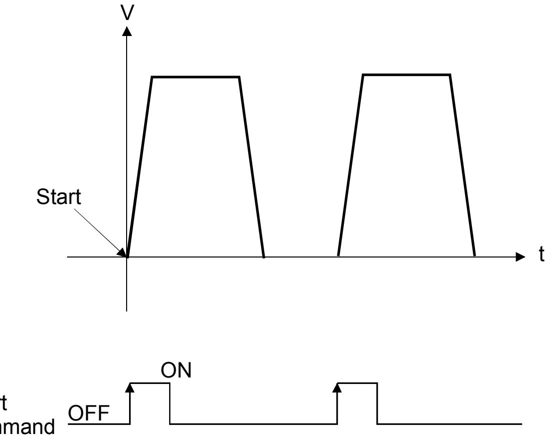
[1-axis fixed-feed control]



[2-axis fixed-feed control]

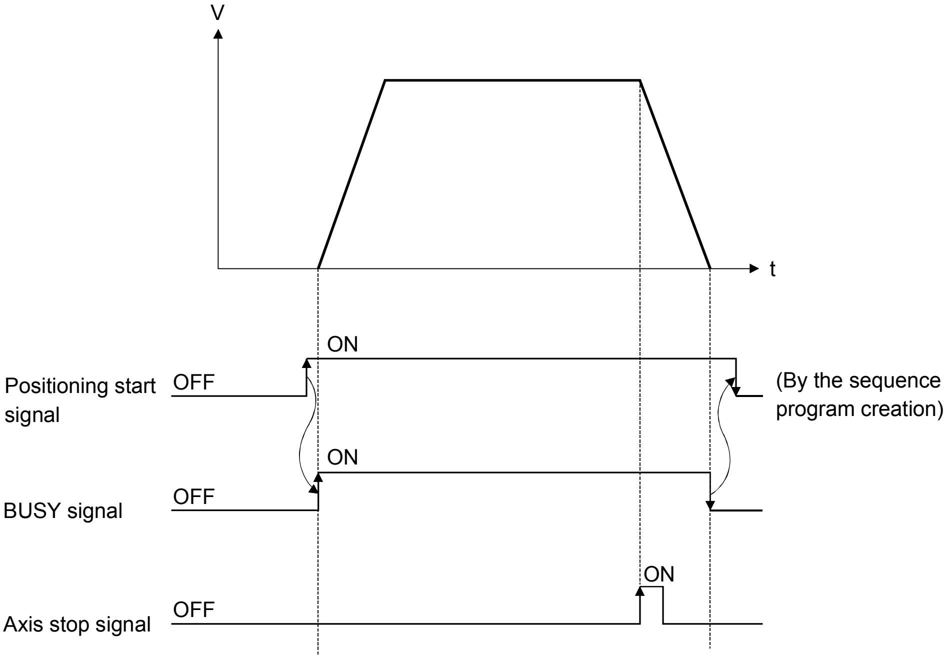


Operation timing



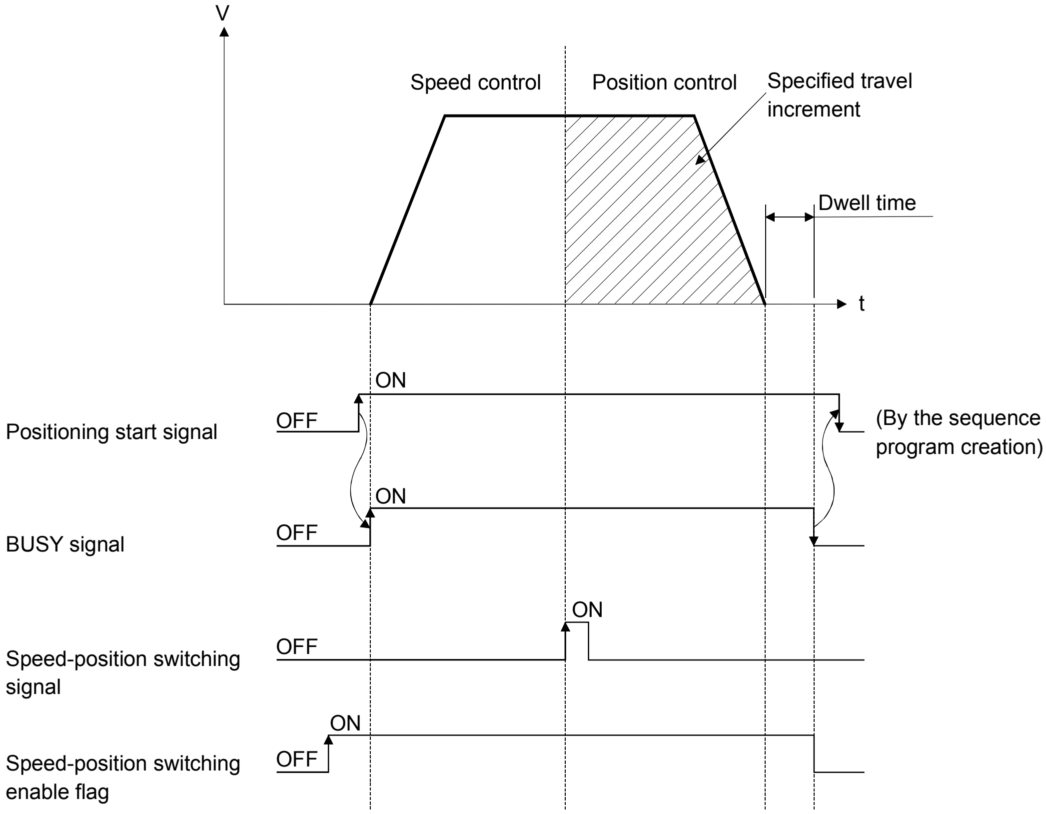
(4) Speed control

After command is executed, control continues with the command speed until the stop command is input.



(5) Speed-position switching control

This starts positioning under speed control, and switches to position control according to the input of the Simple Motion module speed-position switching signal and perform positioning for the specified increment of travel.



■ Independent positioning control and continuous positioning control

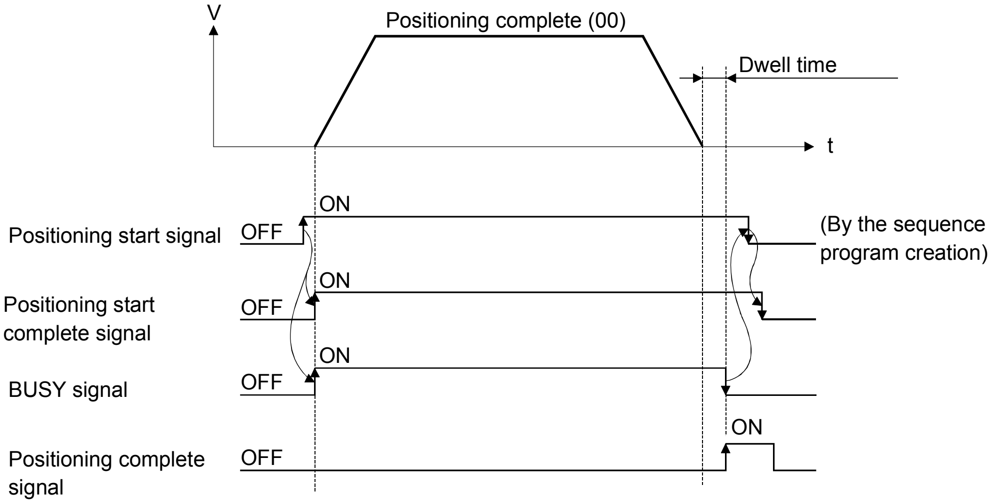
The Simple Motion module performs positioning according to the user-set positioning data, which is a set of information comprised of the control method (position control, speed control, speed-position switching control), positioning address, operation pattern, and so on.

Up to 600 of positioning data are assigned respectively to positioning data Nos. 1 to 600 per axis and registered to the Simple Motion module.

The operation pattern set in each positioning data by the user determines whether to perform positioning operation with one positioning data item or to perform continuous positioning operation with multiple positioning data items.

(1) Independent positioning control (operation pattern = 00: positioning complete)

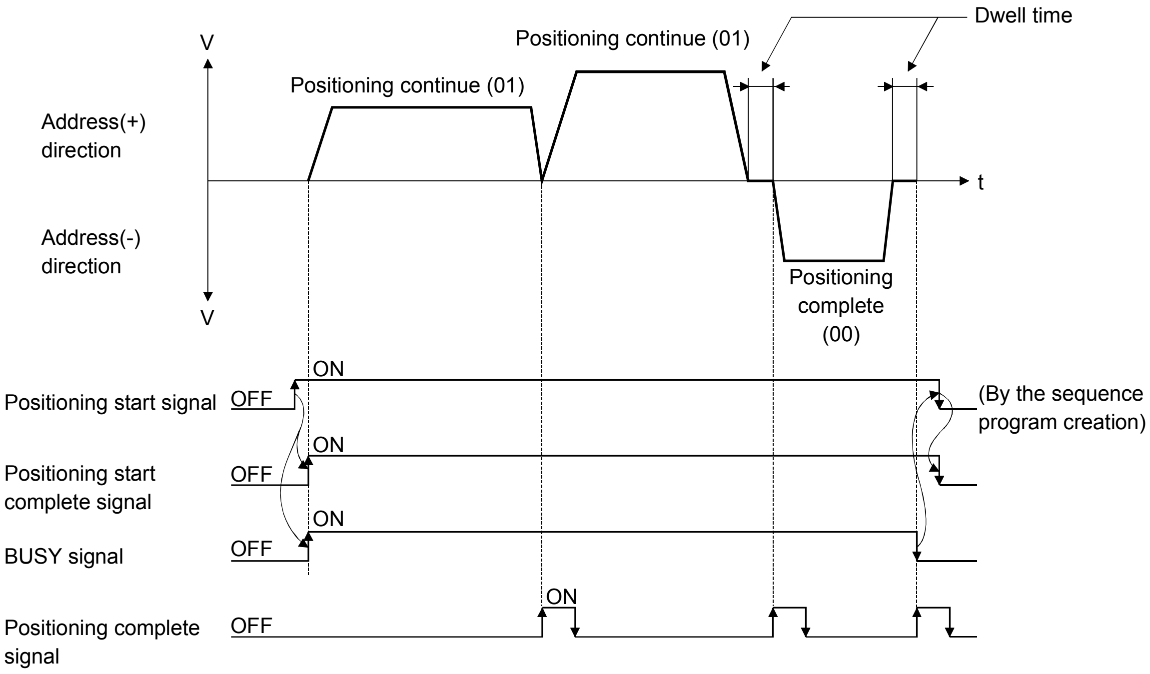
The operation completed upon completion of positioning for the specified positioning data. The positioning completion of this operation pattern is also used as the operation pattern for the last positioning data of continuous positioning and continuous path positioning.



(2) Continuous positioning control (operation pattern = 01: positioning continue)

The operation stops temporarily upon the completion of positioning for the specified positioning data, and then continues with the next positioning data number.

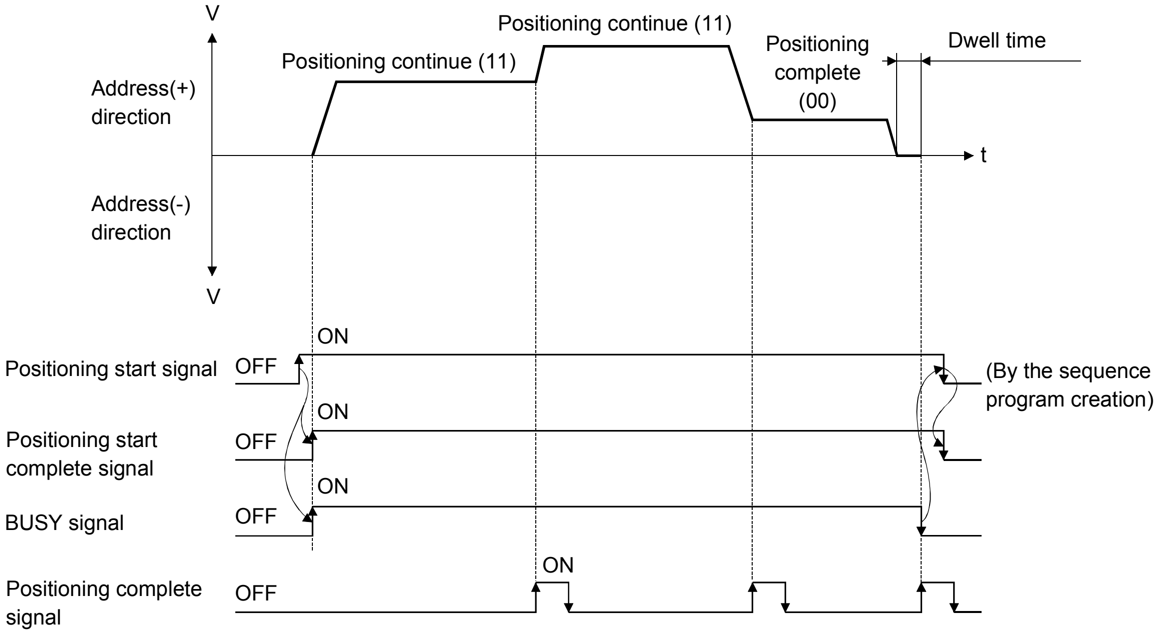
This is specified when performing positioning in which the direction changes because of multiple positioning data items having consecutive positioning data numbers.



(3) Continuous path control (operation pattern = 11: positioning continue)

After executing positioning using the specified positioning data, the operation changes its speed to that of the next positioning data number and continues positioning.

This is specified when continuously executing multiple positioning data items having consecutive positioning data numbers at a specified speed.



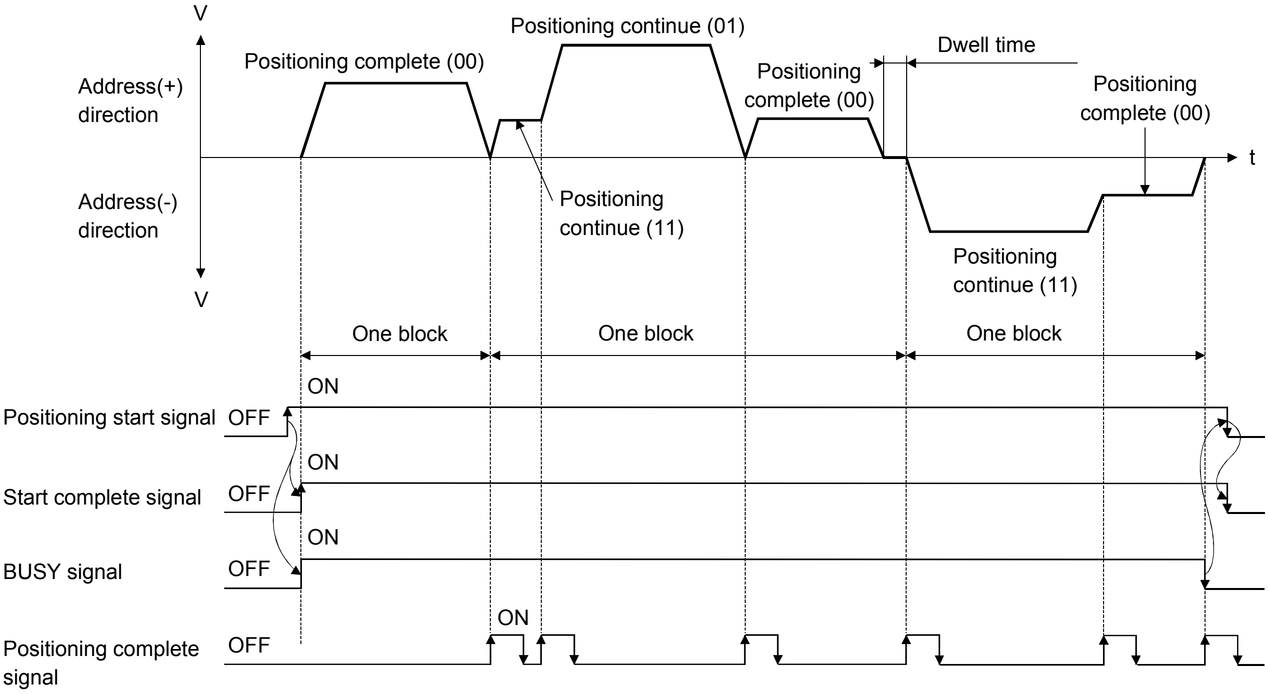
■ Block positioning control

Block positioning is a control that continuously executes the positioning of specified blocks. One block equivalent to a series of positioning data up to the completion of positioning (operation pattern = 00) by Independent or continuous positioning control.

A maximum of 50 blocks per axis can be specified.

Using a one-time start command from the PLC CPU or external, complex positioning control can be performed.

The block positioning control can be performed by specifying the positioning start number and positioning start information in the buffer memory.



■ Overview of acceleration/deceleration processing control

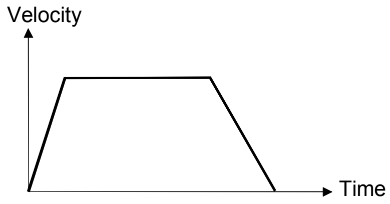
Acceleration/deceleration processing for the positioning processing, manual pulse-generator processing, OPR processing and JOG processing is performed using the user-specified method, acceleration time and deceleration time.

(1) Acceleration/deceleration method

There are two types of acceleration and deceleration processing: the trapezoidal acceleration/deceleration processing method and S-curve acceleration/deceleration processing method. A detailed parameter is used to set which method is used. The specified acceleration/deceleration method is applied to all accelerations and decelerations when starting and completing positioning processing, OPR processing and JOG processing, as well as when changing the speed.

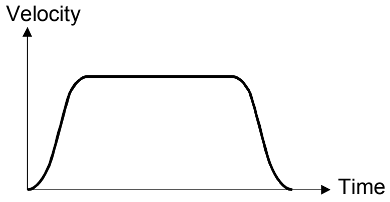
(a) Trapezoidal acceleration/deceleration processing method

This is a method in which linear acceleration/deceleration is carried out based on the acceleration time, deceleration time, and speed limit value set by the user.



(b) S-curve acceleration/deceleration processing method

This method reduces the load on the motor when starting and stopping. This is a method in which acceleration/deceleration is carried out gradually, based on the acceleration time, deceleration time, speed limit value, and S-curve ratio (1 to 100%) set by the user.



(2) Acceleration time, deceleration time, sudden-stop deceleration time

(a) Four types each of the acceleration time and deceleration time for positioning control can be set using basic parameters 2 and detailed parameters 2.

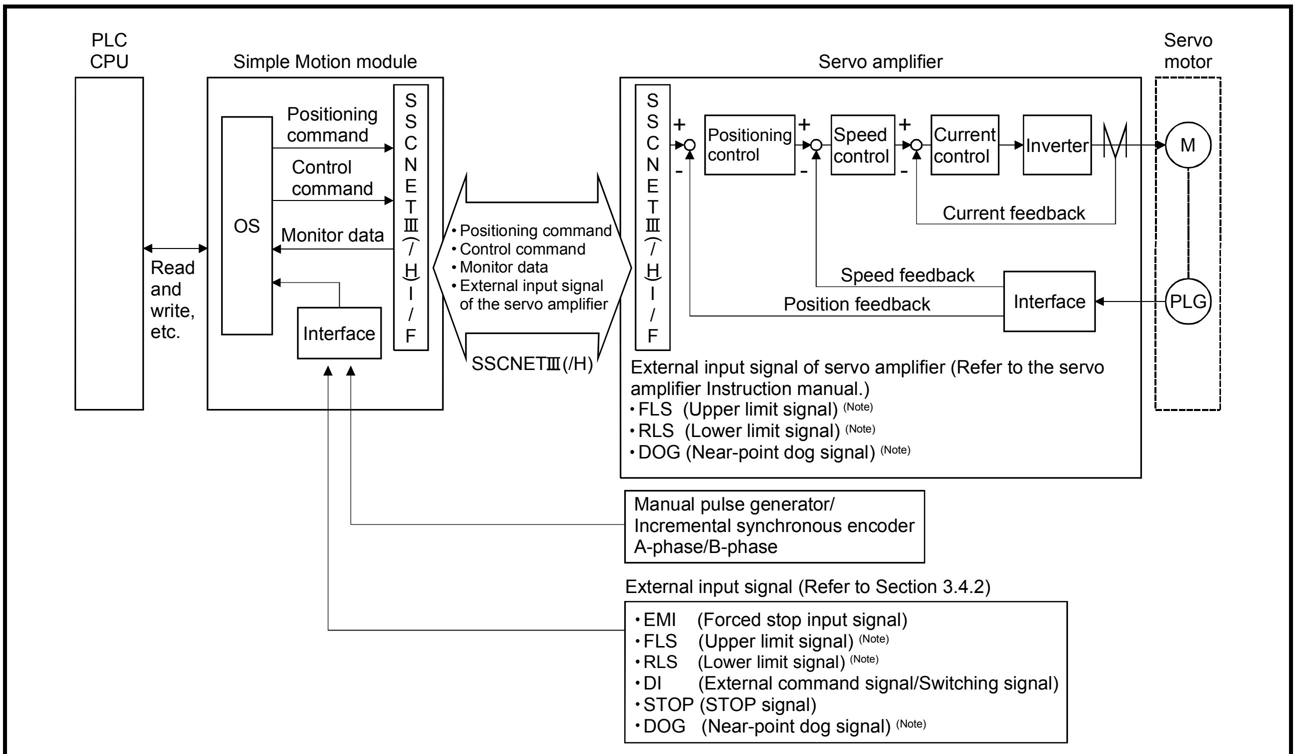
- Acceleration time…….The time elapses before the speed of 0 reaches the limit value.
- Deceleration time…….The time elapses before the speed at the limit value reaches 0.

(b) The sudden-stop deceleration time (1 to 8388608 ms) is set using the detailed parameters 2.

1.1.5 Outline design of positioning system

The outline of the positioning system operation and design using the Simple Motion module is shown below.

(1) Positioning system using Simple Motion module



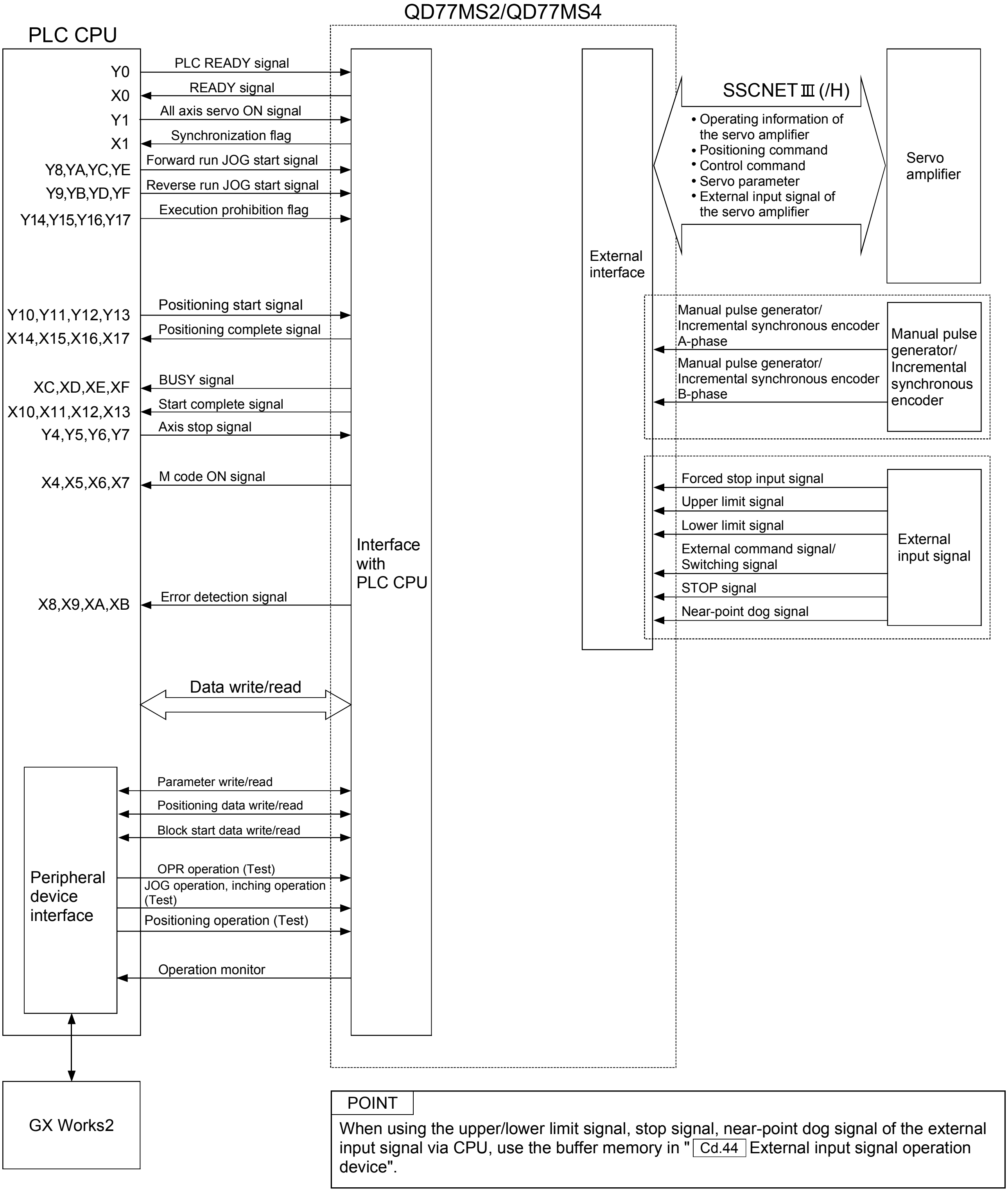
(Note): The external input signal of QD77MS, external input signal of servo amplifier, or external input signal via CPU (buffer memory of QD77MS) can be used in the parameter setting. (Refer to Section 5.2.3.)

Fig. 1.1 Outline of the operation of positioning system using Simple Motion module

1.1.6 Communicating signals between QD77MS and each module

The outline of the signal communication between the Simple Motion module and PLC CPU, GX Works2 and servo amplifier, etc., is shown below.
(GX Works2 communicates with the Simple Motion module via the PLC CPU to which it is connected.)

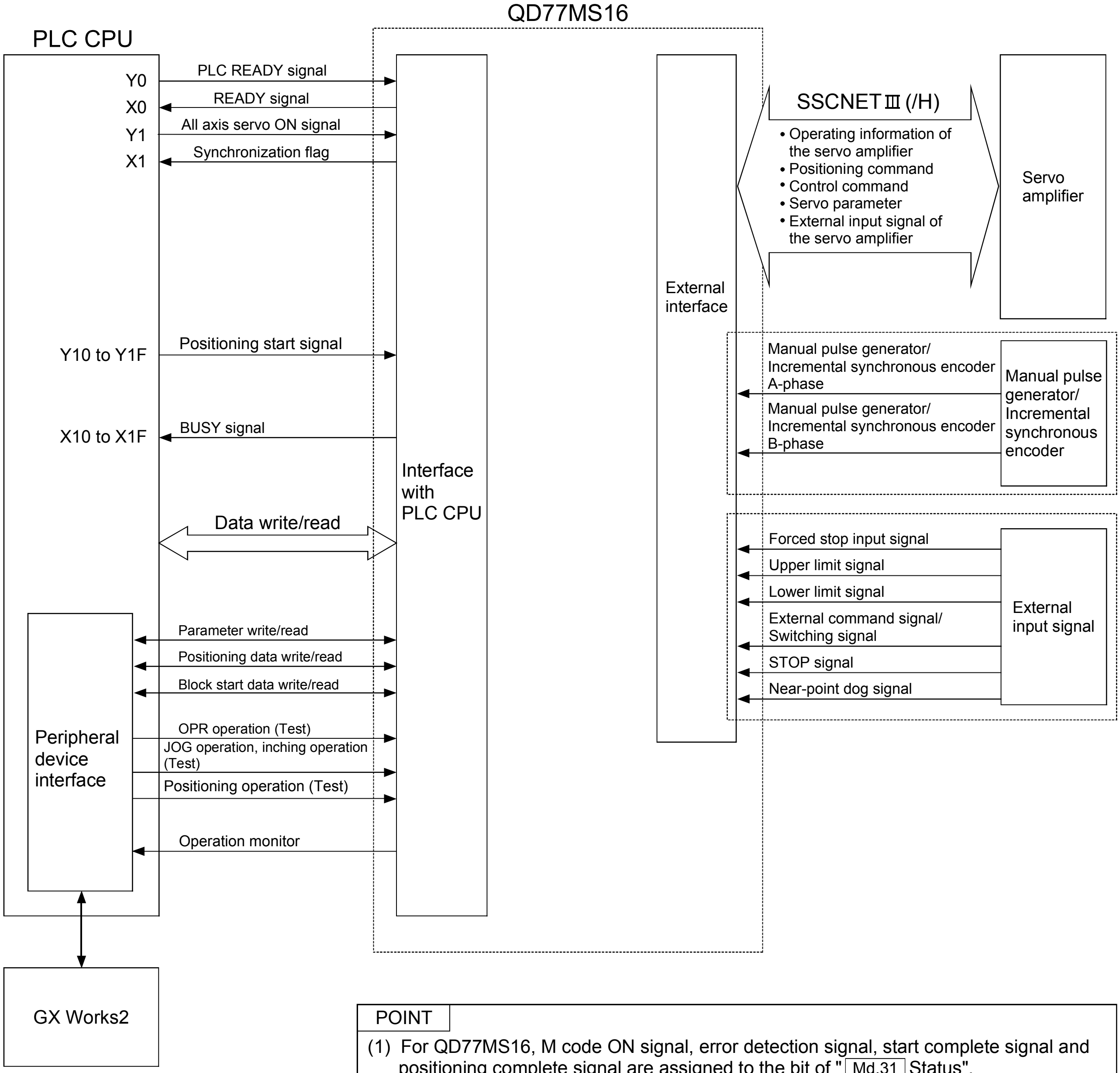
(1) QD77MS2/QD77MS4



POINT

When using the upper/lower limit signal, stop signal, near-point dog signal of the external input signal via CPU, use the buffer memory in " Cd.44 External input signal operation device".

(2) QD77MS16



POINT

(1) For QD77MS16, M code ON signal, error detection signal, start complete signal and positioning complete signal are assigned to the bit of " Md.31 Status".

(2) For QD77MS16, axis stop signal, forward run JOG start signal, reverse run JOG start signal, execution prohibition flag are assigned to the buffer memory Cd.180 to Cd.183 .

(3) When using the upper/lower limit signal, stop signal, near-point dog signal of the external input signal via CPU, use the buffer memory in " Cd.44 External input signal operation device".

■ Simple Motion module ↔ PLC CPU

The Simple Motion module and PLC CPU communicate the following data.

Direction Communication	Simple Motion module → PLC CPU	PLC CPU → Simple Motion module
Control signal ＊	Signal indicating Simple Motion module state • READY signal • BUSY signal etc.	Signal related to commands • PLC READY signal • All axis servo ON signal • Positioning start signal etc.
Data (read/write)	• Parameter • Positioning data • Block start data • Control data • Monitor data	• Parameter • Positioning data • Block start data • Control data

＊ Refer to Section 3.3 "Specifications of input/output signals with PLC CPU" for details.

■ Simple Motion module ↔ GX Works2

The Simple Motion module and GX Works2 communicate the following data via the PLC CPU.

Direction Communication	Simple Motion module → GX Works2	GX Works2 → Simple Motion module
Data (read/write)	• Parameter • Positioning data	• Parameter • Positioning data
Test operation	–	• OPR control start command • Positioning control start command • JOG/Inching operation start command • Teaching start command • Manual pulse generator operation enable/disable command
Operation monitor	• Monitor data	–

■ Simple Motion module ↔ Servo amplifier

The Simple Motion module and servo amplifier communicate the following data via the SSCNETⅢ(/H).

Direction Communication	Simple Motion module → Servo amplifier	Servo amplifier → Simple Motion module
SSCNETⅢ/H	• Positioning commands • Control commands • Servo parameter	• Operating information of the servo amplifier • Servo parameter • External input signal of the servo amplifier
SSCNETⅢ		

■ Simple Motion module ↔ Manual pulse generator/Incremental synchronous encoder

The Simple Motion module and manual pulse generator/incremental synchronous encoder communicate the following data via the external input signal connector.

Direction / Communication	Simple Motion module → Manual pulse generator/Incremental synchronous encoder	Manual pulse generator/Incremental synchronous encoder → Simple Motion module
Pulse signal	–	• Manual pulse generator/Incremental synchronous encoder A-phase • Manual pulse generator/Incremental synchronous encoder B-phase

■ Simple Motion module ↔ External signal

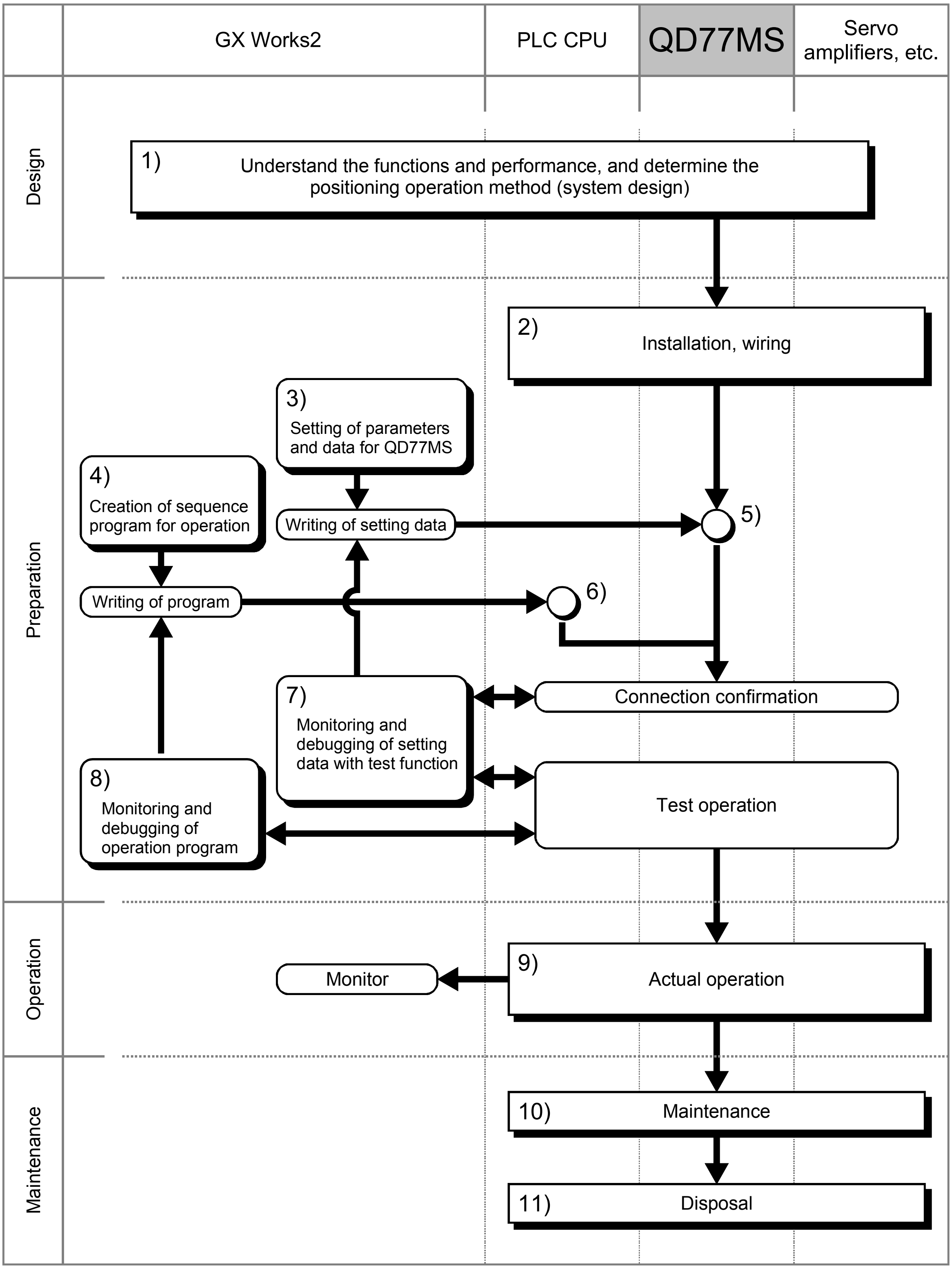
The Simple Motion module and external signal communicate the following data via the external input signal connector.

Direction / Communication	Simple Motion module → External signal	External signal → Simple Motion module
Control signal	–	• Forced stop input signal • External command signal/switching signal • Upper limit signal • Lower limit signal • Stop signal • Near-point dog signal

1.2 Flow of system operation

1.2.1 Flow of all processes

The positioning control processes, using the Simple Motion module, are shown below.

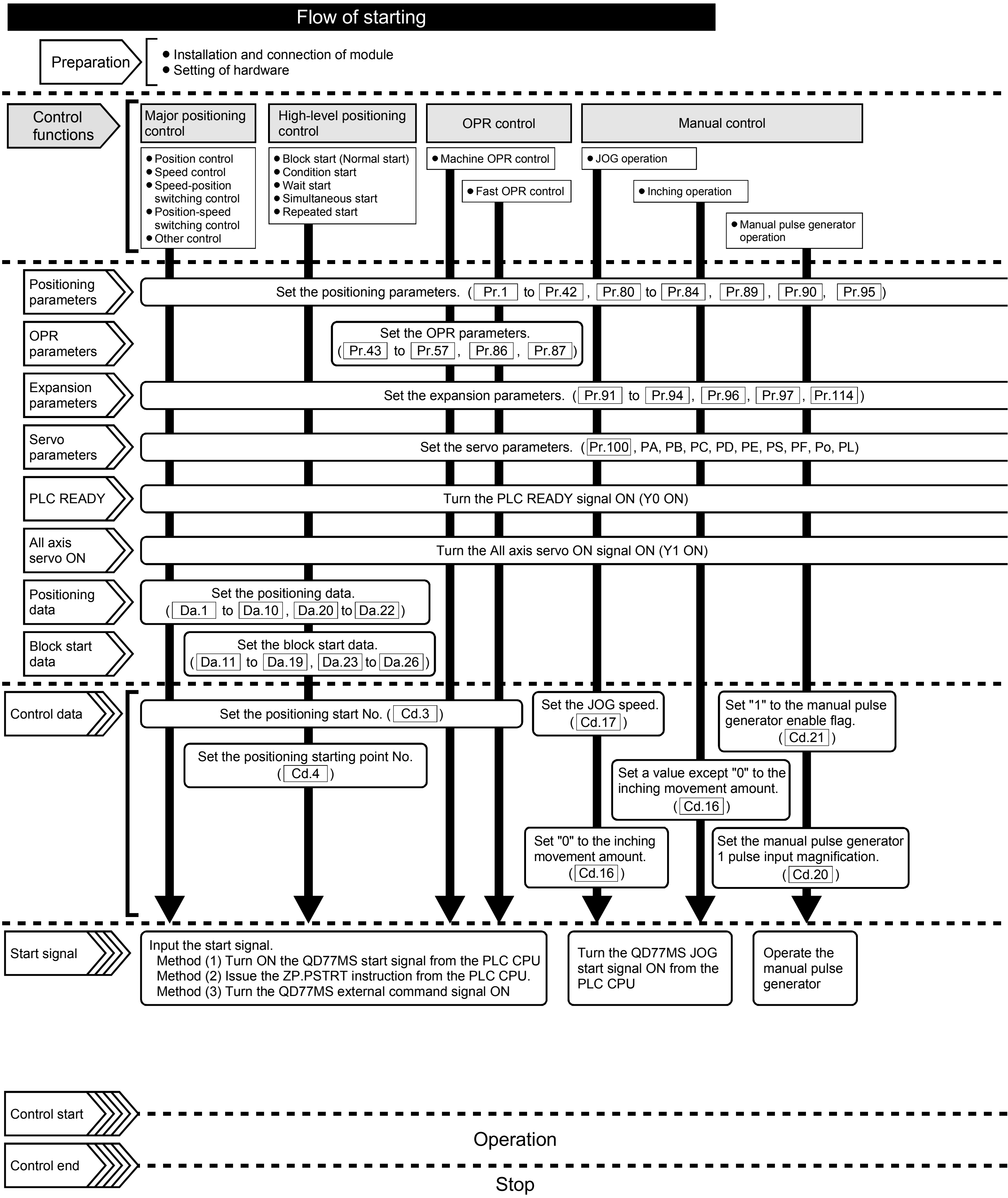


The following work is carried out with the processes shown on the previous page.

	Details	Reference
1)	Understand the product functions and usage methods, the configuration devices and specifications required for positioning control, and design the system.	• Chapter 1 • Chapter 2 • Chapter 3 • Chapter 8 to Chapter 14
2)	Install the Simple Motion module onto the base unit, wire the Simple Motion module and external connection devices (servo amplifier, etc.) and wire the PLC CPU and peripheral devices.	• Chapter 4
3)	Using GX Works2, set the servo parameters, parameter, positioning data, block start data and condition data required for the positioning control to be executed.	• Chapter 5 • Chapter 8 to Chapter 14 • Simple Motion Module Setting Tool Help
4)	Using GX Works2, create the sequence program required for positioning operation.	• Chapter 6 • GX Works2 Version1 Operating Manual (Common)
5)	Write the parameters and positioning data, etc., created with GX Works2 into the Simple Motion module.	• Chapter 7 • Simple Motion Module Setting Tool Help
6)	Using GX Works2, write the created sequence program into the PLC CPU.	• Chapter 7 • GX Works2 Version1 Operating Manual (Common)
7)	Carry out test operation and adjustments in the test function of GX Works2 to check the connection with the Simple Motion module and external connection device, and to confirm that the designated positioning operation is executed correctly. (Debug the set "parameters" and "positioning data", etc.)	• Chapter 14 • Simple Motion Module Setting Tool Help
8)	Carry out test operation and adjustment to confirm that the designated positioning operation is executed correctly. (Debug the created sequence program.)	• GX Works2 Version1 Operating Manual (Common)
9)	Actually operate the positioning operation. At this time, monitor the operation state as required. If an error or warning occurs, remedy.	• Chapter 5 • Chapter 16 • Simple Motion Module Setting Tool Help • GX Works2 Version1 Operating Manual (Common)
10)	Maintenance of the Simple Motion module as required.	• Chapter 4
11)	Dispose of the Simple Motion module.	• Chapter 4

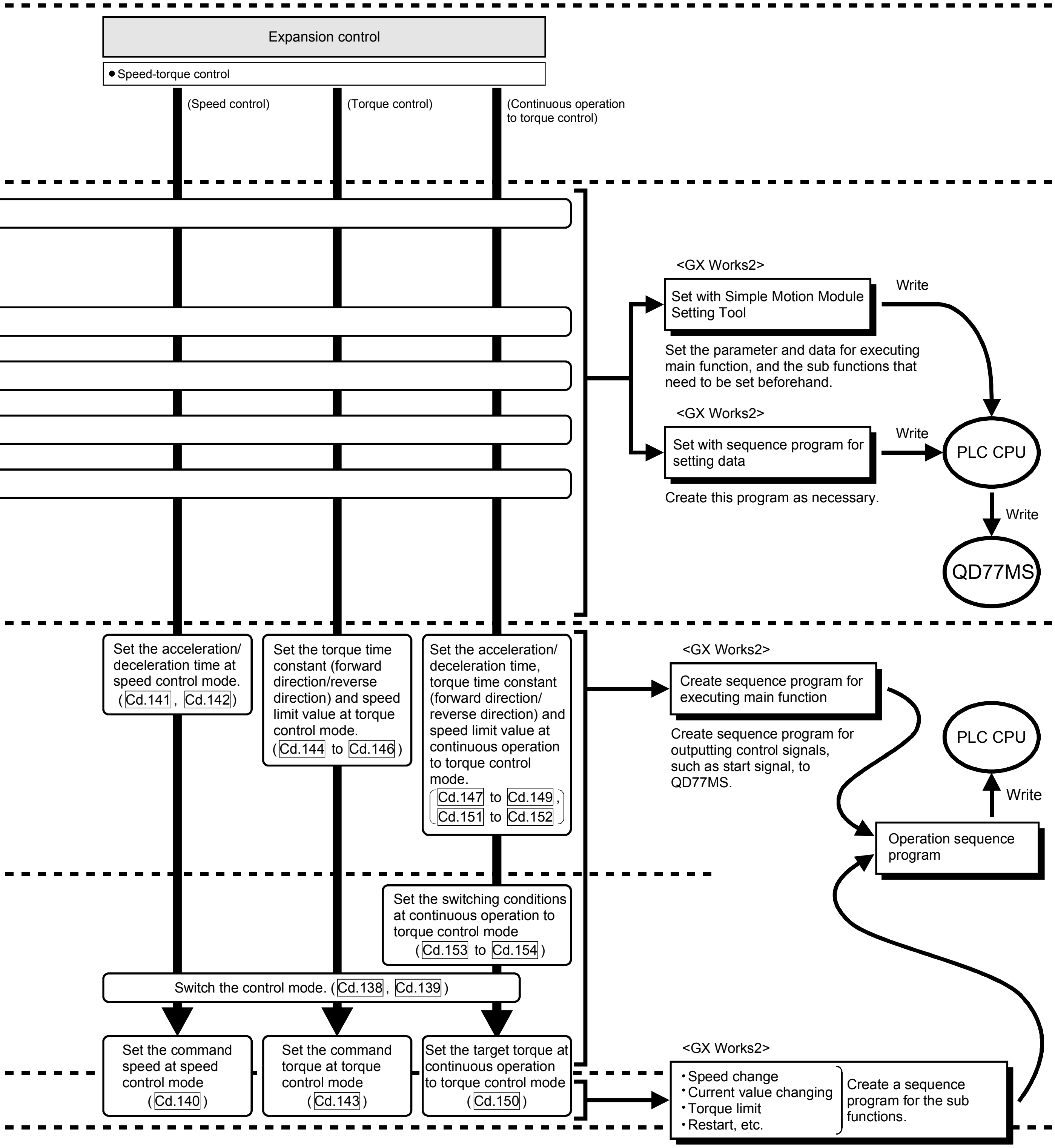
1.2.2 Outline of starting

The outline for starting each control is shown with the following flowchart.
(It is assumed that each module is installed, and the required system configuration, etc., has been prepared.)



Setting method

: Indicates the sequence program that must be created.



Expansion control

● Speed-torque control

(Speed control)

(Torque control)

(Continuous operation to torque control)

<GX Works2>

Set with Simple Motion Module Setting Tool

Set the parameter and data for executing main function, and the sub functions that need to be set beforehand.

<GX Works2>

Set with sequence program for setting data

Create this program as necessary.

Set the acceleration/ deceleration time at speed control mode. (Cd.141, Cd.142)

Set the torque time constant (forward direction/reverse direction) and speed limit value at torque control mode. (Cd.144 to Cd.146)

Set the acceleration/ deceleration time, torque time constant (forward direction/ reverse direction) and speed limit value at continuous operation to torque control mode. (Cd.147 to Cd.149, Cd.151 to Cd.152)

<GX Works2>

Create sequence program for executing main function

Create sequence program for outputting control signals, such as start signal, to QD77MS.

Operation sequence program

Set the switching conditions at continuous operation to torque control mode (Cd.153 to Cd.154)

Switch the control mode. (Cd.138, Cd.139)

Set the command speed at speed control mode (Cd.140)

Set the command torque at torque control mode (Cd.143)

Set the target torque at continuous operation to torque control mode (Cd.150)

<GX Works2>

- Speed change
- Current value changing
- Torque limit
- Restart, etc.

Create a sequence program for the sub functions.

1.2.3 Outline of stopping

Each control is stopped in the following cases.

(1) When each control is completed normally.
(2) When the servo amplifier power supply OFF.
(3) When a PLC CPU error occurs.
(4) When the PLC READY signal is turned OFF.
(5) When an error occurs in the Simple Motion module.
(6) When control is intentionally stopped (Stop signal from PLC CPU turned ON or Stop signal of external input signal turned ON, etc.).

The outline for the stopping process in these cases is shown below. (Excluding (1) for normal stopping.)
Refer to Section 12.1 "Speed-torque control" for the stop processing during the speed control mode, torque control mode or continuous operation to torque control mode.

Stop cause		Stop axis	M code ON signal after stop	Axis operation status after stopping (Md.26)	Stop process					
					OPR control		Major positioning control	High-level positioning control	Manual control	
					Machine OPR control	Fast OPR control			JOG/ Inching operation	Manual pulse generator operation
Forced stop	"Forced stop input signal" OFF from an external device	All axes	No change	Servo OFF	Servo OFF or free run (The operation stops with dynamic brake.)					—
	Servo READY OFF • Servo amplifier power supply OFF	Each axis	No change	Servo amplifier has not been connected						
	• Servo alarm			Error						
	• Forced stop input to servo amplifier			Servo OFF						
Fatal stop (Stop group 1)	Hardware stroke limit upper/lower limit error occurrence	Each axis	No change	Error	Deceleration stop/sudden stop (Select with "Pr.37 Stop group 1 sudden stop selection".)					Deceleration stop
Emergency stop (Stop group 2)	Error occurs in PLC CPU	All axes	No change	Error	Deceleration stop/sudden stop (Select with "Pr.38 Stop group 2 sudden stop selection".)					Deceleration stop
	PLC READY signal OFF		Turns OFF							
	Error in test mode		No change							

Stop cause		Stop axis	M code ON signal after stop	Axis operation status after stopping (Md.26)	Stop process					
					OPR control		Major positioning control	High-level positioning control	Manual control	
					Machine OPR control	Fast OPR control			JOG/ Inching operation	Manual pulse generator operation
Relatively safe stop (Stop group 3)	Axis error detection (Error other than stop group 1 or 2) (Note-1)	Each axis	No change	Error	Deceleration stop/sudden stop (Select with "Pr.39 Stop group 3 sudden stop selection".)					Deceleration stop
	"Stop" input from GX Works2									
Intentional stop (Stop group 3)	"Axis stop signal" ON from PLC CPU	Each axis	No change	Stopped (Standby)						
	"Stop signal" of external input signal ON									

(Note-1): If an error occurs in a positioning data due to an invalid setting value, when the continuous positioning control uses multiple positioning data successively, it automatically decelerates at the previous positioning data. It does not stop suddenly even the setting value is sudden stop in stop group 3. If any of the following error occurs, the operation is performed up to the positioning data immediately before the positioning data where an error occurred, and then stops immediately.

- No command speed (Error code 503)
- Outside linear movement amount range (Error code 504)
- Large arc error deviation (Error code 506)
- Software stroke limit + (Error code 507)
- Software stroke limit - (Error code 508)
- Sub point setting error (Error code 525)
- End point setting error (Error code 526)
- Center point setting error (Error code 527)
- Outside radius range (Error code 544)
- Illegal setting of ABS direction in unit of degree (Error code 546)

REMARK

Provide the emergency stop circuits outside the servo system to prevent cases where danger may result from abnormal operation of the overall system in the event of an external power supply fault or servo system failure.

1.2.4 Outline for restarting

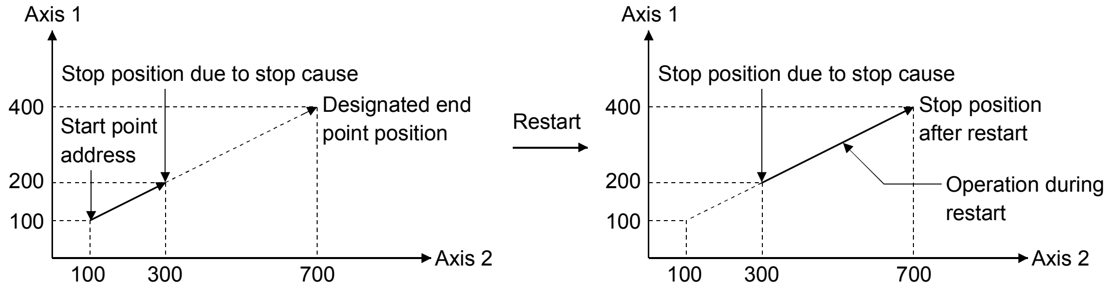
When a stop cause has occurred during operation with position control causing the axis to stop, positioning to the end point of the positioning data can be restarted from the stopped position by using the "Cd.6 Restart command".
If issued during a continuous positioning or continuous path control operation, the restart command will cause the positioning to be re-executed using the current position (pointed by the positioning data No. associated with the moment when the movement was interrupted) as the start point.

■ When "Cd.6 Restart command" is ON

(1) If the "Md.26 Axis operation status" is stopped, positioning to the end point of the positioning data will be restarted from the stopped position regardless of the absolute system or incremental system.

(2) When "Md.26 Axis operation status" is not stopped, the warning "Restart not possible" (warning code: 104) will be applied, and the restart command will be ignored.

(a) The restart operation when the axis 1 movement amount is 300 and the axis 2 movement amount is 600 is shown below.

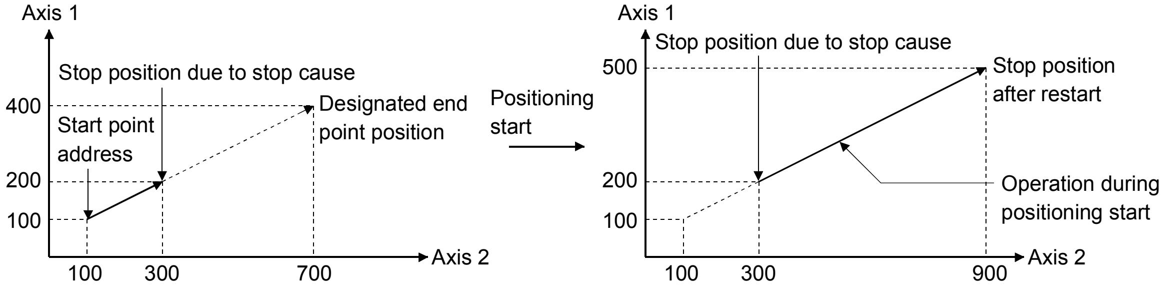


REMARK

If the positioning start signal/external command signal∗ is turned ON while the "Md.26 Axis operation status" is standby or stopped, positioning will be restarted from the start of the positioning start data regardless of the absolute system or incremental system. (∗: When the external command signal is set to "External positioning start") (Same as normal positioning.)

[Example for incremental system]

(a) The positioning start operation, which stops the positioning control while executing that the axis 1 movement amount is 300 and the axis 2 movement amount is 600, is shown below.

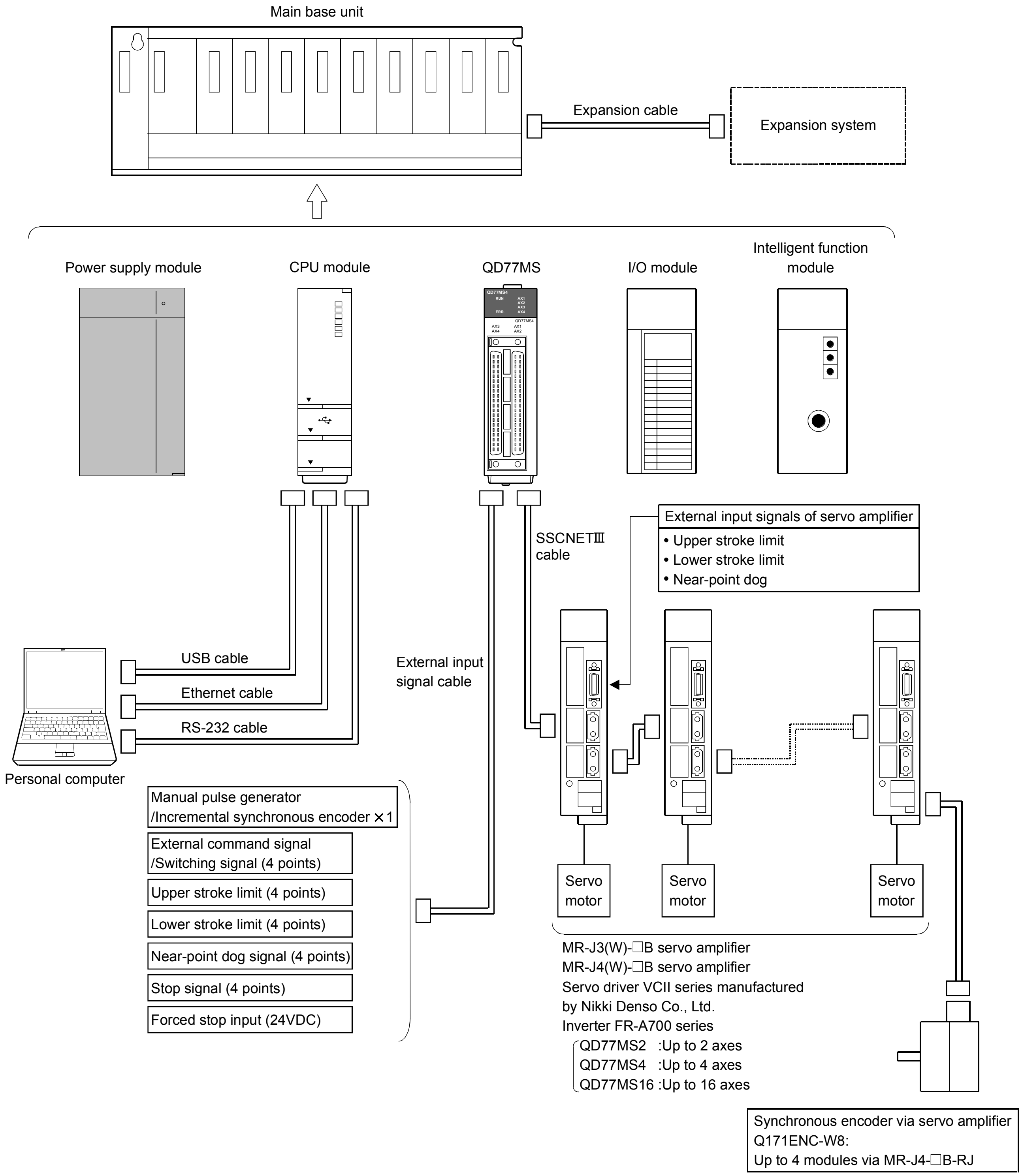


Chapter 2 System Configuration

In this chapter, the general image of the system configuration of the positioning control using Simple Motion module, the configuration devices, applicable CPU and the precautions of configuring the system are explained.
Prepare the required configuration devices to match the positioning control system.

2.1 General image of system

The general image of the system, including such as the QD77MS, PLC CPU and peripheral devices is shown below.



REMARK

(Note-1): Refer to Section "2.3 Applicable system" for the CPU modules that can be used.
(Note-2): Refer to the CPU module User's Manual for the base units that can be used.

2.2 Component list

The positioning system using the Simple Motion module is configured of the following devices.

No.	Part name	Type	Remarks
1	Simple Motion module	QD77MS2	QD77MS□ Number of control axes MS: SSCNETⅢ (/H)model
		QD77MS4	
		QD77MS16	
2	Personal computer	Personal computer which supports Windows®	(Prepared by user) Refer to the "GX Works2 Version1 Operating Manual (Common)" for details.
3	RS-232 cable	QC30R2	(Prepared by user) An RS-232 cable is needed for connecting the CPU module with a personal computer. Refer to the "GX Works2 Version1 Operating Manual (Common)" for details.
4	USB cable	–	(Prepared by user) A USB cable is needed for connecting the CPU module with a personal computer. Refer to the "GX Works2 Version1 Operating Manual (Common)" for details.
5	Ethernet cable	–	(Prepared by user) An Ethernet cable is needed for connecting the CPU module with a personal computer. Refer to the "GX Works2 Version1 Operating Manual (Common)" for details.
6	Servo amplifier	–	(Prepared by user)
7	Manual pulse generator	–	(Prepared by user) Recommended: MR-HDP01 (Mitsubishi Electric)
8	SSCNETⅢ cable (Note-1)	–	(Prepared by user) Cables are needed for connecting the Simple Motion module with a servo amplifier, or between servo amplifiers.
9	External input signal cable (Note-1)	–	(Prepared by user) Cables are needed for connecting the Simple Motion module with an external device. (Prepare them referring to the manuals for the connected devices and information given in 3.4.2 of this manual.)

(Note-1): The SSCNETⅢ cable connecting the Simple Motion module and servo amplifier, or between servo amplifiers, external input signal connector has been prepared.

[SSCNETⅢ cable]

Model name		Cable length [m(ft.)]	Description
MR-J3BUS□M (Note-2) (Standard cord for inside panel)	MR-J3BUS015M	0.15 (0.49)	• Simple Motion module ↔ MR-J4(W)-B/MR-J3(W)-B • MR-J4(W)-B/MR-J3(W)-B ↔ MR-J4(W)-B/MR-J3(W)-B
	MR-J3BUS03M	0.3 (0.98)	
	MR-J3BUS05M	0.5 (1.64)	
	MR-J3BUS1M	1 (3.28)	
	MR-J3BUS3M	3 (9.84)	
MR-J3BUS□M-A (Note-2) (Standard cable for outside panel)	MR-J3BUS5M-A	5 (16.40)	
	MR-J3BUS10M-A	10 (32.81)	
	MR-J3BUS20M-A	20 (65.62)	
MR-J3BUS□M-B (Note-2) (Long distance cable)	MR-J3BUS30M-B	30 (98.43)	
	MR-J3BUS40M-B	40 (131.23)	
	MR-J3BUS50M-B	50 (164.04)	

(Note-2): □ = Cable length
(015: 0.15m (0.49ft.), 03: 0.3m (0.98ft.), 05: 0.5m (1.64ft.), 1: 1m (3.28ft.), 3: 3m (9.84ft.), 5: 5m (16.40ft.), 10: 10m (32.81ft.), 20: 20m (65.62ft.), 30: 30m (98.43ft.), 40: 40m (131.23ft.), 50: 50m (164.04ft.))

[External input signal connector]

Part name	Specification
Applicable connector	A6CON1, A6CON2, A6CON3, A6CON4 (Sold separately)
Applicable wire size	0.3mm^2 (When A6CON1 and A6CON4 are used), AWG24 to AWG28 (When A6CON2 is used), AWG28 (twisted)/AWG30 (single wire) (When A6CON3 is used)

■ Specifications of recommended manual pulse generator

Item	Specification
Model name	MR-HDP01
Ambient temperature	-10 to 60°C (14 to 140°F)
Pulse resolution	25PLS/rev (100 PLS/rev after magnification by 4)
Output method	Voltage-output, Output current Max. 20mA
Power supply voltage	4.5 to 13.2VDC
Current consumption	60mA
Output level	"H" level : Power supply voltage (Note-1) -1V or more (in no load) "L" level : 0.5V or less (with maximum leading-in)
Life time	1000000 revolutions (at 200r/min)
Permitted axial loads	Radial load: Max. 19.6N
	Thrust load: Max. 9.8N
Weight	0.4 [kg]
Number of max. revolution	Instantaneous Max. 600r/min. normal 200r/min
Pulse signal status	2 signals: A phase, B phase, 90° phase difference
Start friction torque	0.06N•m (20°C (68°F))

(Note-1): If a separate power supply is used, use a stabilized power supply of voltage 5VDC ± 0.25V.

■ Serial absolute synchronous encoder specifications

Item	Specifications
Model name	Q171ENC-W8 (Note-1)
Ambient temperature	-5 to 55°C (23 to 131°F)
Resolution	4194304PLS/rev
Transmission method	Serial communications (Connected to MR-J4-☐B-RJ)
Direction of increasing addresses	CCW (viewed from end of shaft)
Protective construction	Dustproof/Waterproof (IP67: Except for the shaft-through portion.)
Permitted speed at power ON	3600r/min
Permitted speed at power OFF (Note-2)	500r/min
Permitted axial loads	Radial load : Up to 19.6N, Thrust load : Up to 9.8N
Runout at input shaft tip	0.02mm(0.00079 inch) or less, (15mm(0.59 inch) from tip)
Start friction torque	0.04N•m (20°C (68°F))
Recommended coupling	Bellows coupling
Permitted angular acceleration	40000rad/s^2
Vibration resistance	5G (50 to 200Hz)
Shock resistance	50G (11ms or less)
Internal current consumption [A]	0.2
Mass [kg]	0.6
Connecting cable [m(ft.)]	Q170ENCCBL☐M (☐=Cable length : 2 (6.56), 5 (16.40), 10 (32.81), 20 (65.62), 30 (98.43), 50 (164.04))
Communications method	Differential driver/receiver
Transmission distance	Up to 50m (164.04ft.)

(Note-1): When "o-ring" is required, please purchase separately by customers.

(Note-2): If it exceeds a permitted speed at power OFF, a position displacement is generated.

■ Serial absolute synchronous encoder input (Use with Synchronous encoder via servo amplifier)

Item	Specifications
Applicable types	Q171ENC-W8
Applicable signal types	Differential-output type : (SN75C1168 or equivalent)
Transmission method	Serial communications
Synchronous method	Counter-clock-wise (viewed from end of shaft)
Communication speed	2.5Mbps
Position detection method	Absolute (ABS) method
Resolution	4194304PLS/rev (22bit)
Number of modules	1/module (MR-J4-□B-RJ)
External connector type	20 pin connector
Applicable connector for the external connection	MR-J3CN2 (Optional)
Applicable wire	J14B103715-00 12Pair
Connecting cable [m(ft.)]	Q170ENCCBL□M-A (□=Cable length: 2 (6.56), 5 (16.40), 10 (32.81), 20 (65.62), 30 (98.43), 50 (164.04))
Cable length	Up to 50m (164.04ft.)
Back up the absolute position.	Depends on the battery (MR-BAT6V1SET).
Battery service life time (value in actual)	10000[h] (When MR-BAT6V1SET is used while the device is turned OFF at the ambient temperature of 25°C (77°F))

2.3 Applicable system

(1) Number of applicable modules

Pay attention to the power supply capacity before mounting modules because power supply capacity may be insufficient depending on the combination with other modules or the number of mounted modules.
If the power supply capacity is insufficient, change the combination of the modules.

(a) When mounted with a CPU module

Applicable CPU module			No. of modules (Note-1)	Base unit (Note-2)	
CPU type		CPU model		Main base unit	Extension base unit
PLC CPU	Basic model QCPU	Q00JCPU	Up to 8 modules	○	○
		Q00CPU	Up to 24 modules		
		Q01CPU			
	High performance model QCPU	Q02CPU	Up to 64 modules	○	○
		Q02HCPU			
		Q06HCPU			
		Q12HCPU			
		Q25HCPU			
	Process CPU	Q02PHCPU	Up to 64 modules	○	○
		Q06PHCPU			
		Q12PHCPU			
		Q25PHCPU			
	Redundant CPU	Q12PRHCPU	Up to 53 modules	×	○
		Q25PRHCPU			
	Universal model QCPU	Q00UJCPU	Up to 8 modules	○	○
		Q00UCPU	Up to 24 modules	○	○
		Q01UCPU			
		Q02UCPU	Up to 36 modules		
		Q03UDCPU	Up to 64 modules		
		Q04UDHCPU			
		Q06UDHCPU			
		Q10UDHCPU			
		Q13UDHCPU			
		Q20UDHCPU			
		Q26UDHCPU			
		Q03UDECPU			
		Q04UDEHCPU			
		Q06UDEHCPU			
		Q10UDEHCPU			
		Q13UDEHCPU			
		Q20UDEHCPU			
		Q26UDEHCPU			
	Universal model QnUDV (High speed type CPU)	Q03UDVCPU	Up to 64 modules	○	○
		Q04UDVCPU			
		Q06UDVCPU			
		Q13UDVCPU			
		Q26UDVCPU			

○: Applicable, ×: N/A

(Note-1): Limited within the range of I/O points for the CPU module.

(Note-2): Can be installed to any I/O slot of a base unit.

(b) Mounting to a MELSECNET/H remote I/O station

Applicable network module	No. of modules (Note-1)	Base unit (Note-2)	
		Main base unit of remote I/O station	Extension base unit of remote I/O station
QJ72LP25-25	Max. 64 modules	○	○
QJ72LP25G			
QJ72BR15			

○: Installation possible, ×: Installation not possible

(Note-1): Within the I/O point range of network module only.

(Note-2): It can be installed in any of the I/O slots of installable base unit.

REMARK

The basic model QCPU cannot configure the MELSECNET/H remote I/O network.

(2) Compatibility with multiple PLC system

When using the QD77MS in a multiple PLC system, first refer to the QCPU User's Manual (multiple CPU system).

(3) Programming tool

The applicable programming tool's versions of the QD77MS are shown below.
(For the applicable programming tool's versions of the CPU module, refer to the "QCPU User's Manual (Hardware Design, Maintenance and Inspection)".)

	Version	
	GX Works2	MR Configurator2
QD77MS2	Version 1.77F or later	Version 1.09K or later
QD77MS4		
QD77MS16		

REMARK

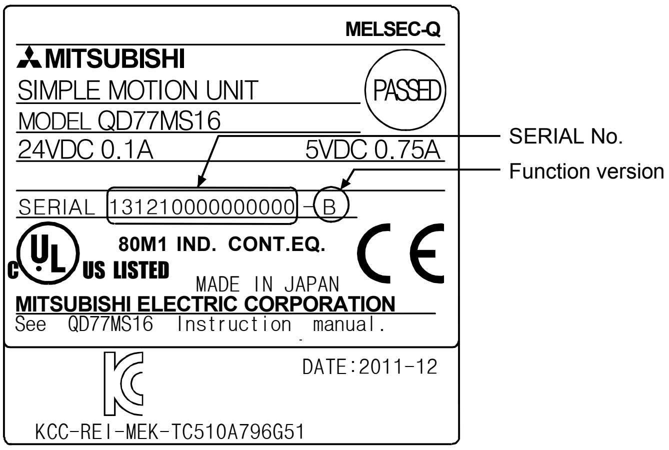
QD77MS cannot be supported with GX Developer, GX Configurator-QP and MR Configurator.
Use GX Works2 and MR Configurator2 to use QD77MS.

2.4 How to check the function version and SERIAL No.

The function version and the SERIAL No. of the Simple Motion module can be checked in the following methods.

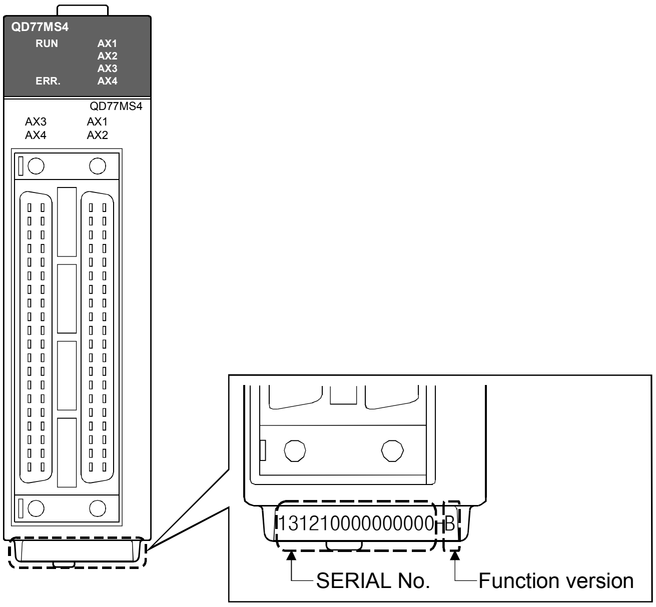
(1) Confirming the serial number on the rating plate

The rating plate is situated on the side face of the Simple Motion module.



(2) Checking on the front of the module

The serial No. on the rating plate is also indicated on the front of the module (lower part).



(3) Confirming by the software

Check the function version and SERIAL No. in "Product Information" displayed on System monitor "Product Information List" of GX Works2.

2.5 Restrictions by the SERIAL No. and version

There are restrictions in the function that can be used by the SERIAL No. of the Simple Motion module and the version of GX Works2.

The combination of each version and function are shown below.

Function	QD77MS2/QD77MS4		QD77MS16		Reference
	First five digits of SERIAL No. (Note-1)	GX Works2	First five digits of SERIAL No. (Note-1)	GX Works2	
Inverter FR-A700 series	14062 or later	1.492N or later	14062 or later	1.492N or later	Appendix 6.3
Driver communication function	15042 or later	1.492N or later	15042 or later	1.492N or later	Section 14.9
Synchronous encoder via servo amplifier					(Note-2)
Mark detection function (Changes latch data range upper limit value/lower limit value during mark detection.)					Section 14.10
External command signal compensation valid/invalid setting					Section 5.2.7
Operation cycle setting for QD77MS2/QD77MS4	15062 or later	1.493P or later	—	—	Section 5.2.7 Section 5.6.1

(Note-1): The serial number can be checked on the "Product Information List" screen in GX Works2.

(Note-2): "MELSEC-Q/L QD77MS/QD77GF/LD77MS/LD77MH Simple Motion Module User’s Manual (Synchronous Control)"

Chapter 3 Specifications and Functions

The various specifications of the Simple Motion module are explained in this chapter.

The "Performance specifications", "List of functions", "Specifications of input/output signals with PLC CPU", and "Specifications of interfaces with external devices", etc., are described as information required when designing the positioning system. Confirm each specification before designing the positioning system.

3.1 Performance specifications

Model Item		QD77MS2	QD77MS4	QD77MS16
Number of control axes		2 axes	4 axes	16 axes
Operation cycle		0.88ms/1.77ms		
Interpolation function		2-axis linear interpolation, 2-axis circular interpolation	2-, 3-, or 4-axis linear interpolation, 2-axis circular interpolation	
Control system		PTP (Point To Point) control, path control (both linear and arc can be set), speed control, speed-position switching control, position-speed switching control, Speed-torque control		
Control unit		mm, inch, degree, PLS		
Positioning data		600 data/axis (Can be set with GX Works2 or sequence program.)		
Backup		Parameters, positioning data, and block start data can be saved on flash ROM (battery-less backup)		
Positioning	Positioning system	PTP control: Incremental system/absolute system Speed-position switching control: Incremental system/absolute system (Note-1) Position-speed switching control: Incremental system Path control: Incremental system/absolute system		
	Positioning range	In absolute system • –214748364.8 to 214748364.7 (µm) • –21474.83648 to 21474.83647 (inch) • 0 to 359.99999 (degree) • –2147483648 to 2147483647 (PLS) In incremental system • –214748364.8 to 214748364.7 (µm) • –21474.83648 to 21474.83647 (inch) • –21474.83648 to 21474.83647 (degree) • –2147483648 to 2147483647 (PLS) In speed-position switching control (INC mode) / position-speed switching control • 0 to 214748364.7 (µm) • 0 to 21474.83647 (inch) • 0 to 21474.83647 (degree) • 0 to 2147483647 (PLS) In speed-position switching control (ABS mode) (Note-1) • 0 to 359.99999 (degree)		
	Speed command	0.01 to 20000000.00 (mm/min) 0.001 to 2000000.000 (inch/min) 0.001 to 2000000.000 (degree/min) (Note-2) 1 to 1000000000 (PLS/s)		
	Acceleration/ deceleration process	Trapezoidal acceleration/deceleration, S-curve acceleration/deceleration		
	Acceleration/ deceleration time	1 to 8388608 (ms) Four patterns can be set for each of acceleration time and deceleration time		
	Sudden stop deceleration time	1 to 8388608 (ms)		

Item \ Model		QD77MS2	QD77MS4	QD77MS16
Starting time (ms) (Note-3)				
	1-axis linear control	0.88	0.88	1.77
	1-axis speed control			
	2-axis linear interpolation control (Composite speed)			
	2-axis linear interpolation control (Reference axis speed)			
	2-axis circular interpolation control			
	2-axis speed control			
	3-axis linear interpolation control (Composite speed)	–		
	3-axis linear interpolation control (Reference axis speed)			
	3-axis speed control			
	4-axis linear interpolation control			
	4-axis speed control			
External wiring connection system		40-pin connector		
Applicable wire size		0.3mm^2 (When A6CON1 and A6CON4 are used), AWG24 to AWG28 (When A6CON2 is used), AWG28 (twisted) /AWG30 (single wire) (When A6CON3 is used)		
Applicable connector for external input signal		A6CON1, A6CON2, A6CON3, A6CON4 (Sold separately)		
SSCNETⅢ cable	MR-J3BUS□M (Note-4)	• QD77MS ↔ MR-J4(W)-B/MR-J3(W)-B/ MR-J4(W)-B/MR-J3(W)-B ↔ MR-J4(W)-B/MR-J3(W)-B • Standard cord for inside panel 0.15m(0.49ft.), 0.3m(0.98ft.), 0.5m(1.64ft.), 1m(3.28ft.), 3m(9.84ft.)		
	MR-J3BUS□M-A (Note-4)	• QD77MS ↔ MR-J4(W)-B/MR-J3(W)-B/ MR-J4(W)-B/MR-J3(W)-B ↔ MR-J4(W)-B/MR-J3(W)-B • Standard cable for outside panel 5m(16.40ft.), 10m(32.81ft.), 20m(65.62ft.)		
	MR-J3BUS□M-B (Note-4), (Note-5)	• QD77MS ↔ MR-J4(W)-B/MR-J3(W)-B/ MR-J4(W)-B/MR-J3(W)-B ↔ MR-J4(W)-B/MR-J3(W)-B • Long distance cable 30m(98.43ft.), 40m(131.23ft.), 50m(164.04ft.)		
5VDC internal current consumption [A]		0.6		0.75
Flash ROM write count		Max. 100000 times		
Number of occupied I/O points [points]		32 (I/O assignment: Intelligent function module 32 points)		
External dimensions [mm(inch)]		98.0 (3.86) (H) × 27.4 (1.08) (W) × 90.0 (3.54) (D)		
Mass [kg]		0.15	0.16	

(Note-1): In speed-position switching control (ABS mode), the control unit available is "degree" only. (For details, refer to Section 9.2.17.)

(Note-2): When "Speed control 10 x multiplier setting for degree axis function" is valid, this will be the setting range 0.01 to 20000000.00 (degree/min). (For details, refer to Section 13.7.10.)

(Note-3): Time from accepting the positioning start signal until BUSY signal turns ON.

(Note-4): □ = Cable length
(015: 0.15m (0.49ft.), 03: 0.3m (0.98ft.), 05: 0.5m (1.64ft.), 1: 1m (3.28ft.), 3: 3m (9.84ft.), 5: 5m (16.40ft.), 10: 10m (32.81ft.), 20: 20m (65.62ft.), 30: 30m (98.43ft.), 40: 40m (131.23ft.), 50: 50m (164.04ft.))

(Note-5): For the cable of less than 30m (98.43ft.), contact your nearest Mitsubishi sales representative.

3.2 List of functions

3.2.1 QD77MS control functions

The Simple Motion module has several functions. In this manual, the Simple Motion module functions are categorized and explained as follows.

■ Main functions

(1) OPR control

"OPR control" is a function (Fast OPR) that established the start point for carrying out positioning control (Machine OPR), and carries out positioning toward that start point. This is used to return a workpiece, located at a position other than the OP when the power is turned ON or after positioning stop, to the OP. The "OPR control" is pre-registered in the Simple Motion module as the "Positioning start data No. 9001 (Machine OPR)", and "Positioning start data No. 9002 (Fast OPR)". (Refer to Chapter 8 "OPR Control".)

(2) Major positioning control

This control is carried out using the "Positioning data" stored in the Simple Motion module. Positioning control, such as position control and speed control, is executed by setting the required items in this "positioning data" and starting that positioning data. An "operation pattern" can be set in this "positioning data", and with this whether to carry out control with continuous positioning data (ex.: positioning data No. 1, No. 2, No. 3, ...) can be set. (Refer to Chapter 9 "Major Positioning Control".)

(3) High-level positioning control

This control executes the "positioning data" stored in the Simple Motion module using the "block start data". The following types of applied positioning control can be carried out.

- Random blocks, handling several continuing positioning data items as "blocks", can be executed in the designated order.
- "Condition judgment" can be added to position control and speed control.
- The operation of the designated positioning data No. that is set for multiple axes can be started simultaneously. (Command is output simultaneously to multiple servo amplifiers.)
- The designated positioning data can be executed repeatedly, etc., (Refer to Chapter 10 "High-Level Positioning Control".)

(4) Manual control

This control executes the random positioning operation by inputting a signal into the Simple Motion module from an external device. Use this manual control to move the workpiece to a random position (JOG operation), and to finely adjust the positioning (inching operation, manual pulse generator operation), etc. (Refer to Chapter 11 "Manual Control".)

(5) Expansion control

The following controls other than the positioning control can be executed. (Refer to Chapter 12 "Expansion Control".)

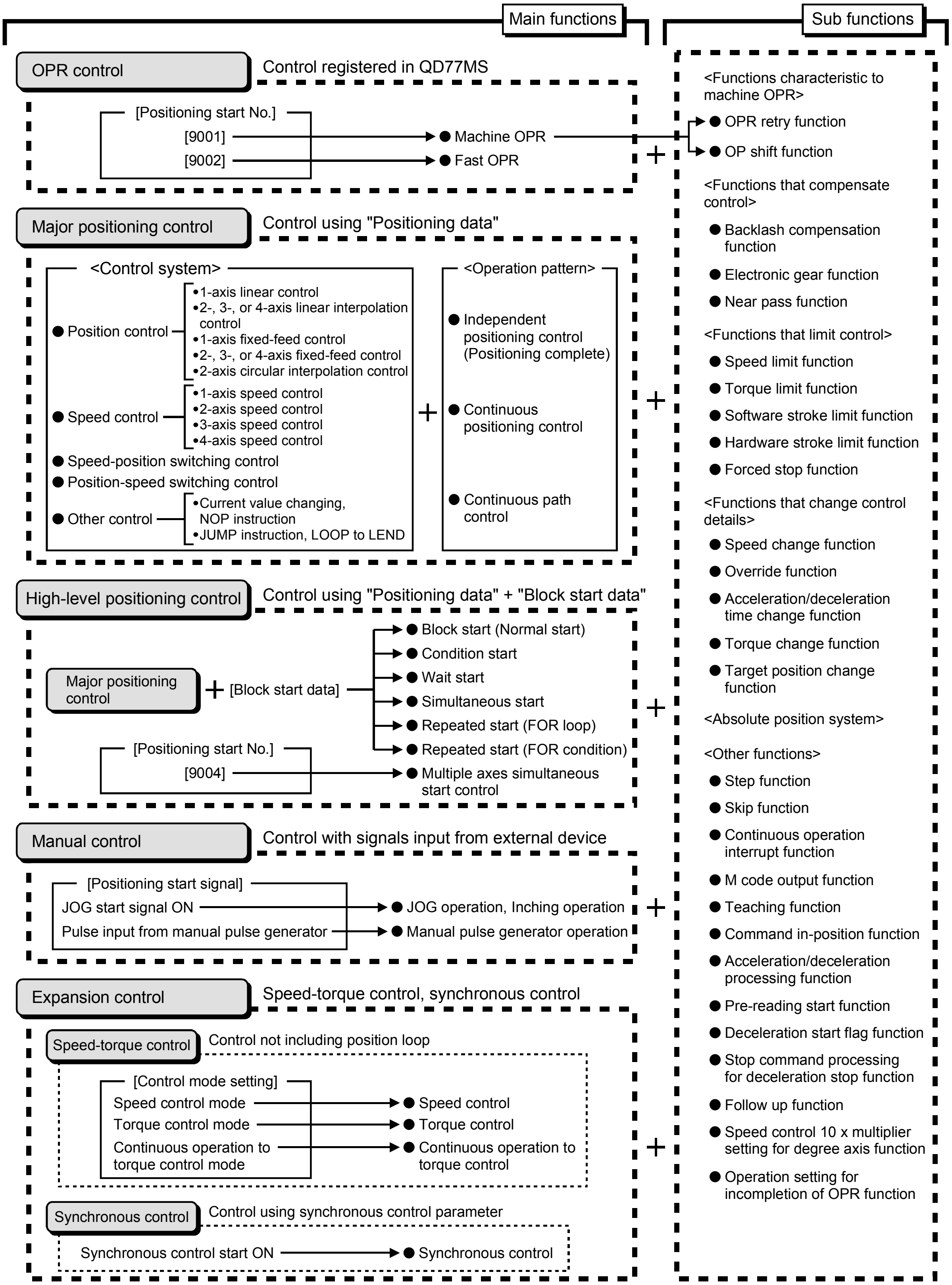
- Speed control and torque control not including position loop for the command to servo amplifier (Speed-torque control).
- Synchronous control with gear, shaft, change gear and cam not by mechanical, but by software use "synchronous control parameter", and is synchronized with input axis (Synchronous control).

■ Sub functions

When executing the main functions, control compensation, limits and functions can be added. (Refer to Chapter 13 "Control Sub Functions".)

■ Common functions

Common control using the Simple Motion module for "parameter initialization" or "backup of execution data" can be carried out. (Refer to Chapter 14 "Common Functions".)



Common functions

- ● Parameter initialization function
- ● Execution data backup function
- ● External signal selection function
- ● External I/O signal logic switching function
- ● History monitor function
- ● Amplifier-less operation function
- ● Virtual servo amplifier function
- ● Driver communication function
- ● Mark detection function
- ● Optional data monitor function
- ● Module error collection function
- ● Connect/disconnect function of SSCNET communication
- ● QD75MH initial value setting function

3.2.2 QD77MS main functions

The outline of the main functions for positioning control with the Simple Motion module is described below. (Refer to "Section 2" for details on each function.)

Main functions			Details	Reference section
OPR control	Machine OPR control		Mechanically establishes the positioning start point using a near-point dog, etc. (Positioning start No. 9001)	8.2
	Fast OPR control		Positions a target to the OP address (Md.21 Machine feed value) stored in the Simple Motion module using machine OPR. (Positioning start No. 9002)	8.3
Major positioning control	Position control	Linear control (1-axis linear control) (2-axis linear interpolation control) (3-axis linear interpolation control) (4-axis linear interpolation control)	Positions a target using a linear path to the address set in the positioning data or to the position designated with the movement amount.	9.2.2 9.2.3 9.2.4 9.2.5
		Fixed-feed control (1-axis fixed-feed control) (2-axis fixed-feed control) (3-axis fixed-feed control) (4-axis fixed-feed control)	Positions a target by the movement amount designated with the amount set in the positioning data. (With fixed-feed control, the"Md.20 Current feed value" is set to "0" when the control is started. With 2-, 3-, or 4-axis fixed-feed control, the fixed-feed is fed along a linear path obtained by interpolation.)	9.2.6 9.2.7 9.2.8 9.2.9
		2-axis circular interpolation control	Positions a target using an arc path to the address set in the positioning data, or to the position designated with the movement amount, sub point or center point.	9.2.10 9.2.11
	Speed control	Speed control (1-axis speed control) (2-axis speed control) (3-axis speed control) (4-axis speed control)	Continuously outputs the command corresponding to the command speed set in the positioning data.	9.2.12 9.2.13 9.2.14 9.2.15
	Speed-position switching control		First, carries out speed control, and then carries out position control (positioning with designated address or movement amount) by turning the "speed-position switching signal" ON.	9.2.16 9.2.17
	Position-speed switching control		First, carries out position control, and then carries out speed control (continuous output of the command corresponding to the designated command speed) by turning the "position-speed switching signal" ON.	9.2.18
	Other control	Current value changing	Changes the current feed value (Md.20) to the address set in the positioning data. The following two methods can be used. (The machine feed value (Md.21) cannot be changed.) • Current value changing using positioning data • Current value changing using current value changing start No. (No. 9003)	9.2.19
		NOP instruction	No execution control system. When NOP instruction is set, this instruction is not executed and the operation of the next data is started.	9.2.20
		JUMP instruction	Unconditionally or conditionally jumps to designated positioning data No.	9.2.21
		LOOP	Carries out loop control with repeated LOOP to LEND.	9.2.22
		LEND	Returns to the beginning of the loop control with repeated LOOP to LEND.	9.2.23

Main functions		Details	Reference section
High-level positioning control	Block start (Normal start)	With one start, executes the positioning data in a random block with the set order.	10.3.2
	Condition start	Carries out condition judgment set in the "condition data" for the designated positioning data, and then executes the "block start data". When the condition is established, the "block start data" is executed. When not established, that "block start data" is ignored, and the next point's "block start data" is executed.	10.3.3
	Wait start	Carries out condition judgment set in the "condition data" for the designated positioning data, and then executes the "block start data". When the condition is established, the "block start data" is executed. When not established, stops the control until the condition is established. (Waits.)	10.3.4
	Simultaneous start	Simultaneously executes the positioning data having the No. for the axis designated with the "condition data". (Outputs commands at the same timing.)	10.3.5
	Repeated start (FOR loop)	Repeats the program from the block start data set with the "FOR loop" to the block start data set in "NEXT" for the designated number of times.	10.3.6
	Repeated start (FOR condition)	Repeats the program from the block start data set with the "FOR condition" to the block start data set in "NEXT" until the conditions set in the "condition data" are established.	10.3.7
	Multiple axes simultaneous start control	Starts the operation of multiple axes simultaneously according to the command output level. (Positioning start No. 9004, same as the "simultaneous start" above)	10.5
Manual control	JOG operation	Outputs a command to servo amplifier while the JOG start signal is ON.	11.2
	Inching operation	Outputs commands corresponding to minute movement amount by manual operation to servo amplifier. (Performs fine adjustment with the JOG start signal.)	11.3
	Manual pulse generator operation	Outputs pulses commanded with the manual pulse generator to servo amplifier.	11.4
Expansion control	Speed-torque control	Carries out the speed control or torque control that does not include the position loop for the command to servo amplifier by switching control mode.	12.1
	Synchronous control	Carries out the synchronous control that synchronizes with input axis by setting the system such as gear, shaft, change gear and cam to the "synchronous control parameter".	12.2

In "major positioning control" ("high-level positioning control"), "Operation pattern" can be set to designate whether to continue executing positioning data. Outlines of the "operation patterns" are given below.

Da.1 Operation pattern	Details	Reference section
Independent positioning control (positioning complete)	When "independent positioning control" is set for the operation pattern of the started positioning data, only the designated positioning data will be executed, and then the positioning will end.	9.1.2
Continuous positioning control	When "continuous positioning control" is set for the operation pattern of the started positioning data, after the designated positioning data is executed, the program will stop once, and then the next following positioning data will be executed.	
Continuous path control	When "continuous path control" is set for the operation pattern of the started positioning data, the designated positioning data will be executed, and then without decelerating, the next following positioning data will be executed.	

3.2.3 QD77MS sub functions

The outline of the functions that assist positioning control using the Simple Motion module is described below. (Refer to "Section 2" for details on each function.)

Sub function		Details	Reference section
Functions characteristic to machine OPR	OPR retry function	This function retries the machine OPR with the upper/lower limit switches during OPR. This allows machine OPR to be carried out even if the axis is not returned to before the near-point dog with JOG operation, etc.	13.2.1
	OP shift function	After returning to the machine OP, this function compensates the position by the designated distance from the machine OP position and sets that position as the OP address.	13.2.2
Functions that compensate control	Backlash compensation function	This function compensates the mechanical backlash amount. Feed commands equivalent to the set backlash amount are output each time the movement direction changes.	13.3.1
	Electronic gear function	By setting the movement amount per pulse, this function can freely change the machine movement amount per commanded pulse. When the movement amount per pulse is set, a flexible positioning system that matches the machine system can be structured.	13.3.2
	Near pass function ＊1	This function suppresses the machine vibration when the positioning data is switched during continuous path control in the interpolation control.	13.3.3
Functions that limit control	Speed limit function	If the command speed exceeds "Pr.8 Speed limit value" during control, this function limits the commanded speed to within the "Pr.8 Speed limit value" setting range.	13.4.1
	Torque limit function	If the torque generated by the servomotor exceeds "Pr.17 Torque limit setting value" during control, this function limits the generated torque to within the "Pr.17 Torque limit setting value" setting range.	13.4.2
	Software stroke limit function	If a command outside of the upper/lower limit stroke limit setting range, set in the parameters, is issued, this function will not execute positioning for that command.	13.4.3
	Hardware stroke limit function	This function carries out deceleration stop with the hardware stroke limit switch.	13.4.4
	Forced stop function	This function is stopped the all axis of the servo amplifier when the forced stop input signal of the Simple Motion module external input signal connector is turned ON.	13.4.5
Functions that change control details	Speed change function	This function changes the speed during positioning. Set the new speed in the speed change buffer memory (Cd.14 New speed value), and change the speed with the speed change request (Cd.15).	13.5.1
	Override function	This function changes the speed within a percentage of 1 to 300% during positioning. This is executed using "Cd.13 Positioning operation speed override".	13.5.2
	Acceleration/deceleration time change function	This function changes the acceleration/deceleration time during speed change. (Functions added to the speed change function and override function)	13.5.3
	Torque change function	This function changes the "torque limit value" during control.	13.5.4
	Target position change function	This function changes the target position during positioning. Position and speed can be changed simultaneously.	13.5.5

Sub function		Details	Reference section
Absolute position system		This function restores the absolute position of designated axis. If the OPR is executed at the start of system, after that, it is unnecessary to carry out the OPR when the power is turned ON.	13.6
Other functions	Step function	This function temporarily stops the operation to confirm the positioning operation during debugging, etc. The operation can be stopped at each "automatic deceleration" or "positioning data".	13.7.1
	Skip function	This function stops (decelerates to a stop) the positioning being executed when the skip signal is input, and carries out the next positioning.	13.7.2
	M code output function	This function issues a command for a sub work (clamp or drill stop, tool change, etc.) corresponding to the M code No. (0 to 65535) that can be set for each positioning data.	13.7.3
	Teaching function	This function stores the address positioned with manual control into the "Da.6 Positioning address/movement amount" having the designated positioning data No. (Cd.39).	13.7.4
	Command in-position function	At each automatic deceleration, this function calculates the remaining distance for the Simple Motion module to reach the positioning stop position. When the value is less than the set value, the "command in-position flag" is set to "1". When using another auxiliary work before ending the control, use this function as a trigger for the sub work.	13.7.5
	Acceleration/deceleration processing function	This function adjusts the acceleration/deceleration.	13.7.6
	Continuous operation interrupt function	This function interrupts continuous operation. When this request is accepted, the operation stops when the execution of the current positioning data is completed.	6.5.4
	Pre-reading start function	This function shortens the virtual start time.	13.7.7
	Deceleration start flag function	Function that turns ON the flag when the constant speed status or acceleration status switches to the deceleration status during position control, whose operation pattern is "Positioning complete", to make the stop timing known.	13.7.8
	Stop command processing for deceleration stop function	Function that selects a deceleration curve when a stop cause occurs during deceleration stop processing to speed 0.	13.7.9
	Follow up function	This function monitors the motor rotation amount with the servo turned OFF, and reflects it on the current feed value.	13.8.2
	Speed control 10 x multiplier setting for degree axis function	This function is executed the positioning control by the 10 x speed of the command speed and the speed limit value when the setting unit is "degree".	13.7.10
	Operation setting for incompletion of OPR function	This function is provided to select whether positioning control is operated or not, when OPR request flag is ON.	13.7.11

＊1: The near pass function is featured as standard and is valid only for position control. It cannot be set to be invalid with parameters.

3.2.4 QD77MS common functions

The outline of the functions executed as necessary is described below.
(Refer to "Section 2" for details on each function.)

Common functions	Details	Reference section
Parameter initialization function	This function returns the "parameters" stored in the buffer memory/internal memory and flash ROM/internal memory (nonvolatile) of Simple Motion module to the default values. The following two methods can be used. 1) Method using sequence program 2) Method using GX Works2	14.2
Execution data backup function	This function stores the "setting data", currently being executed, into the flash ROM/internal memory (nonvolatile). 1) Method using sequence program 2) Method using GX Works2	14.3
External signal selection function	This function selects from the following signals when using the upper/lower limit signal, the near-point dog signal, and the stop signal. • External input signal of QD77MS • External input signal of servo amplifier • External input signal via CPU (buffer memory of QD77MS)	14.4
External I/O signal logic switching function	This function switches I/O signal logic according to externally connected devices. This function enables the use of the system that does not use b (N.C.)-contact signals, such as Upper/lower limit signal, by setting parameters to positive logic.	14.5
History monitor function	This function monitors errors, warnings, and start history of all axes.	14.6
Amplifier-less operation function	This function executes the positioning control of Simple Motion module without connecting to the servo amplifiers. It is used to debug the program at the start-up of the device or simulate the positioning operation.	14.7
Virtual servo amplifier function	This function executes the operation as the axis (virtual servo amplifier axis) that operates only command (instruction) virtually without servo amplifiers.	14.8
Driver communication function	This function uses the "Master-slave operation function" of servo amplifier. The Simple Motion module controls the master axis and the slave axis is controlled by data communication between servo amplifiers (driver communication) without Simple Motion module.	14.9
Mark detection function	This function is used to latch any data at the input timing of the mark detection signal (DI1 to DI4).	14.10
Optional data monitor function	This function is used to store the data selected by user up to 4 data per axis to buffer memory and monitor them.	14.11
Module error collection function	This function collects errors occurred in the Simple Motion module in the PLC CPU. Holding the error contents in the PLC CPU, this function enables to check the error history even after the PLC CPU in powered off or reset.	14.12
Connect/disconnect function of SSCNET communication	Temporarily connect/disconnect of SSCNET communication is executed during system's power supply ON. This function is used to exchange the servo amplifiers or SSCNETⅢ cables.	14.13
QD75MH initial value setting function	This function is used to set the factory-set initial value of QD75MH for the setting data set in the QD77MS buffer memory/internal memory and flash ROM/internal memory (nonvolatile).	14.14

3.2.5 Combination of QD77MS main functions and sub functions

With positioning control using the Simple Motion module, the main functions and sub functions can be combined and used as necessary. A list of the main function and sub function combinations is given below.

Sub functions Main functions			Combination with operation pattern. ＊1	Functions characteristic to machine OPR		Functions that compensate control		
				OPR retry function	OP shift function	Backlash compensation function	Electronic gear function	Near pass function
OPR control	Machine OPR control		×	△ ＊11	○	○	○	＊2
	Fast OPR control		×	×	×	○	○	
Major positioning control	Position control	1-axis linear control	○	×	×	○	○	
		2-, 3-, or 4-axis linear interpolation control	○	×	×	○	○	
		1-axis fixed-feed control	△ (Continuous path control cannot be set)	×	×	○	○	
		2-, 3-, or 4-axis fixed-feed control (interpolation)	△ (Continuous path control cannot be set)	×	×	○	○	
		2-axis circular interpolation control	○	×	×	○	○	
	Speed control (1- to 4-axis)		△ (Only independent positioning control can be set)	×	×	○	○	
	Speed-position switching control		△ (Continuous path control cannot be set)	×	×	○	○	
	Position-speed switching control		△ (Only independent positioning control can be set)					
	Other control	Current value changing	△ (Continuous path control cannot be set)	×	×	×	×	
		NOP instruction	×					
		JUMP instruction	×	×	×	×	×	
		LOOP to LEND						
Manual control	JOG operation, inching operation		×	×	×	○	○	×
	Manual pulse generator operation		×	×	×	○	○	×
Expansion control	Speed-torque control		×	×	×	×	○	×

＊1: The operation pattern is one of the "positioning data" setting items.
＊2: The near pass function is featured as standard and is valid only for setting continuous path control for position control.
＊3: Invalid during creep speed.
＊4: Invalid during continuous path control.
＊5: Combination with the inching operation is not available. (Inching operation does not perform acceleration/deceleration processing.)
＊6: Valid for the reference axis only.
＊7: Valid for only the case where a deceleration start is made during position control.
＊8: Change the current value using the positioning data. Disabled for a start of positioning start No. 9003.
＊9: Valid for "Md.22 Feedrate " and "Md.28 Axis feedrate".
＊10: Valid for a start of positioning start No.9003, but invalid for a start of positioning data (No. 1 to 600).
＊11: OPR retry function cannot be used during the scale origin signal detection method machine OPR.
＊12: Refer to Section 12.1 "Speed-torque control" for acceleration/deceleration processing in the speed-torque control.

	Functions that limit control					Functions that change control details					Other functions										
	Speed limit function	Torque limit function	Software stroke limit function	Hardware stroke limit function	Forced stop function	Speed change function	Override function	Acceleration/ deceleration time change function	Torque change function	Target position change function	Step function	Skip function	M code output function	Teaching function	Command in-position function	Acceleration/deceleration processing function	Pre-reading start function	Deceleration start flag function	Stop command processing for deceleration stop function	Speed control 10 x multiplier setting for degree axis function	Operation setting for incompletion of OPR function
	○	○	×	◎	○	△ ＊3	△ ＊3	△ ＊3	○	×	×	×	×	×	×	○	×	×	○	○	×
	○	○	×	◎	○	○	○	○	○	×	×	×	×	×	○	○	×	×	○	○	×
	○	○	○	◎	○	○	○	○	○	△ ＊4	○	○	○	×	○	○	○	○	○	○	○
	○	○	○	◎	○	○	○	○	○	×	○	○	○	×	○	○	○	△ ＊6	○	○	○
	○	○	○	◎	○	○	○	○	○	×	○	○	○	×	○	○	○	○	○	○	○
	○	○	○	◎	○	○	○	○	○	×	○	○	○	×	○	○	○	△ ＊6	○	○	○
	○	○	○	◎	○	○	○	○	○	×	○	○	○	×	○	○	○	×	○	×	○
	○	○	○	◎	○	○	○	○	○	×	×	×	○	×	×	○	○	×	○	○	○
	○	○	○	◎	○	○	○	○	○	×	○	○ ×	○	×	○	○	○	△ ＊7	○	○	○
	×	×	○ ×	◎ ×	○	×	×	×	×	×	○ ×	○ ×	△ ＊8 ×	×	×	×	×	×	×	×	△ ＊10 ×
	×	×	×	×	○	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×
	○	○	○	◎	○	△ ＊5	△ ＊5	△ ＊5	○	×	×	×	×	○	×	△ ＊5	×	×	×	○	×
	×	○	○	◎	○	×	×	×	○	×	×	×	×	○	×	×	×	×	×	△ ＊9	×
	○	○	○	◎	○	×	×	×	○	×	×	×	×	×	×	△ ＊12	×	×	×	○	○

◎: Always combine, ○: Combination possible, △: Combination limited, ×: Combination not possible

3.3 Specifications of input/output signals with PLC CPU

3.3.1 List of input/output signals with PLC CPU

The Simple Motion module uses 32 input points and 32 output points for exchanging data with the PLC CPU.
The input/output signals when the head I/O number of Simple Motion module is set to "0H" are shown below.
If it is set to other than "0H", change the I/O number according to setting of head I/O number.
Device X refers to the signals input from the Simple Motion module to the PLC CPU, and device Y refers to the signals output from the PLC CPU to the Simple Motion module.

(1) QD77MS2

Signal direction: QD77MS2 → PLC CPU			Signal direction: PLC CPU → QD77MS2		
Device No.	Signal name		Device No.	Signal name	
X0	READY		Y0	PLC READY	
X1	Synchronization flag		Y1	All axis servo ON	
X2	Use prohibited		Y2	Use prohibited	
X3			Y3		
X4	Axis 1	M code ON	Y4	Axis 1	Axis stop
X5	Axis 2		Y5	Axis 2	
X6	Use prohibited		Y6	Use prohibited	
X7			Y7		
X8	Axis 1	Error detection	Y8	Axis 1	Forward run JOG start
X9	Axis 2		Y9		Reverse run JOG start
XA	Use prohibited		YA	Axis 2	Forward run JOG start
XB			YB		Reverse run JOG start
XC	Axis 1	BUSY	YC	Use prohibited	
XD	Axis 2		YD		
XE	Use prohibited		YE		
XF			YF		
X10	Axis 1	Start complete	Y10	Axis 1	Positioning start
X11	Axis 2		Y11	Axis 2	
X12	Use prohibited		Y12	Use prohibited	
X13			Y13		
X14	Axis 1	Positioning complete	Y14	Axis 1	Execution prohibition flag
X15	Axis 2		Y15	Axis 2	
X16	Use prohibited		Y16	Use prohibited	
X17			Y17		
X18			Y18		
X19			Y19		
X1A			Y1A		
X1B			Y1B		
X1C			Y1C		
X1D			Y1D		
X1E			Y1E		
X1F			Y1F		

Important

[Y2, Y3], [Y6, Y7], [YC to YF], [Y12, Y13], [Y18 to Y1F], [X2, X3], [X6, X7], [XA, XB], [XE, YF], [X12, X13], and [X16 to X1F] are used by the system, and cannot be used by the user.

If these devices are used, the operation of the QD77MS2 will not be guaranteed.

(2) QD77MS4

Signal direction: QD77MS4 → PLC CPU			Signal direction: PLC CPU → QD77MS4		
Device No.	Signal name		Device No.	Signal name	
X0	READY		Y0	PLC READY	
X1	Synchronization flag		Y1	All axis servo ON	
X2	Use prohibited		Y2	Use prohibited	
X3			Y3		
X4	Axis 1	M code ON	Y4	Axis 1	Axis stop
X5	Axis 2		Y5	Axis 2	
X6	Axis 3		Y6	Axis 3	
X7	Axis 4		Y7	Axis 4	
X8	Axis 1	Error detection	Y8	Axis 1	Forward run JOG start
X9	Axis 2		Y9		Reverse run JOG start
XA	Axis 3		YA	Axis 2	Forward run JOG start
XB	Axis 4		YB		Reverse run JOG start
XC	Axis 1	BUSY	YC	Axis 3	Forward run JOG start
XD	Axis 2		YD		Reverse run JOG start
XE	Axis 3		YE	Axis 4	Forward run JOG start
XF	Axis 4		YF		Reverse run JOG start
X10	Axis 1	Start complete	Y10	Axis 1	Positioning start
X11	Axis 2		Y11	Axis 2	
X12	Axis 3		Y12	Axis 3	
X13	Axis 4		Y13	Axis 4	
X14	Axis 1	Positioning complete	Y14	Axis 1	Execution prohibition flag
X15	Axis 2		Y15	Axis 2	
X16	Axis 3		Y16	Axis 3	
X17	Axis 4		Y17	Axis 4	
X18	Use prohibited		Y18	Use prohibited	
X19			Y19		
X1A			Y1A		
X1B			Y1B		
X1C			Y1C		
X1D			Y1D		
X1E			Y1E		
X1F			Y1F		

Important

[Y2, Y3], [Y18 to Y1F], [X2, X3], and [X18 to X1F] are used by the system, and cannot be used by the user.

If these devices are used, the operation of the QD77MS4 will not be guaranteed.

(3) QD77MS16

Signal direction: QD77MS16 → PLC CPU			Signal direction: PLC CPU → QD77MS16		
Device No.	Signal name		Device No.	Signal name	
X0	READY		Y0	PLC READY	
X1	Synchronization flag		Y1	All axis servo ON	
X2	Use prohibited		Y2	Use prohibited	
X3			Y3		
X4			Y4		
X5			Y5		
X6			Y6		
X7			Y7		
X8			Y8		
X9			Y9		
XA			YA		
XB			YB		
XC			YC		
XD			YD		
XE			YE		
XF			YF		
X10	Axis 1	BUSY	Y10	Axis 1	Positioning start
X11	Axis 2		Y11	Axis 2	
X12	Axis 3		Y12	Axis 3	
X13	Axis 4		Y13	Axis 4	
X14	Axis 5		Y14	Axis 5	
X15	Axis 6		Y15	Axis 6	
X16	Axis 7		Y16	Axis 7	
X17	Axis 8		Y17	Axis 8	
X18	Axis 9		Y18	Axis 9	
X19	Axis 10		Y19	Axis 10	
X1A	Axis 11		Y1A	Axis 11	
X1B	Axis 12		Y1B	Axis 12	
X1C	Axis 13		Y1C	Axis 13	
X1D	Axis 14		Y1D	Axis 14	
X1E	Axis 15		Y1E	Axis 15	
X1F	Axis 16		Y1F	Axis 16	

POINT

(1) For QD77MS16, M code ON signal, error detection signal, start complete signal and positioning complete signal are assigned to the bit of "Md.31 Status".

(2) For QD77MS16, axis stop signal, forward run JOG start signal, reverse run JOG start signal, execution prohibition flag are assigned to the buffer memory Cd.180 to Cd.183.

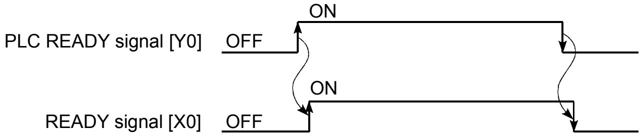
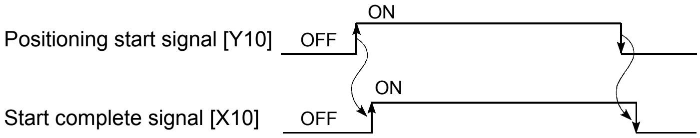
Important

[Y2 to YF] and [X2 to XF] are used by the system, and cannot be used by the user.
If these devices are used, the operation of the QD77MS16 will not be guaranteed.

3.3.2 Details of input signals (QD77MS → PLC CPU)

The ON/OFF timing and conditions of the input signals are shown below.

(1) QD77MS2/QD77MS4

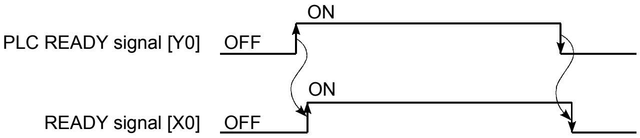
Device No.	Signal name			Details
X0	READY		ON: READY OFF: Not READY/ Watch dog timer error	• When the PLC READY signal [Y0] turns from OFF to ON, the parameter setting range is checked. If no error is found, this signal turns ON. • When the PLC READY signal [Y0] turns OFF, this signal turns OFF. • When watch dog timer error occurs, this signal turns OFF. • This signal is used for interlock in a sequence program, etc. 
X1	Synchronization flag		OFF: Module access disabled ON: Module access enabled	• After the PLC is turned ON or the CPU module is reset, this signal turns ON if the access from the CPU module to the Simple Motion module is possible. • When "Asynchronous" is selected in the module synchronization setting of the CPU module, this signal can be used as interlock for the access from a sequence program to the Simple Motion module.
X4 X5 X6 X7	Axis 1 Axis 2 Axis 3 Axis 4	M code ON	OFF: M code is not set ON: M code is set	• In the WITH mode, this signal turns ON when the positioning data operation is started. In the AFTER mode, this signal turns ON when the positioning data operation is completed. • This signal turns OFF with the "Cd.7 M code OFF request". • When M code is not designated (when "Da.10 M code" is "0"), this signal will remain OFF. • With using continuous path control for the positioning operation, the positioning will continue even when this signal does not turn OFF. However, a warning will occur. (Warning code: 503) • When the PLC READY signal [Y0] turns OFF, the M code ON signal will also turn OFF. • If operation is started while the M code is ON, an error will occur.
X8 X9 XA XB	Axis 1 Axis 2 Axis 3 Axis 4	Error detection	OFF: No error ON: Error occurrence	• This signal turns ON when an error listed in Section 16.4 occurs, and turns OFF when the error is reset on "Cd.5 Axis error reset".
XC XD XE XF	Axis 1 Axis 2 Axis 3 Axis 4	BUSY (Note-1)	OFF: Not BUSY ON: BUSY	• This signal turns ON at the start of positioning, OPR or JOG operation. It turns OFF when the "Da.9 Dwell time" has passed after positioning stops. (This signal remains ON during positioning.) This signal turns OFF when the positioning is stopped with step operation. • During manual pulse generator operation, this signal turns ON while the "Cd.21 Manual pulse generator enable flag" is ON. • This signal turns OFF at error completion or positioning stop.
X10 X11 X12 X13	Axis 1 Axis 2 Axis 3 Axis 4	Start complete	OFF: Start incomplete ON: Start complete	• This signal turns ON when the positioning start signal turns ON and the Simple Motion module starts the positioning process. (The start complete signal also turns ON during OPR control.) 
X14 X15 X16 X17	Axis 1 Axis 2 Axis 3 Axis 4	Positioning complete (Note-2)	OFF: Positioning incomplete ON: Positioning complete	• This signal turns ON for the time set in "Pr.40 Positioning complete signal output time" from the instant when the positioning control for each positioning data No. is completed. For the interpolation control, the positioning completed signal of interpolation axis turns ON during the time set to the reference axis. (It does not turn ON when "Pr.40 Positioning complete signal output time" is "0".) • If positioning (including OPR), JOG/Inching operation, or manual pulse generator operation is started while this signal is ON, the signal will turn OFF. • This signal will not turn ON when speed control or positioning is canceled midway.

Important

(Note-1): The BUSY signal turns ON even when position control of movement amount 0 is executed. However, since the ON time is short, the ON status may not to be detected in the sequence program.

(Note-2): "Positioning complete" of the QD77MS2/QD77MS4 refers to the point when the pulse output from QD77MS2/QD77MS4 is completed.
Thus, even if the QD77MS2/QD77MS4's positioning complete signal turns ON, the system may continue operation.

(2) QD77MS16

Device No.	Signal name			Details
X0	READY		ON: READY OFF: Not READY/ Watch dog timer error	• When the PLC READY signal [Y0] turns from OFF to ON, the parameter setting range is checked. If no error is found, this signal turns ON. • When the PLC READY signal [Y0] turns OFF, this signal turns OFF. • When watch dog timer error occurs, this signal turns OFF. • This signal is used for interlock in a sequence program, etc. 
X1	Synchronization flag		OFF: Module access disabled ON: Module access enabled	• After the PLC is turned ON or the CPU module is reset, this signal turns ON if the access from the CPU module to the Simple Motion module is possible. • When "Asynchronous" is selected in the module synchronization setting of the CPU module, this signal can be used as interlock for the access from a sequence program to the Simple Motion module.
X10	Axis 1	BUSY (Note-1)	OFF: Not BUSY ON: BUSY	• This signal turns ON at the start of positioning, OPR or JOG operation. It turns OFF when the "Da.9 Dwell time" has passed after positioning stops. (This signal remains ON during positioning.) This signal turns OFF when the positioning is stopped with step operation. • During manual pulse generator operation, this signal turns ON while the "Cd.21 Manual pulse generator enable flag" is ON. • This signal turns OFF at error completion or positioning stop.
X11	Axis 2			
X12	Axis 3			
X13	Axis 4			
X14	Axis 5			
X15	Axis 6			
X16	Axis 7			
X17	Axis 8			
X18	Axis 9			
X19	Axis 10			
X1A	Axis 11			
X1B	Axis 12			
X1C	Axis 13			
X1D	Axis 14			
X1E	Axis 15			
X1F	Axis 16			

Important

(Note-1): The BUSY signal turns ON even when position control of movement amount 0 is executed. However, since the ON time is short, the ON status may not to be detected in the sequence program.

3.3.3 Details of output signals (PLC CPU → QD77MS)

The ON/OFF timing and conditions of the output signals are shown below.

(1) QD77MS2/QD77MS4

Device No.	Signal name			Details
Y0	PLC READY		OFF: PLC READY OFF ON: PLC READY ON	(a) This signal notifies the Simple Motion module that the PLC CPU is normal. • It is turned ON/OFF with the sequence program. • The PLC READY signal is turned ON during positioning control, OPR control, JOG operation, inching operation, manual pulse generator operation and speed-torque control etc. unless the system is in the GX Works2 test function. (b) When the data (parameter etc.) are changed, the PLC READY signal is turned OFF depending on the parameter (Refer to Chapter 7.). (c) The following processes are carried out when the PLC READY signal turns from OFF to ON. • The parameter setting range is checked. • The READY signal [X0] turns ON. (d) The following processes are carried out when the PLC READY signal turns from ON to OFF. In these cases, the OFF time should be set to 100ms or more. • The READY signal [X0] turns OFF. • The operating axis stops. • The M code ON signal [X4 to X7] for each axis turns OFF, and "0" is stored in "Md.25 Valid M code". (e) When parameters or positioning data (No. 1 to 600) are written from the GX Works2 or PLC CPU to the flash ROM, the PLC READY signal will turn OFF.
Y1	All axis servo ON		OFF: Servo OFF ON: Servo ON	• The servo for all the servo amplifiers connected to the Simple Motion module is turned ON or OFF.
Y4	Axis 1	Axis stop	OFF: Axis stop not requested ON: Axis stop requested	• When the axis stop signal turns ON, the OPR control, positioning control, JOG operation, inching operation, manual pulse generator operation and speed-torque control etc. will stop. • By turning the axis stop signal ON during positioning operation, the positioning operation will be "stopped". • Whether to decelerate stop or suddenly stop can be selected with "Pr.39 Stop group 3 sudden stop selection". • During interpolation control of the positioning operation, if the axis stop signal of any axis turns ON, all axes in the interpolation control will decelerate and stop.
Y5	Axis 2			
Y6	Axis 3			
Y7	Axis 4			
Y8	Axis 1	Forward run JOG start	OFF: JOG not started ON: JOG started	• When the JOG start signal is ON, JOG operation will be carried out at the "Cd.17 JOG speed". When the JOG start signal turns OFF, the operation will decelerate and stop. • When inching movement amount is set, the designated movement amount is output for one operation cycle and then the operation stops.
Y9	Axis 1	Reverse run JOG start		
YA	Axis 2	Forward run JOG start		
YB	Axis 2	Reverse run JOG start		
YC	Axis 3	Forward run JOG start		
YD	Axis 3	Reverse run JOG start		
YE	Axis 4	Forward run JOG start		
YF	Axis 4	Reverse run JOG start		
Y10	Axis 1	Positioning start	OFF: Positioning start not requested ON: Positioning start requested	• OPR operation or positioning operation is started. • The positioning start signal is valid at the rising edge, and the operation is started. • When the positioning start signal turns ON during BUSY, the operation starting warning will occur (warning code: 100).
Y11	Axis 2			
Y12	Axis 3			
Y13	Axis 4			
Y14	Axis 1	Execution prohibition flag	OFF: Not during execution prohibition ON: During execution prohibition	• If the execution prohibition flag is ON when the positioning start signal turns ON, positioning control does not start until the execution prohibition flag turns OFF. Used with the "Pre-reading start function". (Refer to Section 13.7.7.)
Y15	Axis 2			
Y16	Axis 3			
Y17	Axis 4			

(2) QD77MS16

Device No.	Signal name			Details
Y0	PLC READY		OFF: PLC READY OFF ON: PLC READY ON	(a) This signal notifies the Simple Motion module that the PLC CPU is normal. • It is turned ON/OFF with the sequence program. • The PLC READY signal is turned ON during positioning control, OPR control, JOG operation, inching operation, manual pulse generator operation and speed-torque control etc. unless the system is in the GX Works2 test function. (b) When the data (parameter etc.) are changed, the PLC READY signal is turned OFF depending on the parameter (Refer to Chapter 7.). (c) The following processes are carried out when the PLC READY signal turns from OFF to ON. • The parameter setting range is checked. • The READY signal [X0] turns ON. (d) The following processes are carried out when the PLC READY signal turns from ON to OFF. In these cases, the OFF time should be set to 100ms or more. • The READY signal [X0] turns OFF. • The operating axis stops. • The M code ON signal (Md.31 Status: b12) for each axis turns OFF, and "0" is stored in "Md.25 Valid M code". (e) When parameters or positioning data (No. 1 to 600) are written from the GX Works2 or PLC CPU to the flash ROM, the PLC READY signal will turn OFF.
Y1	All axis servo ON		OFF: Servo OFF ON: Servo ON	• The servo for all the servo amplifiers connected to the Simple Motion module is turned ON or OFF.
Y10	Axis 1	Positioning start	OFF: Positioning start not requested ON: Positioning start requested	• OPR operation or positioning operation is started. • The positioning start signal is valid at the rising edge, and the operation is started. • When the positioning start signal turns ON during BUSY, the operation starting warning will occur (warning code: 100).
Y11	Axis 2			
Y12	Axis 3			
Y13	Axis 4			
Y14	Axis 5			
Y15	Axis 6			
Y16	Axis 7			
Y17	Axis 8			
Y18	Axis 9			
Y19	Axis 10			
Y1A	Axis 11			
Y1B	Axis 12			
Y1C	Axis 13			
Y1D	Axis 14			
Y1E	Axis 15			
Y1F	Axis 16			

3.4 Specifications of interfaces with external devices

3.4.1 Electrical specifications of input signals

(1) External input signals

(a) Specifications of external input signals

Item		Specifications	
Signal name		Upper limit signal Lower limit signal STOP signal	Near-point dog signal External command signal/ Switching signal
Number of input points		4 points each	
Input method		Positive common/Negative common shared	
Common terminal arrangement		4 points/common (Common contact: COM)	
Isolation method		Photocoupler	
Rated input voltage		24VDC	
Rated input current (IIN)		Approx. 5mA	
Operating voltage range		19.2 to 26.4VDC (24VDC +10/-20%, ripple ratio 5% or less)	
ON voltage/current		17.5VDC or more/3.5mA or more	
OFF voltage/current		7VDC or less/1.0mA or less	
Input resistance		Approx. 6.8kΩ	
Response time	OFF to ON	4ms or less	1ms or less
	ON to OFF		

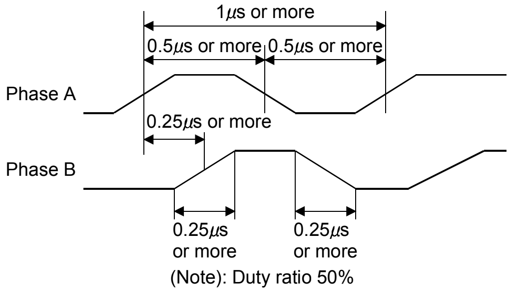
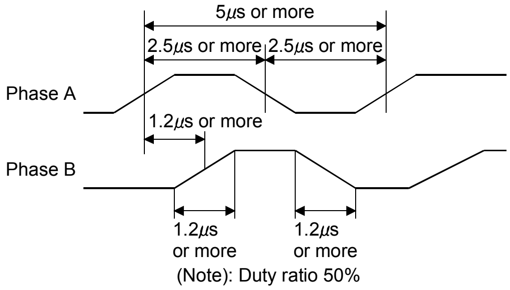
(2) Forced stop input

(a) Specifications of forced stop input signal

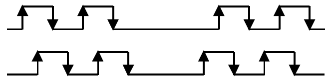
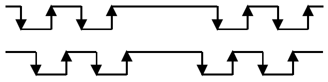
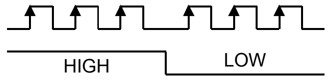
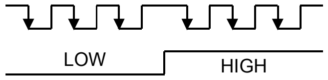
Item		Specifications
Number of input points		1 point
Input method		Positive common/Negative common shared
Common terminal arrangement		1 point/common (Common contact: EMI.COM)
Isolation method		Photocoupler
Rated input voltage		24VDC
Rated input current (IIN)		Approx. 5mA
Operating voltage range		19.2 to 26.4VDC (24VDC +10/ -20%, ripple ratio 5% or less)
ON voltage/current		17.5VDC or more/3.5mA or more
OFF voltage/current		7VDC or less/1mA or less
Input resistance		Approx. 6.8kΩ
Response time	OFF to ON	4ms or less
	ON to OFF	

(3) Manual pulse generator/Incremental synchronous encoder input

(a) Specifications of manual pulse generator/incremental synchronous encoder

Item		Specifications
Signal input form (Note-1)		Phase A/Phase B (Magnification by 4/ Magnification by 2/Magnification by 1), PLS/SIGN
Differential-output type (26LS31 or equivalent)	Maximum input pulse frequency	1Mpps (After magnification by 4, up to 4Mpps) (Note-2)
	Pulse width	1μs or more
	Leading edge/trailing edge time	0.25μs or less
	Phase difference	0.25μs or more
	High-voltage	2.0 to 5.25VDC
	Low-voltage	0 to 0.8VDC
	Differential voltage	±0.2V
	Cable length	Up to 30m (98.43ft.)
	Example of waveform	
Voltage-output/ Open-collector type (5VDC)	Maximum input pulse frequency	200kpps (After magnification by 4, up to 800kpps) (Note-2)
	Pulse width	5μs or more
	Leading edge/trailing edge time	1.2μs or less
	Phase difference	1.2μs or more
	High-voltage	3.0 to 5.25 VDC
	Low-voltage	0 to1.0VDC
	Cable length	Up to 10m (32.81ft.)
	Example of waveform	

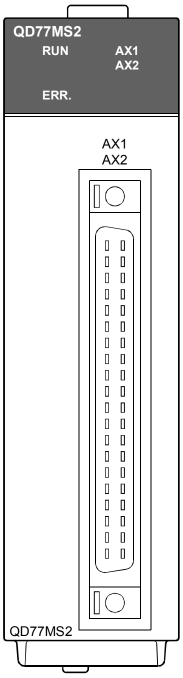
(Note-1): Set the signal input form in "Pr.24 Manual pulse generator/Incremental synchronous encoder input selection".

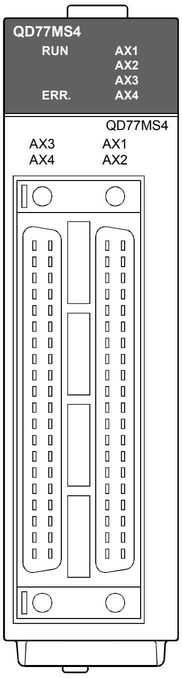
Pr.24 Manual pulse generator/ Incremental synchronous encoder input selection	Pr.22 Input signal logic selection			
	Positive logic		Negative logic	
	Forward run	Reverse run	Forward run	Reverse run
Phase A/Phase B				
PLS/SIGN				

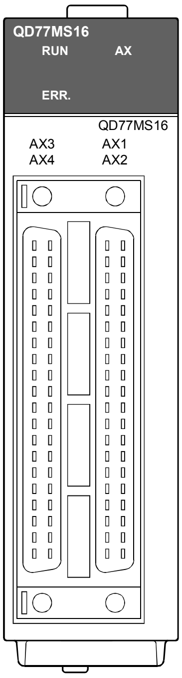
(Note-2): Maximum input pulse frequency is magnified by 4, when "A-phase/B-phase Magnification by 4" is set in "Pr.24 Manual pulse generator/Incremental synchronous encoder input selection".

3.4.2 Signal layout for external input signal connector

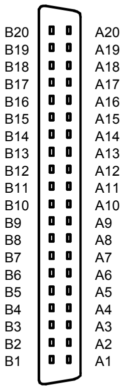
The specifications of the connector section, which is the input/output interface for the Simple Motion module and external device, are shown below.







The signal layout for the external input signal connector of Simple Motion module is shown.

Pin layout	AX4		AX3		AX2		AX1	
	Axis 4 (External input signal 4)		Axis 3 (External input signal 3)		Axis 2 (External input signal 2)		Axis 1 (External input signal 1)	
	Pin No.	Signal name	Pin No.	Signal name	Pin No.	Signal name	Pin No.	Signal name
 Front view of the module	2B20	No connect (Note-7)	2A20	No connect (Note-7)	1B20	HB (Note-3), (Note-4), (Note-5)	1A20	5V (Note-9)
	2B19		2A19		1B19	HA (Note-3), (Note-4), (Note-5)	1A19	5V (Note-9)
	2B18		2A18		1B18	HBL (Note-3), (Note-4), (Note-6)	1A18	HBH (Note-3), (Note-4), (Note-6)
	2B17		2A17		1B17	HAL (Note-3), (Note-4), (Note-6)	1A17	HAH (Note-3), (Note-4), (Note-6)
	2B16		2A16		1B16	No connect (Note-7)	1A16	No connect (Note-7)
	2B15		2A15		1B15	5V (Note-10)	1A15	5V (Note-10)
	2B14		2A14		1B14	SG (Note-10)	1A14	SG (Note-10)
	2B13		2A13		1B13	No connect (Note-7)	1A13	No connect (Note-7)
	2B12		2A12		1B12		1A12	
	2B11		2A11		1B11		1A11	
	2B10		2A10		1B10		1A10	
	2B9		2A9		1B9		1A9	
	2B8				1B8	EMI. COM	1A8	EMI
	2B7	COM	2A7	COM	1B7	COM	1A7	COM
	2B6	COM	2A6	COM	1B6	COM	1A6	COM
	2B5	DI4 (Note-8)	2A5	DI3 (Note-8)	1B5	DI2 (Note-8)	1A5	DI1 (Note-8)
	2B4	STOP (Note-8)	2A4	STOP (Note-8)	1B4	STOP (Note-8)	1A4	STOP (Note-8)
	2B3	DOG (Note-8)	2A3	DOG (Note-8)	1B3	DOG (Note-8)	1A3	DOG (Note-8)
	2B2	RLS (Note-8)	2A2	RLS (Note-8)	1B2	RLS (Note-8)	1A2	RLS (Note-8)
	2B1	FLS (Note-8)	2A1	FLS (Note-8)	1B1	FLS (Note-8)	1A1	FLS (Note-8)

(Note-1) : Pin No. "1□□□" indicates the pin No. for the right connector. Pin No. "2□□□" indicates the pin No. for the left connector.

(Note-2) : For QD77MS2 does not have AX3 and AX4 connector of the left side.

(Note-3) : Input type from manual pulse generator/incremental synchronous encoder is switched in "Pr.89 Manual pulse generator/Incremental synchronous encoder input type selection". (Only the value specified against the axis 1 is valid.)

- 0: Differential-output type
- 1: Voltage-output/open-collector type (Default value)

(Note-4) : Set the signal input form in "Pr.24 Manual pulse generator/Incremental synchronous encoder input selection".

(Note-5) : Voltage-output/open-collector type
Connect the A-phase/PLS signal to HA, and the B-phase/SIGN signal to HB.

(Note-6) : Differential-output type
Connect the A-phase/PLS signal to HAH, and the A-phase/PLS inverse signal to HAL.
Connect the B-phase/SIGN signal to HBH, and the B-phase/SIGN inverse signal to HBL.

(Note-7) : Do not connect to any of the terminal explained as "No connect".

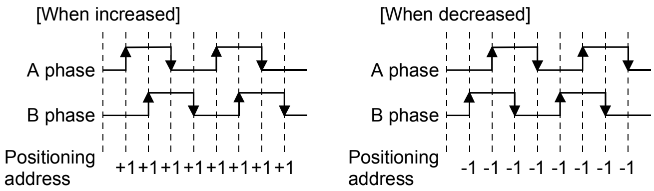
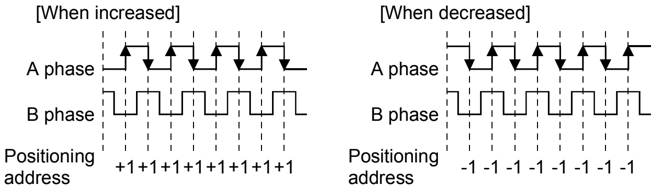
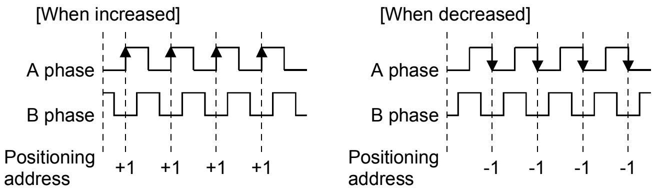
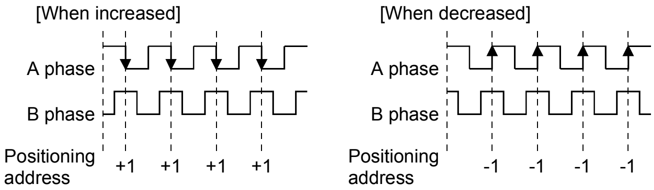
(Note-8) : Set the external command signal [DI, FLS, RLS, DOG, STOP] in "Pr.80 External input signal selection" and "Pr.95 External command signal selection" at QD77MS16 use.

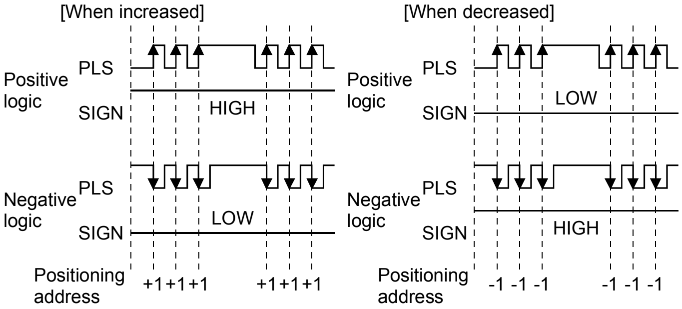
(Note-9) : Do not connect wires other than the signal wires of the manual pulse generator to 1A20 and 1A19.

(Note-10): Do not use 1A(B)15 and 1A(B)14 for other than the power supply of manual pulse generator.

3.4.3 List of input signal details

The details of each external input signal connector of Simple Motion module are shown below.

Signal name			Pin No.	Signal details
Differential type	Manual pulse generator/Incremental synchronous encoder A phase/PLS	(+) (HAH)	1A17	(1) Phase A/Phase B • Input the pulse signal from the manual pulse generator/incremental synchronous encoder A phase and B phase. • If the A phase leads the B phase, the positioning address will increase at the rising and falling edges of each phase. • If the B phase leads the A phase, the positioning address will decrease at the rising and falling edges of each phase. (a) Magnification by 4  (b) Magnification by 2  (c) Magnification by 1 1) Positive logic  2) Negative logic 
		(-) (HAL)	1B17	
	Manual pulse generator/Incremental synchronous encoder B phase/SIGN	(+) (HBH)	1A18	
		(-) (HBL)	1B18	
Voltage-output/open-collector type	Manual pulse generator/Incremental synchronous encoder A phase/PLS	(HA)	1B19	
	Manual pulse generator/Incremental synchronous encoder B phase/SIGN	(HB)	1B20	

Signal name			Pin No.	Signal details
Differential type	Manual pulse generator/Incremental synchronous encoder A phase/PLS	(+) (HAH)	1A17	(2) PLS/SIGN Input the pulse signal for counting the increased/decreased pulse in the pulse input (PLS). Input the signal for controlling forward run and reverse run in the direction sign (SIGN). 1) "Pr.22 Input signal logic selection" is positive logic • The motor will forward run when the direction sign is HIGH. • The motor will reverse run when the direction sign is LOW. 2) "Pr.22 Input signal logic selection" is negative logic • The motor will forward run when the direction sign is LOW. • The motor will reverse run when the direction sign is HIGH. 
		(-) (HAL)	1B17	
	Manual pulse generator/Incremental synchronous encoder B phase/SIGN	(+) (HBH)	1A18	
		(-) (HBL)	1B18	
Voltage-output/ open-collector type	Manual pulse generator/Incremental synchronous encoder A phase/PLS	(HA)	1B19	
	Manual pulse generator/Incremental synchronous encoder B phase/SIGN	(HB)	1B20	

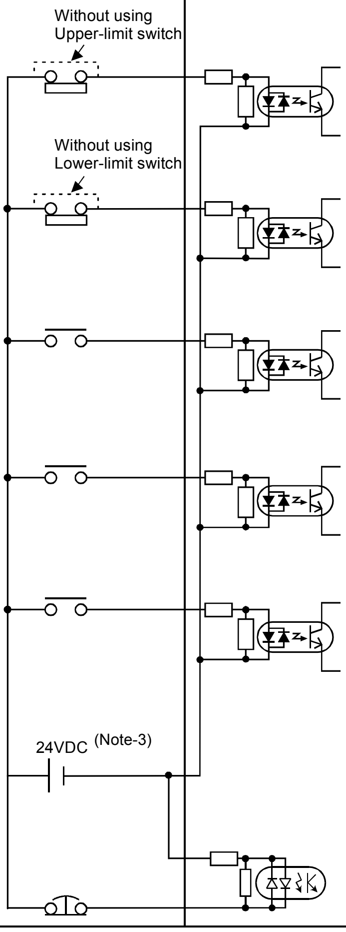
Signal name		Pin No.	Signal details
Compatibility with the QD75MH Manual pulse generator power supply output (+ 5VDC) (5V)		1A20 1A19	• Power supply for manual pulse generator MR-HDP01. (+ 5VDC) (This power supply is used with the external input signal cable of QD75MH.) (Note): Do not connect wires other than the signal wires of the manual pulse generator.
Upper limit signal (FLS)		1A1 1B1 2A1 2B1	• This signal is input from the limit switch installed at the upper limit position of the stroke. • Positioning will stop when this signal turns OFF. • When OPR retry function is valid, this will be the upper limit for finding the near-point dog signal.
Lower limit signal (RLS)		1A2 1B2 2A2 2B2	• This signal is input from the limit switch installed at the lower limit position of the stroke. • Positioning will stop when this signal turns OFF. • When OPR retry function is valid, this will be the lower limit for finding the near-point dog signal.
Near-point dog signal (DOG)		1A3 1B3 2A3 2B3	• This signal is used for detecting the near-point dog during OPR. • The near-point dog OFF → ON is detected at the rising edge. • The near-point dog ON → OFF is detected at the falling edge.
Stop signal (STOP)		1A4 1B4 2A4 2B4	• Input this signal to stop positioning. • When this signal turns ON, the QD77MS will stop the positioning being executed. After that, even if this signal is turned from ON to OFF, the system will not start.
External command/ Switching signal	(DI1)	1A5	• Input a control switching signal during speed-position or position-speed switching control. • Use this signal as the input signal of positioning start, speed change request, skip request and mark detection from an external device. Set the function to use this signal in "Pr.42 External command function selection". (Note): Set the signal in "Pr.95 External command signal selection" at QD77MS16 use.
	(DI2)	1B5	
	(DI3)	2A5	
	(DI4)	2B5	
Common (COM)		1A6 1A7 1B6 1B7 2A6 2A7 2B6 2B7	• Common for upper/lower limit, near-point dog, stop, and external command /switching signals.
Forced stop input signal (EMI)		1A8	• This signal is input when batch forced stop is available for all axes of servo amplifier. EMI ON (Opened) : Forced stop EMI OFF (24VDC input) : Forced stop release
Forced stop input signal common (EMI.COM)		1B8	
Manual pulse generator power supply output (+ 5VDC) (5V)		1A15 1B15	• Power supply for manual pulse generator. (+ 5VDC) (Note): This power supply is used for manual pulse generator. It must not be used except for the manual pulse generator power supply.
Manual pulse generator power supply output (GND) (SG)		1A14 1B14	• Power supply for manual pulse generator. (GND) (Note): This power supply is used for manual pulse generator. It must not be used except for the manual pulse generator power supply.

(Note-1): There are no signals of 2A□ and 2B□ at QD77MS2 use.

3.4.4 Interface internal circuit

The outline diagrams of the internal circuits for the external device connection interface of Simple Motion module are shown below.

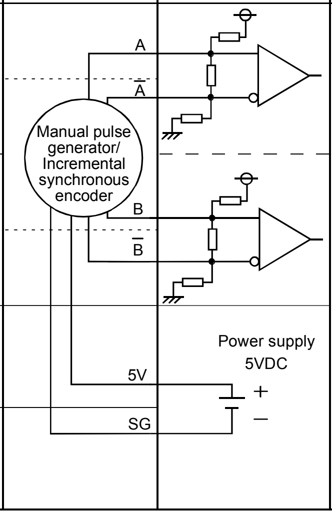
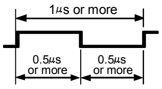
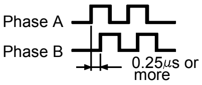
(1) Interface between external input signals/forced stop input signals

Input or Output	Signal name		Pin No.	Wiring example	Internal circuit	Description
Input	Upper-limit signal (Note-1)	FLS	□□1 (Note-2)			Upper-limit signal, Lower-limit signal, Near-point dog signal, Stop signal, External command signal, Switching signal, Forced stop input signal
	Lower-limit signal (Note-1)	RLS	□□2 (Note-2)			
	Near-point dog signal (Note-1)	DOG	□□3 (Note-2)			
	Stop signal	STOP	□□4 (Note-2)			
	External command/ Switching	DI	□□5 (Note-2)			
	Common	COM	□□6 (Note-2) □□7 (Note-2)			
	Forced stop input signal	EMI	1A8			
		EMI.COM	1B8			

(Note-1): When using external input signal of servo amplifier, set "1" with " Pr.80 External signal selection". In addition, refer to Section 13.4.4 for wiring of upper/lower limit signal and Section 8.1.1 for wiring of near-point dog signal.
(Note-2): "□□" indicates "1A (AX1)", "1B (AX2)", 2A (AX3)", or "2B (AX4)".
(Note-3): As for the 24VDC sign, both "+" and "-" are possible.

(2) Manual pulse generator/Incremental synchronous encoder input

(a) Interface between manual pulse generator/incremental synchronous encoder (Differential-output type)

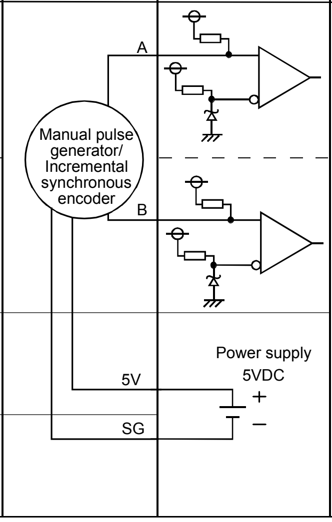
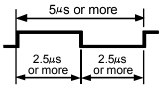
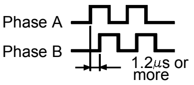
Input or Output	Signal name		Pin No.	Wiring example	Internal circuit	Specification	Description
Input (Note-1), (Note-2)	Manual pulse generator, phase A/ PLS	A+ HAH	1A17			• Rated input voltage 5.5VDC or less • HIGH level 2.0 to 5.25VDC • LOW level 0.8VDC or less • 26LS31 or equivalent	For connection manual pulse generator/ incremental synchronous encoder • Pulse width  (Duty ratio: 50%) • Leading edge, Trailing edge time ••• 0.25μs or less • Phase difference (Phases A, B)  (1) Positioning address increases if Phase A leads Phase B. (2) Positioning address decreases if Phase B leads Phase A.
		A- HAL	1B17				
	Manual pulse generator, phase B/ SIGN	B+ HBH	1A18				
		B- HBL	1B18				
Power supply	5V(Note-3)		1A15 1B15				
	SG		1A14 1B14				

(Note-1): Set "0: Differential-output type" in " Pr.89 Manual pulse generator/Incremental synchronous encoder input type selection" if the manual pulse generator/Incremental synchronous encoder of differential-output type is used.
The default value is "1: Voltage-output/open-collector type".

(Note-2): Set the signal input form in " Pr.24 Manual pulse generator/Incremental synchronous encoder input selection".

(Note-3): The 5VDC power supply from the Simple Motion module must not be used if a separate power supply is applied to the manual pulse generator/incremental synchronous encoder.
If a separate power supply is used, use a stabilized power supply of voltage 5VDC.
Anything else may cause a failure.

(b) Interface between manual pulse generator/Incremental synchronous encoder (Voltage-output/open-collector type)

Input or Output	Signal name	Pin No.	Wiring example	Internal circuit	Specification	Description
Input (Note-1), (Note-2)	Manual pulse generator, phase A/PLS HA	1B19			• Rated input voltage 5.5VDC or less • HIGH level 3 to 5.25VDC/ 2mA or less • LOW level 1VDC or less/ 5mA or more	For connection manual pulse generator/ incremental synchronous encoder • Pulse width  (Duty ratio: 50%) • Leading edge, Trailing edge time ••• 1.2μs or less • Phase difference (Phases A, B)  (1) Positioning address increases if Phase A leads Phase B. (2) Positioning address decreases if Phase B leads Phase A.
	Manual pulse generator, phase B/SIGN HB	1B20				
Power supply	5V(Note-3)	1A15 1B15				
	SG	1A14 1B14				

(Note-1): Set "1: Voltage-output/open-collector type" in " Pr.89 Manual pulse generator/Incremental synchronous encoder input type selection" if the manual pulse generator/Incremental synchronous encoder of voltage-output/open-collector type is used.
The default value is "1: Voltage-output/open-collector type".

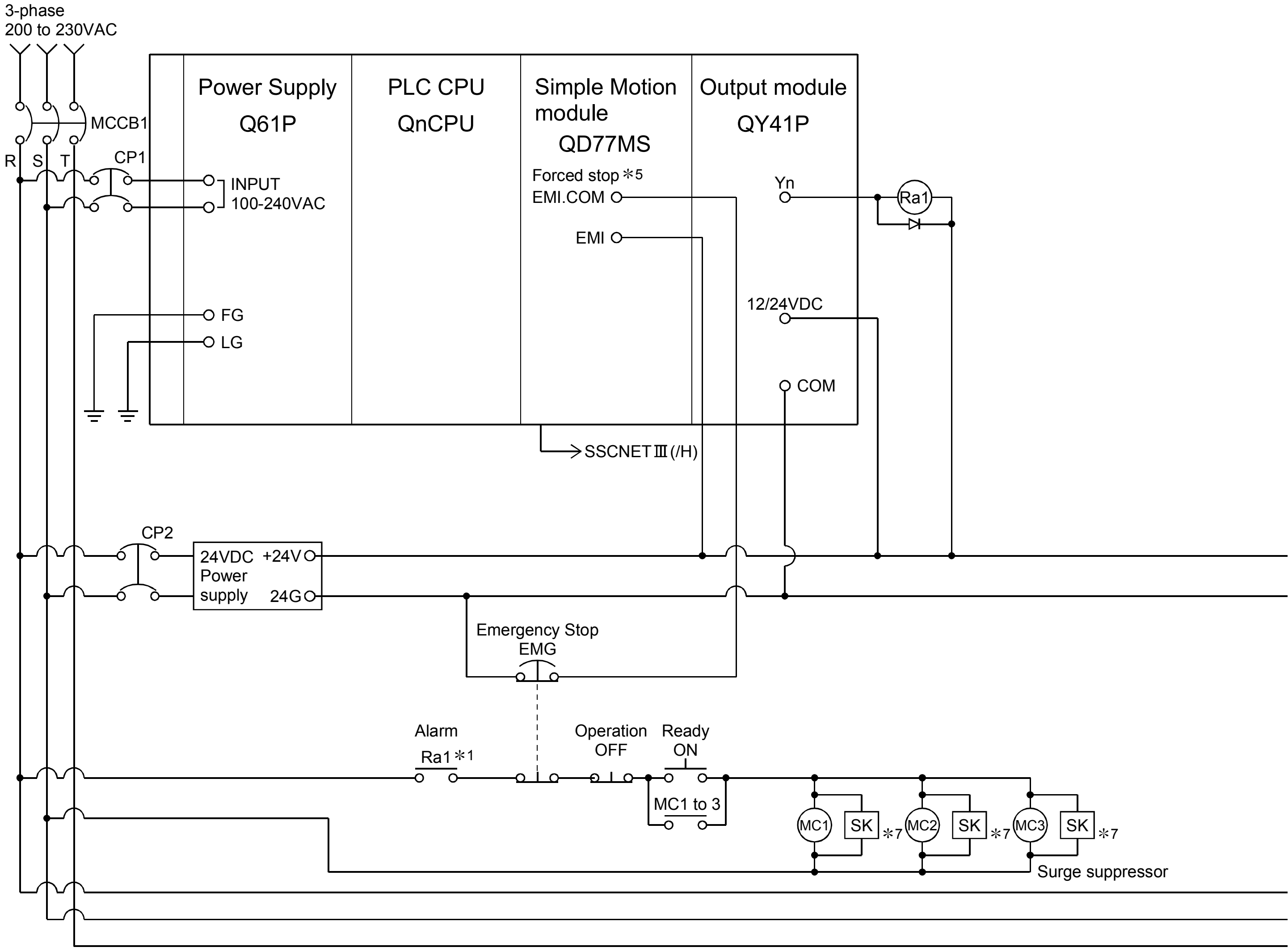
(Note-2): Set the signal input form in " Pr.24 Manual pulse generator/Incremental synchronous encoder input selection".

(Note-3): The 5VDC power supply from the Simple Motion module must not be used if a separate power supply is applied to the manual pulse generator/incremental synchronous encoder.
If a separate power supply is used, use a stabilized power supply of voltage 5VDC.
Anything else may cause a failure.

3.5 External circuit design

Configure up the power supply circuit and main circuit which turn off the power supply after detection alarm occurrence and servo forced stop. When designing the main circuit of the power supply, make sure to use a circuit breaker (MCCB).
The outline diagrams for the external device connection interface are shown below.

(1) Example when using the forced stop of the QD77MS

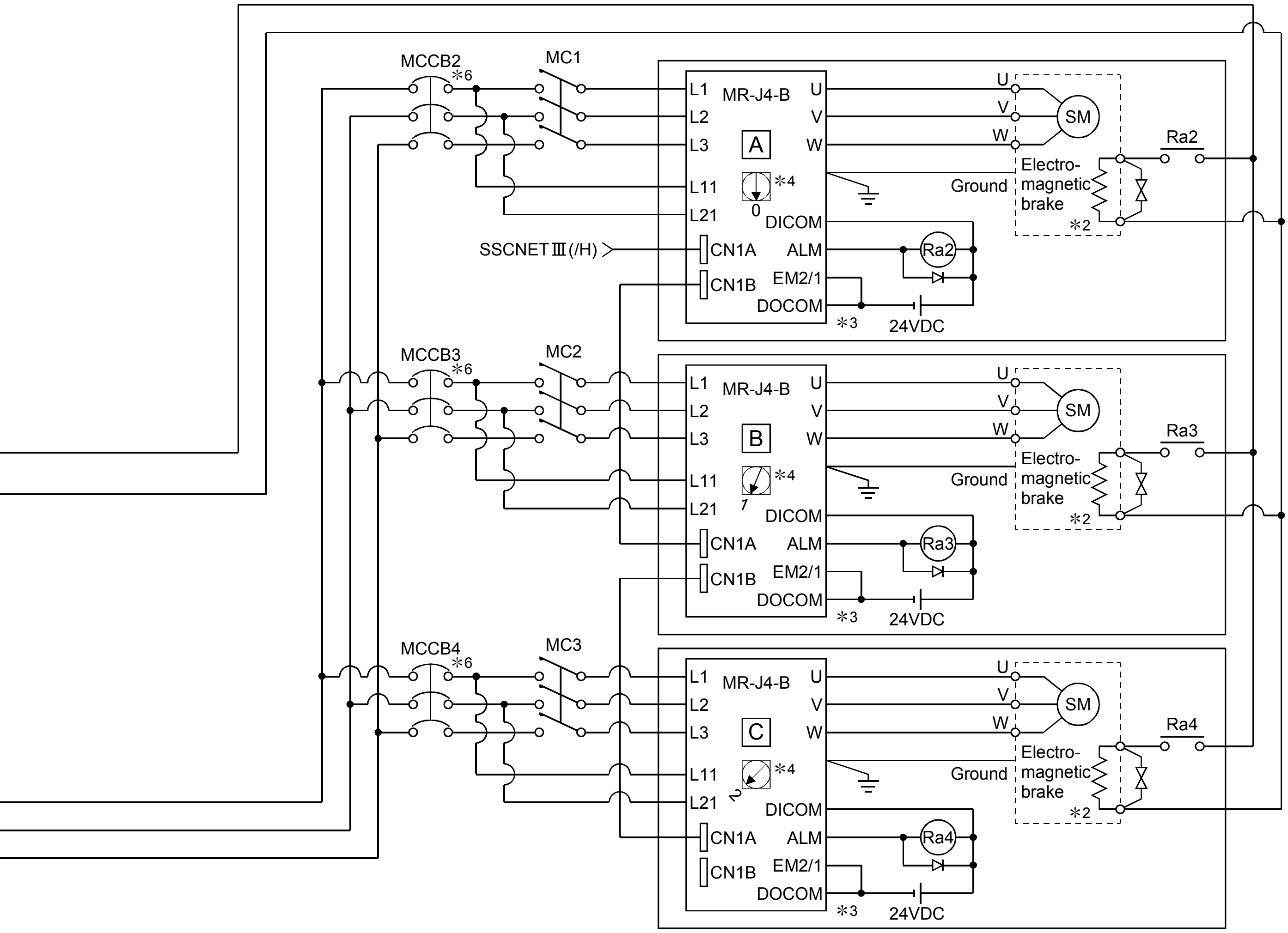


POINT

(1) ＊1: Configure up the power supply circuit which switch off the electromagnetic contactor (MC) after detection alarm occurrence on the PLC CPU.
(2) ＊2: It is also possible to use a full wave rectified power supply as the power supply for the electromagnetic brake.
(3) ＊3: It is also possible to use forced stop signal of the servo amplifier.
(4) ＊4: Set the axis selection rotary switch of servo amplifier as follows to set the axis No. of servo amplifier.

• Axis 1: 0	• Axis 5: 4	• Axis 9: 8	• Axis 13: C
• Axis 2: 1	• Axis 6: 5	• Axis 10: 9	• Axis 14: D
• Axis 3: 2	• Axis 7: 6	• Axis 11: A	• Axis 15: E
• Axis 4: 3	• Axis 8: 7	• Axis 12: B	• Axis 16: F

(5) ＊5: The status of forced stop input signal can be confirmed with "Md.50 Forced stop input".
(6) ＊6: Refer to the servo amplifier instruction manual for selection of the circuit breaker and electromagnetic contactor.
(7) ＊7: The surge suppressor is recommended to be used for an AC relay or electromagnetic contactor (MC) near the servo amplifier. Refer to the servo amplifier instruction manual for selection of the circuit breakers and magnetic contractors for wiring.

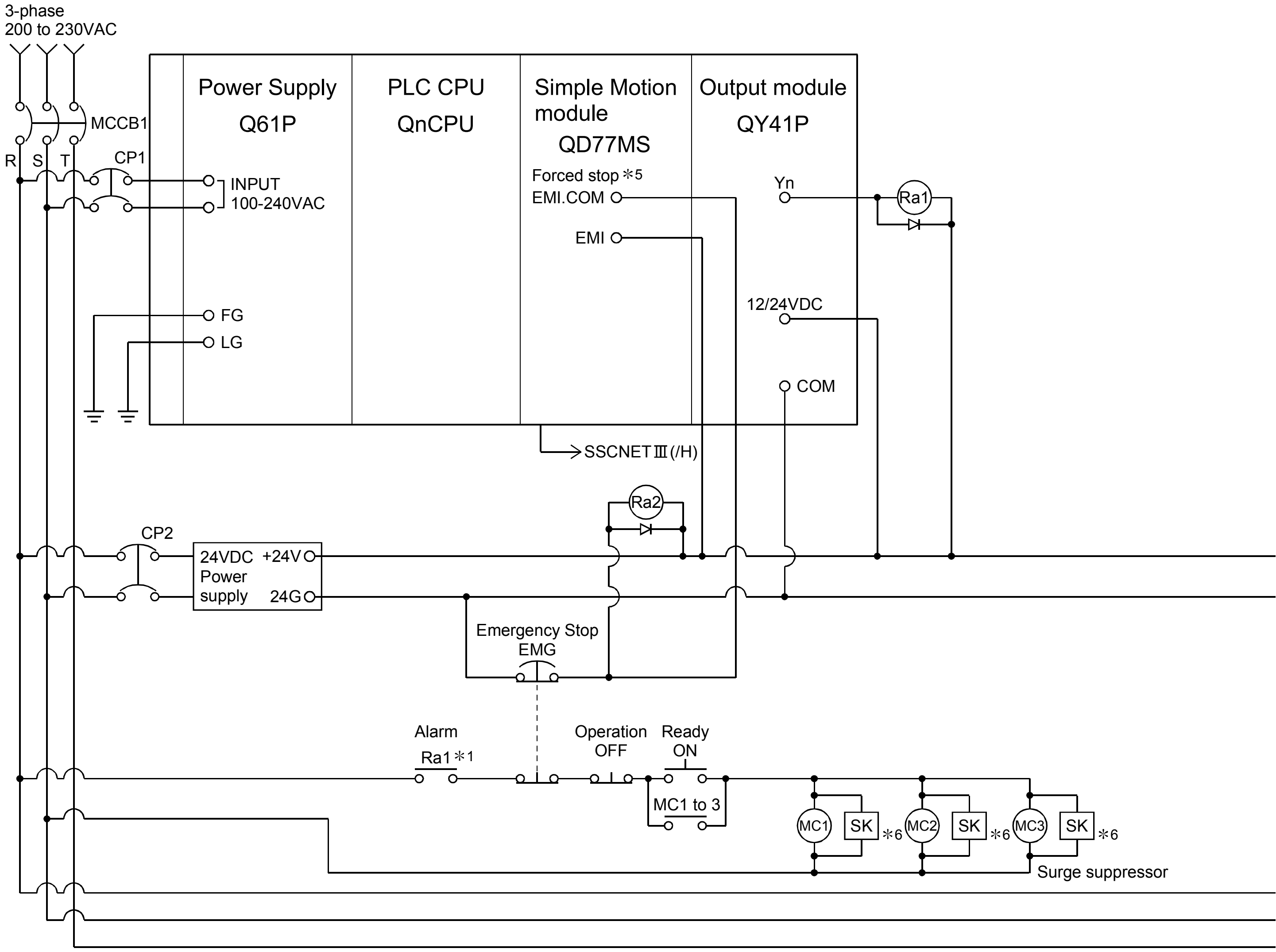


(Note-1): When the control power supply of servo amplifier is shut off, it is not possible to communicate with the servo amplifier after that.
Example) When the control power supply L11/L21 of servo amplifier in above B figure is shut off, it is also not possible to communicate with the servo amplifier C.
If only a specific servo amplifier main circuit power supply is shut off, be sure to shut off the main circuit power supply L1/L2/L3, and do not shut off the control power supply L11/L21.

(Note-2): Be sure to shut off the both of main circuit power supply L1/L2/L3 and control power supply L11/L21 after disconnection of SSCNET communication by the connect/disconnect function of SSCNET communication at the time of exchange of servo amplifier. At this time, it is not possible to communicate between the servo amplifier and Simple Motion module. Therefore, be sure to exchange the servo amplifier after stopping the operating of machine beforehand.

(Note-3): If the emergency stop signal of Simple Motion module turns OFF when setting of "Pr.82 Forced stop valid/invalid selection" to "0: Valid", servomotor is stopped with dynamic brake. (The LED display of servo amplifier indicates "E7.1" (Controller forced stop input warning).)

(2) Example when using the forced stop of the QD77MS and MR-J4-B



POINT

(1) ＊1: Configure up the power supply circuit which switch off the electromagnetic contactor (MC) after detection alarm occurrence on the PLC CPU.

(2) ＊2: It is also possible to use a full wave rectified power supply as the power supply for the electromagnetic brake.

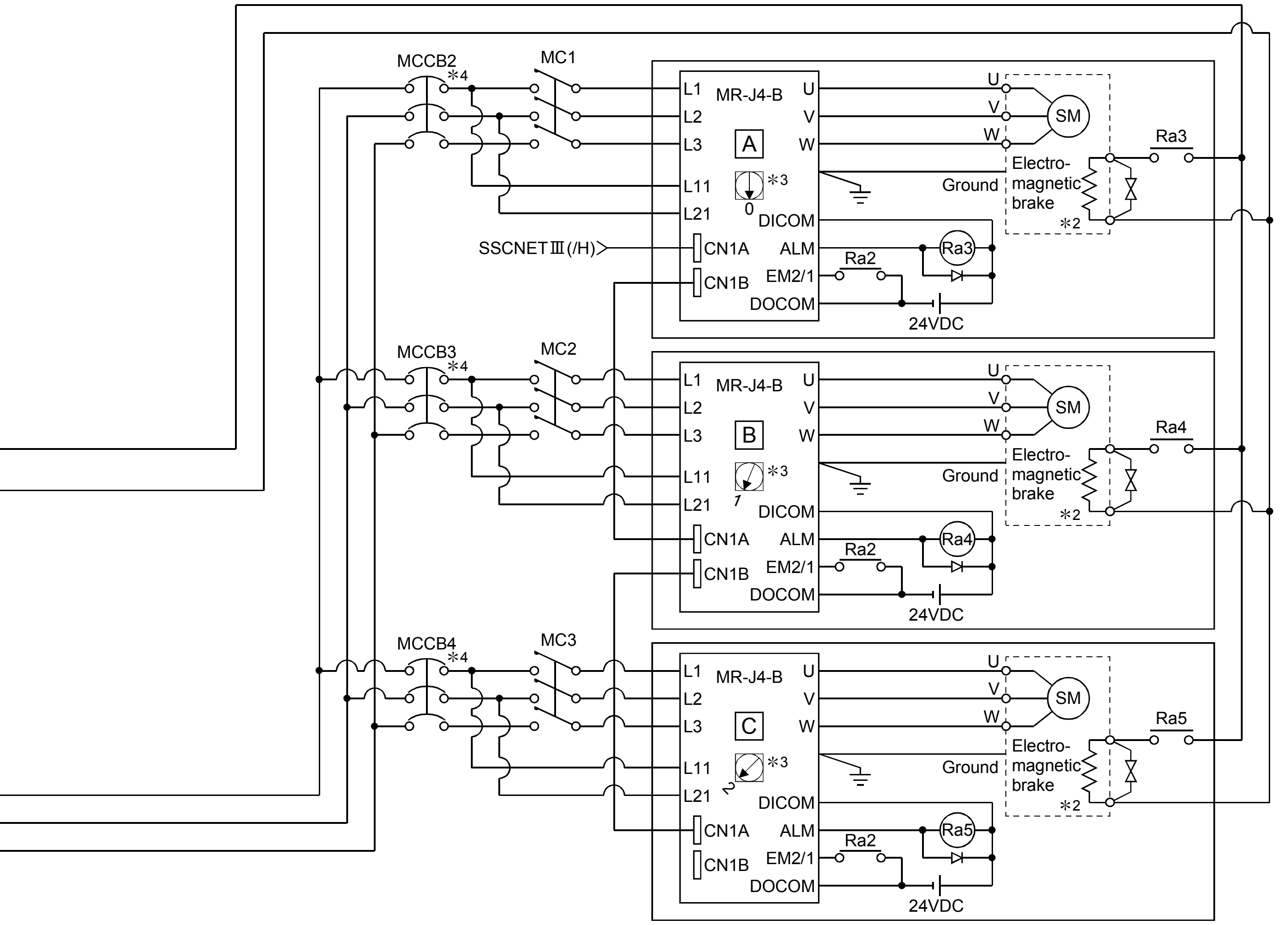
(3) ＊3: Set the axis selection rotary switch of servo amplifier as follows to set the axis No. of servo amplifier.

• Axis 1: 0	• Axis 5: 4	• Axis 9: 8	• Axis 13: C
• Axis 2: 1	• Axis 6: 5	• Axis 10: 9	• Axis 14: D
• Axis 3: 2	• Axis 7: 6	• Axis 11: A	• Axis 15: E
• Axis 4: 3	• Axis 8: 7	• Axis 12: B	• Axis 16: F

(4) ＊4: Refer to the servo amplifier instruction manual for selection of the circuit breaker and electromagnetic contactor.

(5) ＊5: The status of forced stop input signal can be confirmed with "Md.50 Forced stop input".

(6) ＊6: The surge suppressor is recommended to be used for an AC relay or electromagnetic contactor (MC) near the servo amplifier. Refer to the servo amplifier instruction manual for selection of the circuit breakers and magnetic contractors for wiring.



(Note-1): When the control power supply of servo amplifier is shut off, it is not possible to communicate with the servo amplifier after that.

Example) When the control power supply L11/L21 of servo amplifier in above B figure is shut off, it is also not possible to communicate with the servo amplifier C.

If only a specific servo amplifier main circuit power supply is shut off, be sure to shut off the main circuit power supply L1/L2/L3, and do not shut off the control power supply L11/L21.

(Note-2): Be sure to shut off the both of main circuit power supply L1/L2/L3 and control power supply L11/L21 after disconnection of SSCNET communication by the connect/disconnect function of SSCNET communication at the time of exchange of servo amplifier. At this time, it is not possible to communicate between the servo amplifier and Simple Motion module. Therefore, be sure to exchange the servo amplifier after stopping the operating of machine beforehand.

(Note-3): The dynamic brake is operated, and servomotor occurs to the free run when EM1 (forced stop) of servo amplifier turn OFF. At the time, the display shows the servo forced stop warning (E6.1).

During ordinary operation, do not used forced stop signal to alternate stop and run.

The service life of the servo amplifier may be shortened.

MEMO

Chapter 4 Installation, Wiring and Maintenance of the Product

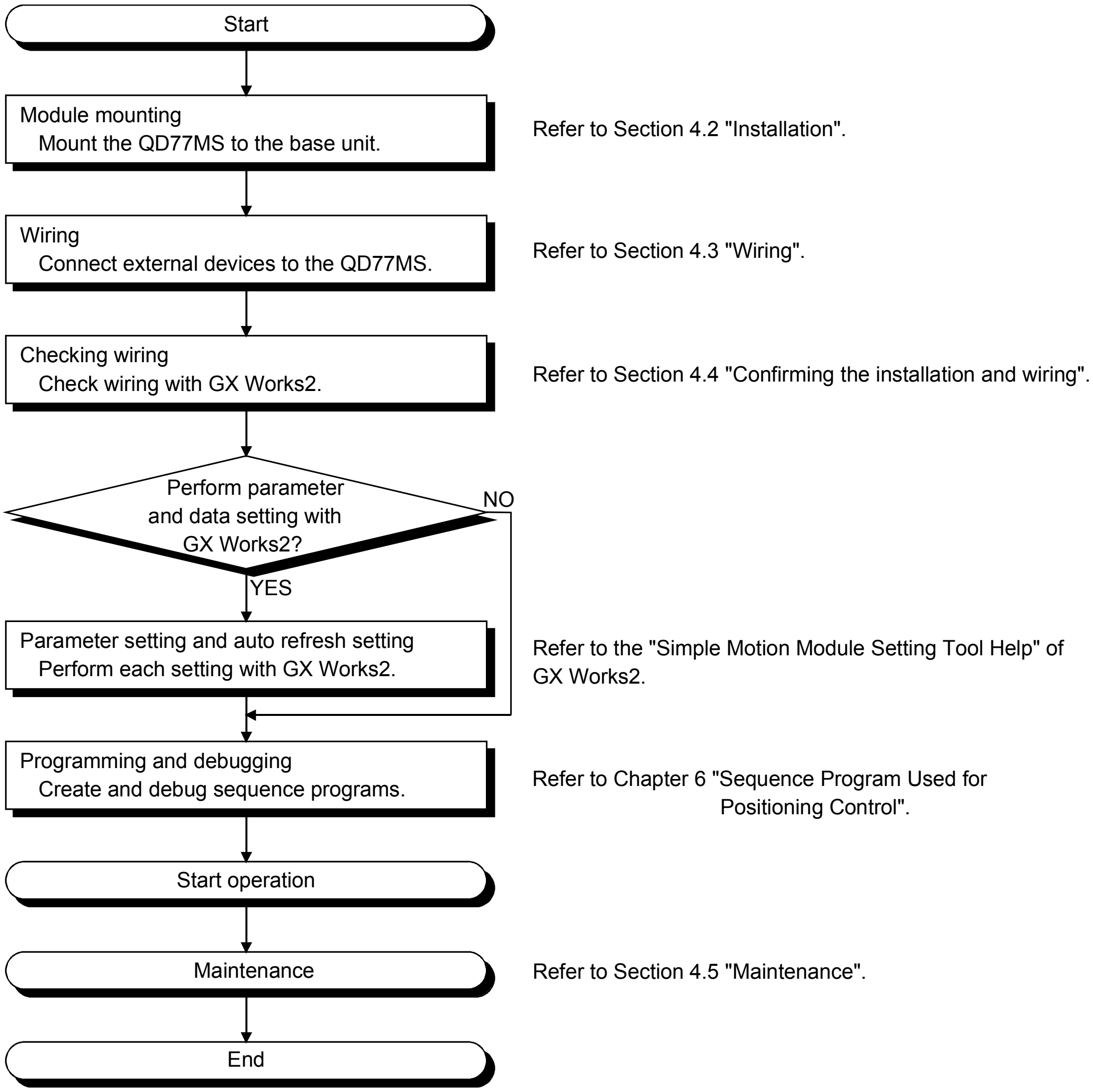
The installation, wiring and maintenance of the Simple Motion module are explained in this chapter.

Important information such as precautions to prevent malfunctioning of the Simple Motion module, accidents and injuries as well as the proper work methods are described.
Read this chapter thoroughly before starting installation, wiring or maintenance, and always following the precautions.

4.1 Outline of installation, wiring and maintenance

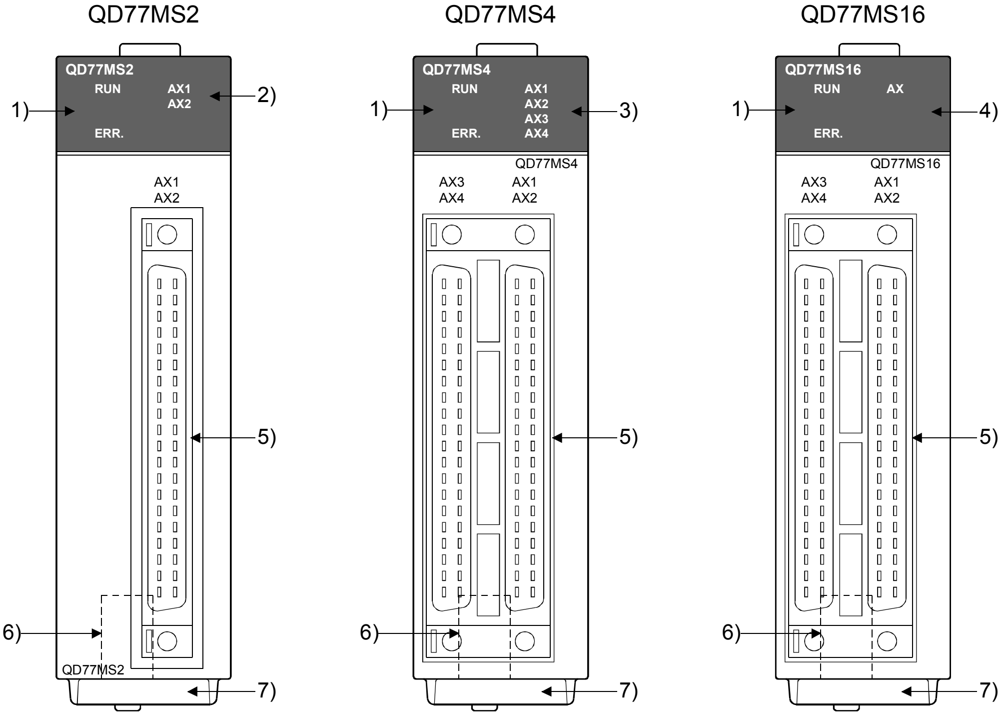
4.1.1 Installation, wiring and maintenance procedures

The outline and procedures for Simple Motion module installation, wiring and maintenance are shown below.



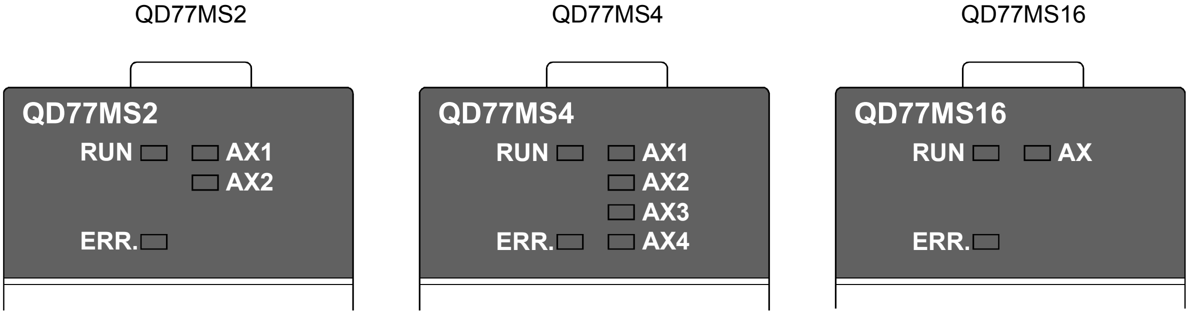
4.1.2 Names of each part

(1) The part names of the Simple Motion module are shown below.



No.	Name	Description
1)	RUN indicator LED, ERR indicator LED	Refer to this section (2).
2)	Axis display LED (AX1 to AX2)	
3)	Axis display LED (AX1 to AX4)	
4)	Axis display LED (AX)	
5)	External input signal connector	Connector to connect the mechanical system input, manual pulse generator/incremental synchronous encoder, or forced stop input. (40-pin connector) Refer to Section 3.4.2 for details.
6)	SSCNETⅢ cable connector	Connector to connect the servo amplifier.
7)	Serial number plate	Indicates the serial number written on the rating plate.

(2) The LED display indicates the following operation statuses of the Simple Motion module and axes.



	LED Display			Description
	QD77MS2	QD77MS4	QD77MS16	
RUN LED is OFF.	RUN ☐ ☐ AX1 ☐ AX2 ERR. ☐	RUN ☐ ☐ AX1 ☐ AX2 ☐ AX3 ERR. ☐ ☐ AX4	RUN ☐ ☐ AX ERR. ☐	Hardware failure, watch dog timer error
RUN LED is ON. ERR. LED is OFF.	RUN ■ ☐ AX1 ☐ AX2 ERR. ☐	RUN ■ ☐ AX1 ☐ AX2 ☐ AX3 ERR. ☐ ☐ AX4	RUN ■ ☐ AX ERR. ☐	The module operates normally.
ERR. LED is ON.	RUN ■ ☐ AX1 ☐ AX2 ERR. ■	RUN ■ ☐ AX1 ☐ AX2 ☐ AX3 ERR. ■ ☐ AX4	RUN ■ ☐ AX ERR. ■	System error
AX LED is OFF. (In the QD77MS2/QD77MS4, AX LED of the stopping axis, standby axis is OFF. In the QD77MS16, AX LED is OFF when all axes are stopping or standby.)	RUN ■ ☐ AX1 ☐ AX2 ERR. ☐	RUN ■ ☐ AX1 ☐ AX2 ☐ AX3 ERR. ☐ ☐ AX4	RUN ■ ☐ AX ERR. ☐	During axis stop, during axis standby.
AX LED is ON. (In the QD77MS2/QD77MS4, AX LED of the operating axis is steady. In the QD77MS16, AX LED is steady when any of the axes is operating.)	RUN ■ ■ AX1 ☐ AX2 ERR. ☐	RUN ■ ■ AX1 ☐ AX2 ☐ AX3 ERR. ☐ ☐ AX4	RUN ■ ■ AX ERR. ☐	During axis operation.
ERR. LED is flashing. AX is flashing. (In the QD77MS2/QD77MS4, AX LED of the axis in which an error occurred is flashing. In the QD77MS16, AX LED is flashing when an error occurs in any of the axes.)	RUN ■ ◆ AX1 ☐ AX2 ERR. ◆	RUN ■ ◆ AX1 ☐ AX2 ☐ AX3 ERR. ◆ ☐ AX4	RUN ■ ◆ AX ERR. ◆	Axis error
All LED are ON.	RUN ■ ■ AX1 ■ AX2 ERR. ■	RUN ■ ■ AX1 ■ AX2 ■ AX3 ERR. ■ ■ AX4	RUN ■ ■ AX ERR. ■	Hardware failure

The symbols in the Display column indicate the following LED statuses:
☐: OFF, ■: ON, ◆: Flashing

4.1.3 Handling precautions

Handle the Simple Motion module and cable while observing the following precautions.

[1] Handling precautions

⚠CAUTION

- Use the programmable controller in an environment that meets the general specifications in the manual "Safety Guidelines", the manual supplied with the main base unit.
  Using the programmable controller in an environment outside the range could result in electric shock, fire, operation failure, and damage to or deterioration of the product.
- Do not directly touch the module's conductive parts and electronic components. Doing so may could cause an operation failure or give damage to the module.
- Be sure there are no foreign matters such as sawdust or wiring debris inside the module. Such debris could cause fire, damage, or operation failure.
- Never try to disassemble or modify the modules. It may cause product failure, operation failure, injury or fire.
- Completely turn off the externally supplied power used in the system before installation or removing the module. Not doing so could result in damage to the module.
- Because the connector has its orientation, check it before attaching or detaching the connector straight from the front.
  Unless it is properly installed, a poor contact may occur, resulting in erroneous input and output.

[2] Other precautions

(1) Main body

- The main body case is made of plastic. Take care not to drop or apply strong impacts onto the case.
- Do not remove the PCB of Simple Motion module from the case. Failure to observe this could lead to faults.
- Before touching the module, always touch grounded metal, etc. to discharge static electricity from human body. Failure to do so may cause the module to fail or malfunction.

(2) Cable

- Do not press on the cable with a sharp object.
- Do not twist the cable with force.
- Do not forcibly pull on the cable.
- Do not step on the cable.
- Do not place objects on the cable.
- Do not damage the cable sheath.

(3) Installation environment

Do not install the module in the following type of environment.

- Where the ambient temperature exceeds the 0 to 55°C (32 to 131°F) range.
- Where the ambient humidity exceeds the 5 to 95%RH range.
- Where temperature sudden changes and dew condenses.
- Where there is corrosive gas or flammable gas.
- Where there are high levels of dust, conductive powder, such as iron chips, oil mist, salt or organic solvents.
- Where the module is subject to direct sunlight.
- Where there are strong electric fields or magnetic fields.
- Where vibration or impact could be directly applied onto the main body.

4.2 Installation

4.2.1 Precautions for installation

The precautions for installing the Simple Motion module are given below. Refer to this section as well as Section 4.1.3 "Handling precautions" when carrying out the work.

Precautions for installation

⚠DANGER

- Completely turn off the externally supplied power used in the system before installing or removing the module.
  Not doing so could result in electric shocks, an operation failure or damage to the module.

⚠CAUTION

- Never try to disassemble or modify the modules. It may cause product failure, operation failure, injury or fire.
- Completely turn off the externally supplied power used in the system before installation or removing the module.
  Not doing so could result in an operation failure or damage to the module.
- After the first use of the module, the number of connections/disconnections is limited to 50 times (in accordance with IEC 61131-2). Exceeding the limit may cause malfunction.
- Use the programmable controller in an environment that meets the general specifications in the manual "Safety Guidelines", the manual supplied with the main base unit.
  Using the programmable controller in an environment outside the range could result in electric shock, fire, operation failure, and damage to or deterioration of the product.
- Do not directly touch the module's conductive parts and electronic components. Doing so may could cause an operation failure or give damage to the module.
- While pressing the installation lever located at the bottom of module, insert the module fixing tab into the fixing hole in the base unit until it stops. Then, securely mount the module with the fixing hole as a supporting point.
  Incorrect loading of the module can cause a malfunction, failure or drop.
  When using the module in the environment of much vibration, tighten the module with a screw.
  Tighten the screw within the range of the specified tightening torque.
  Insufficient tightening may lead to dropping, short-circuit, or malfunctioning.
  Excessive tightening may damage the screw or module, leading to dropping, short-circuit, or malfunctioning.
- Lock the control panel and prevent access to those who are not certified to handle or install electric equipment.

4.3 Wiring

The precautions for wiring the Simple Motion module are given below. Refer to this section as well as Section 4.1.3 "Handling precautions" when carrying out the work.

4.3.1 Precautions for wiring

⚠DANGER

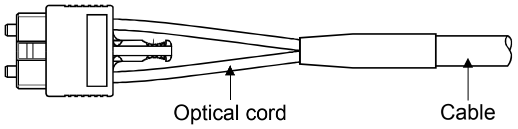
- Completely turn off the externally supplied power used in the system before installation or wiring. Not doing so could result in electric shock or damage to the product.

⚠CAUTION

- Check the layout of the terminals and then properly route the wires to the module.
- Connectors for external input signal must be crimped or pressured with the tool specified by the manufacturer, or must be correctly soldered. Insufficient connections may cause short circuit, fire, or malfunction.
- Be careful not to let foreign matter such as sawdust or wire chips get inside the module. These may cause fires, failure or malfunction.
- The top surface of the module is covered with protective films to prevent foreign objects such as cable off cuts from entering the module when wiring. Do not remove this film until the wiring is complete. Before operating the system, be sure to remove the film to provide adequate ventilation.
- Securely connect the connector for SSCNETⅢ cable to the bottom connector on the module.
- When removing the cable from the module, do not pull the cable. Hold the connector that is connected to the module. Pulling the cable that is still connected to the module may cause malfunction or damage to the module or cable.
- The external input/output signal cable and the communication cable should not be routed near or bundled with the main circuit cable, power cable and/or other such load - carrying cables other than those for the PLC. These cables should be separated by at least 100mm (3.94inch) or more. They can cause electrical interference, surges and inductance that can lead to mis-operation.
- The shielded cable for connecting Simple Motion module can be secured in place. If the shielded cable is not secured, unevenness or movement of the shielded cable or careless pulling on it could result in damage to the Simple Motion module, servo amplifier or shielded cable or defective cable connections could cause mis-operation of the unit.
- If the cable connected to the Simple Motion module and the power line must be adjacently laid (less than 100mm (3.94inch)), use a shielded cable. Ground the shield of the cable securely to the control panel on the Simple Motion module side. (A wiring example is given on this section "[1] Precautions for wiring").

⚠CAUTION

- Forcibly removal the SSCNETⅢ cable from the Simple Motion module will damage the Simple Motion module and SSCNETⅢ cables.
- After removal of the SSCNETⅢ cable, be sure to put a cap on the SSCNETⅢ connector. Otherwise, adhesion of dirt deteriorates in characteristic and it may cause malfunctions.
- Do not remove the SSCNETⅢ cable while turning on the power supply of Simple Motion module and servo amplifier. Do not see directly the light generated from SSCNETⅢ connector and the end of SSCNETⅢ cable. When the light gets into eye, may feel something is wrong for eye. (The light source of SSCNETⅢ cable complies with class1 defined in JISC6802 or IEC60825-1.)
- If the SSCNETⅢ cable is added a power such as a major shock, lateral pressure, haul, sudden bending or twist, its inside distorts or breaks, and optical transmission will not be available.
  Be sure to take care enough so that the short SSCNETⅢ cable is added a twist easily.
- Be sure to use the SSCNETⅢ cable within the range of operating temperature described in this manual. Especially, as optical fiber for MR-J3BUS□M and MR-J3BUS□M-A are made of synthetic resin, it melts down if being left near the fire or high temperature. Therefore, do not make it touched the part which becomes high temperature, such as radiator or regenerative option of servo amplifier, or servomotor.
- When laying the SSCNETⅢ cable, be sure to secure the minimum cable bend radius or more. (Refer to this Section [2] Precautions for SSCNETⅢ cable wiring.)
- Put the SSCNETⅢ cable in the duct or fix the cable at the closest part to the Simple Motion module with bundle material in order to prevent SSCNETⅢ cable from putting its own weight on SSCNETⅢ connector. When laying cable, the optical cord should be given loose slack to avoid from becoming smaller than the minimum bend radius, and it should not be twisted.
  Also, fix and hold it in position with using cushioning such as sponge or rubber which does not contain plasticizing material.
- Migrating plasticizer is used for vinyl tape. Keep the MR-J3BUS□M, and MR-J3BUS□M-A cables away from vinyl tape because the optical characteristic may be affected.



SSCNETⅢ cable	Cord	Cable
MR-J3BUS□M	△	
MR-J3BUS□M-A	△	△
MR-J3BUS□M-B	○	○

○: Normally, cable is not affected by plasticizer.
△: Phthalate ester plasticizer such as DBP and DOP may affect optical characteristic of cable.

Generally, soft polyvinyl chloride (PVC), polyethylene resin (PE) and fluorine resin contain non-migrating plasticizer and they do not affect the optical characteristic of SSCNETⅢ cable. However, some wire sheaths and cable ties, which contain migrating plasticizer (phthalate ester), may affect MR-J3BUS□M and MR-J3BUS□M-A cables (made of plastic).
In addition, MR-J3BUS□M-B cable (made of quartz glass) is not affected by plasticizer.

⚠CAUTION

- If the adhesion of solvent and oil to the cord part of SSCNETⅢ cable may lower the optical characteristic and machine characteristic. If it is used such an environment, be sure to do the protection measures to the cord part.
- When keeping the Simple Motion module or servo amplifier, be sure to put on a cap to connector part so that a dirt should not adhere to the end of SSCNETⅢ connector.
- SSCNETⅢ connector to connect the SSCNETⅢ cable is put a cap to protect light device inside connector from dust. For this reason, do not remove a cap until just before connecting SSCNETⅢ cable. Then, when removing SSCNETⅢ cable, make sure to put a cap.
- Keep the cap and the tube for protecting light cord end of SSCNETⅢ cable in a plastic bag with a zipper of SSCNETⅢ cable to prevent them from becoming dirty.
- When exchanging the Simple Motion module or servo amplifier, make sure to put cap on SSCNETⅢ connector. When asking repair of Simple Motion module or servo amplifier for some troubles, make also sure to put a cap on SSCNETⅢ connector. When the connector is not put a cap, the light device may be damaged at the transit. In this case, exchange and repair of light device is required.

[1] Precautions for wiring

(1) Use separate cables for connecting to the Simple Motion module and for the power cable that create surge and inductance.

(2) The cable for connecting the Simple Motion module can be placed in the duct or secured in place by clamps. If the cable is not placed in the duct or secured by clamps, unevenness or movement of the cable or careless pulling on it could result in damage to the unit or cable or defective cable connections could cause mis-operation of the unit.

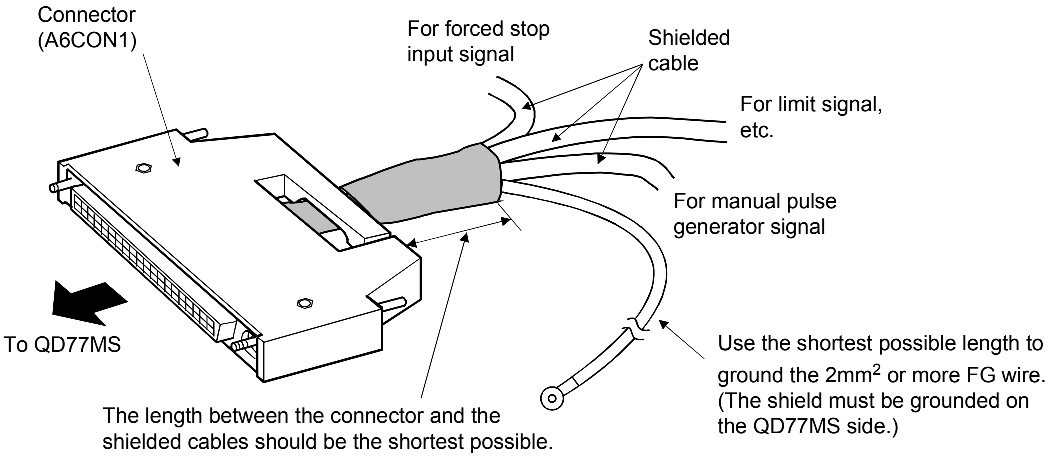
(3) If a duct is being used, separate the cables to connect the Simple Motion module from the power line duct, or use metal piping.
Ground the pipes securely after metal piping.

(4) Use the twisted pair shielded cable (wire size 0.3 mm^2 or more). The shielded must be grounded on the Simple Motion module side. (The following figure shows a wiring example.)

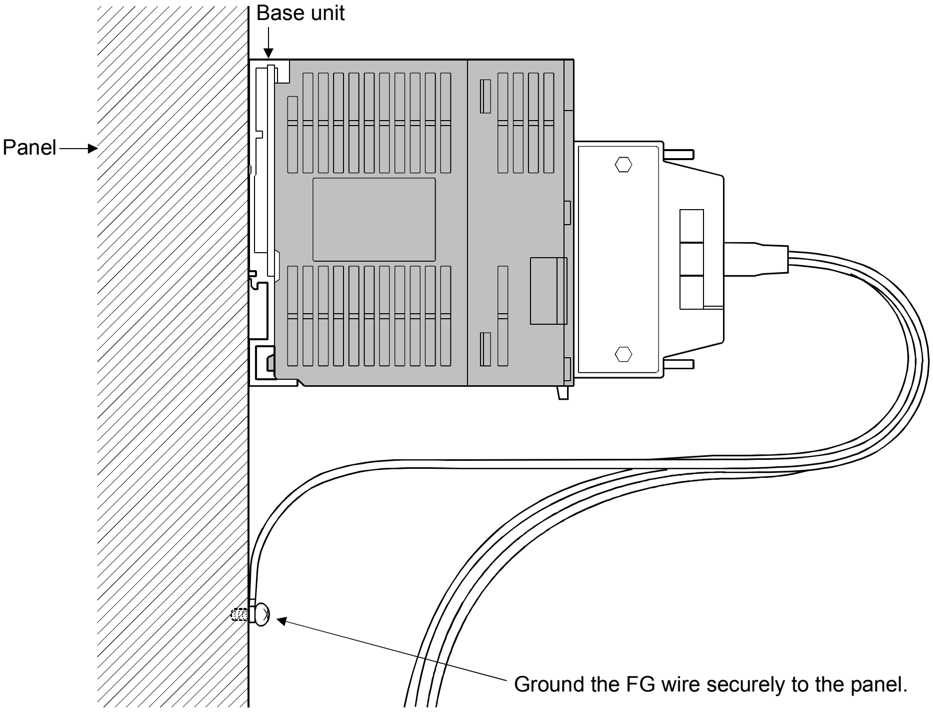
(5) Use separate shielded cables of the forced stop input signal (EMI, EMI.COM), limit signal (FLS, RLS, DOG, STOP), external command signal/switching signal (DI, COM), and manual pulse generator/incremental synchronous encoder input signal (HAH, HAL, HBH, HBL, HA, HB, 5V, SG) for connecting to the Simple Motion module. They can cause electrical interference, surges and inductance that can lead to mis-operation.

[Wiring example of shielded cable]

The following shows a wiring example for noise reduction in the case when the connector (A6CON1) is used.

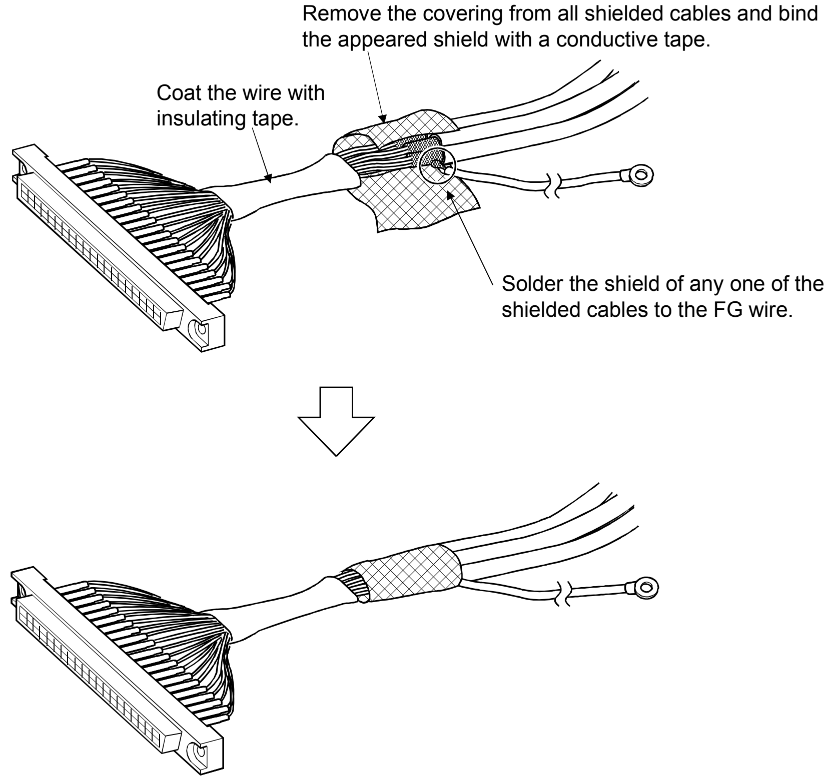


Grounding of FG wire



[Processing example of shielded cables]

Connections of FG wire and each shielded cable

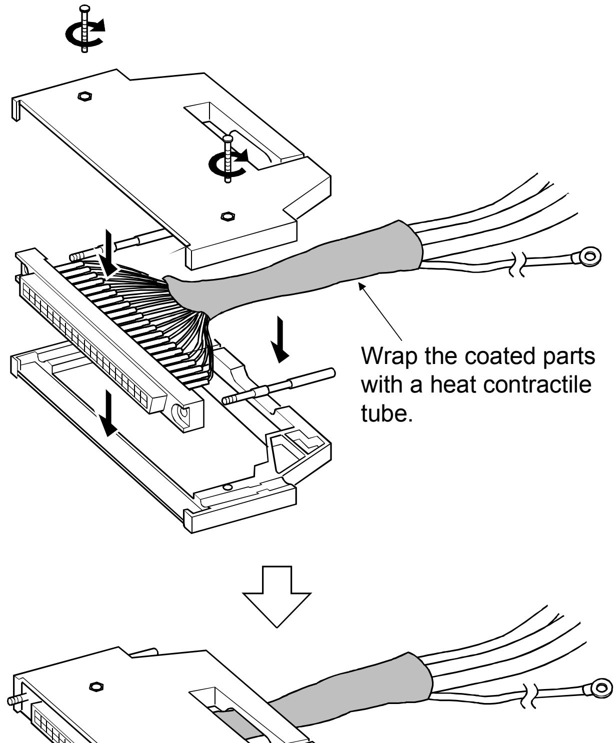


Remove the covering from all shielded cables and bind the appeared shield with a conductive tape.

Coat the wire with insulating tape.

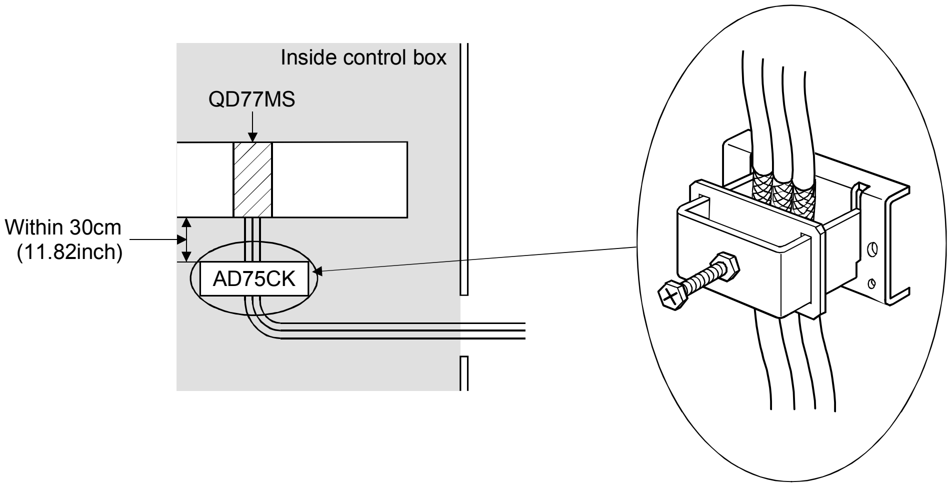
Solder the shield of any one of the shielded cables to the FG wire.

Assembling of connector (A6CON1)

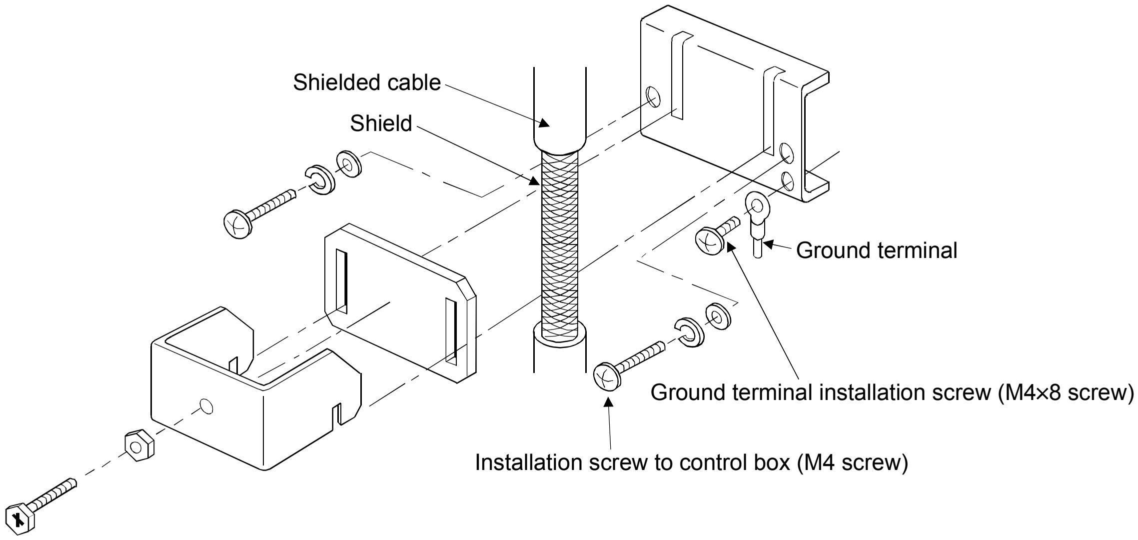


Wrap the coated parts with a heat contractile tube.

(6) To make this product conform to the EMC directive instruction and Low Voltage Directives, be sure to used of a AD75CK type cable clamp (manufactured by Mitsubishi Electric) for grounding connected to the control box and the shielded cable.



[How to ground shielded cable using AD75CK]



Using the AD75CK, you can tie four cables of about 7mm (0.28inch) outside diameter together for grounding.
(Refer to the "AD75CK-type Cable Clamping Instruction Manual" (IB-68682).)

⚠CAUTION

- Do not ground the cable clamp to the top of control panel. Doing so may lead to damage by damage of screws, etc. during installation or removing the cable clamp.

[2] Precautions for SSCNETⅢ cable wiring

SSCNETⅢ cable is made from optical fiber. If optical fiber is added a power such as a major shock, lateral pressure, haul, sudden bending or twist, its inside distorts or breaks, and optical transmission will not be available. Especially, as optical fiber for MR-J3BUS☐M, MR-J3BUS☐M-A is made of synthetic resin, it melts down if being left near the fire or high temperature. Therefore, do not make it touched the part which becomes high temperature, such as radiator or regenerative option of servo amplifier and servomotor. Be sure to use optical fiber within the range of operating temperature described in this manual. Read described item of this section carefully and handle it with caution.

(1) Minimum bend radius

Make sure to lay the cable with greater radius than the minimum bend radius.

Do not press the cable to edges of equipment or others. For SSCNETⅢ cable, the appropriate length should be selected with due consideration for the dimensions and arrangement of Simple Motion module or servo amplifier. When closing the door of control panel, pay careful attention for avoiding the case that SSCNETⅢ cable is hold down by the door and the cable bend becomes smaller than the minimum bend radius.

Model name of SSCNET Ⅲ cable	Minimum bend radius [mm] ([inch])
MR-J3BUS☐M	25 (0.98)
MR-J3BUS☐M-A	Enforced covering cord: 50 (1.97), Cord: 25 (0.98)
MR-J3BUS☐M-B	Enforced covering cord: 50 (1.97), Cord: 30 (1.18)

(2) Tension

If tension is added on the SSCNETⅢ cable, the increase of transmission loss occurs because of external force which concentrates on the fixing part of SSCNETⅢ cable or the connecting part of SSCNETⅢ connector. At worst, the breakage of SSCNETⅢ cable or damage of SSCNETⅢ connector may occur. For cable laying, handle without putting forced tension. (Refer to Section Appendix 2.1 "SSCNETⅢ cables" for the tension strength.)

(3) Lateral pressure

If lateral pressure is added on the SSCNETⅢ cable, the cable itself distorts, internal optical fiber gets stressed, and then transmission loss will increase. At worst, the breakage of SSCNETⅢ cable may occur. As the same condition also occurs at cable laying, do not tighten up SSCNETⅢ cable with a thing such as nylon band (TY-RAP).

Do not trample it down or tuck it down with the door of control box or others.

(4) Twisting

If the SSCNETⅢ cable is twisted, it will become the same stress added condition as when local lateral pressure or bend is added. Consequently, transmission loss increases, and the breakage of SSCNETⅢ cable may occur at worst.

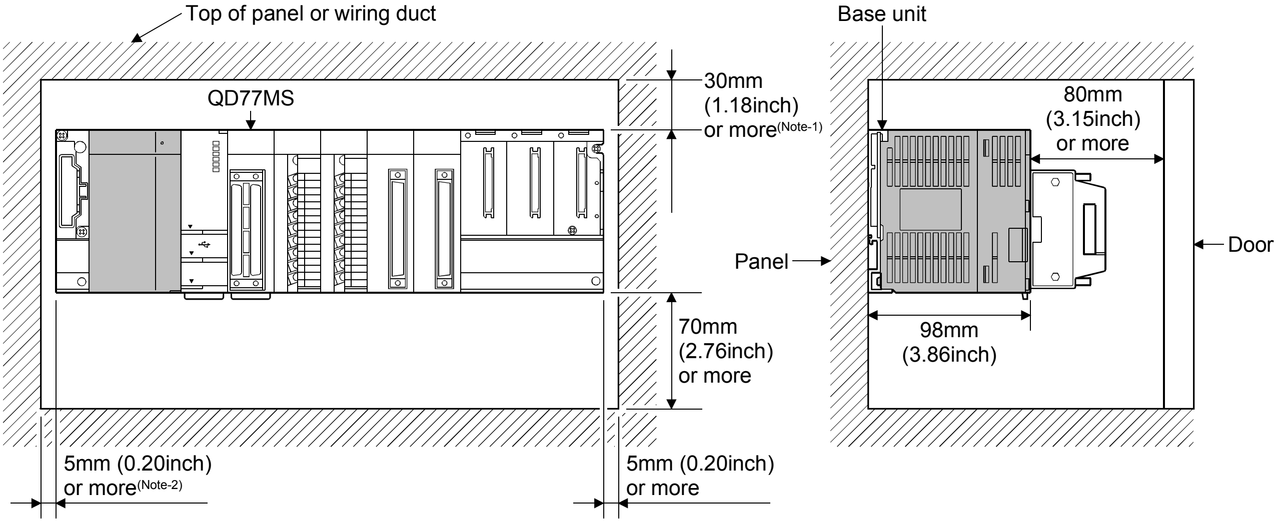
(5) Disposal

When incinerating optical cable (cord) used for SSCNETⅢ cable, hydrogen fluoride gas or hydrogen chloride gas which is corrosive and harmful may be generated. For disposal of SSCNETⅢ cable, request for specialized industrial waste disposal services that have incineration facility for disposing hydrogen fluoride gas or hydrogen chloride gas.

(6) Wiring process of SSCNETⅢ cable

Put the SSCNETⅢ cable in the duct or fix the cable at the closest part to the Simple Motion module with bundle material in order to prevent SSCNETⅢ cable from putting its own weight on SSCNETⅢ connector. Leave the following space for wiring.

- Putting in the duct

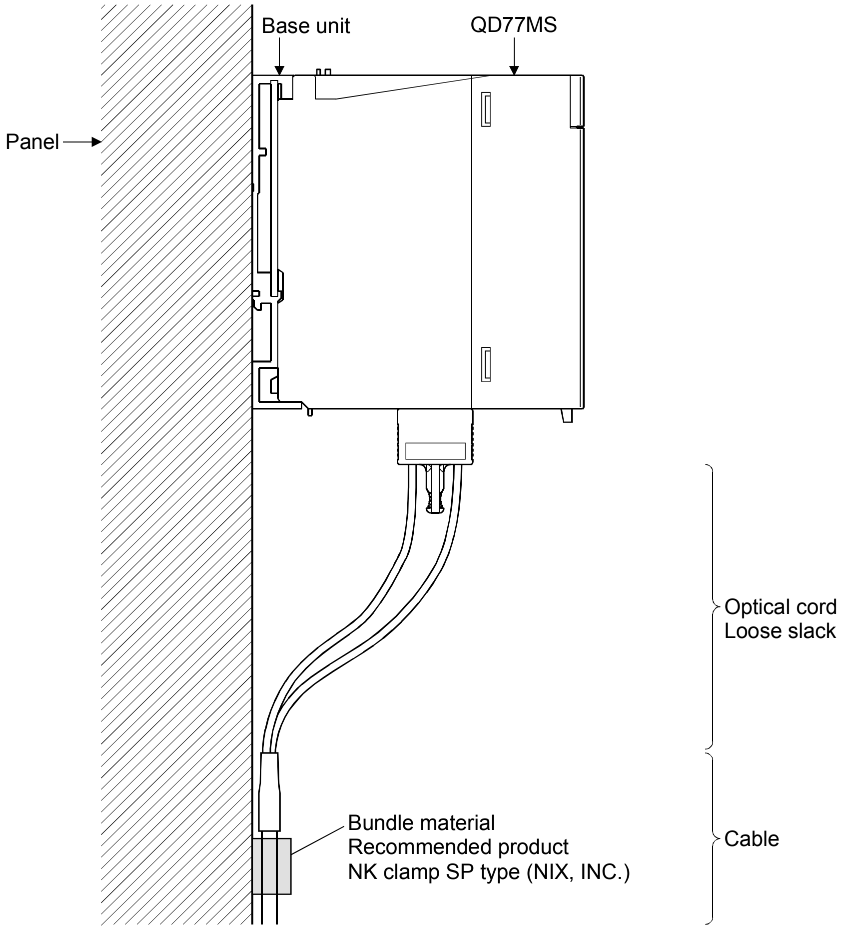


(Note-1): For wiring duct with 50mm (1.97inch) or less height. For other cases, 40mm (1.58inch) or more.

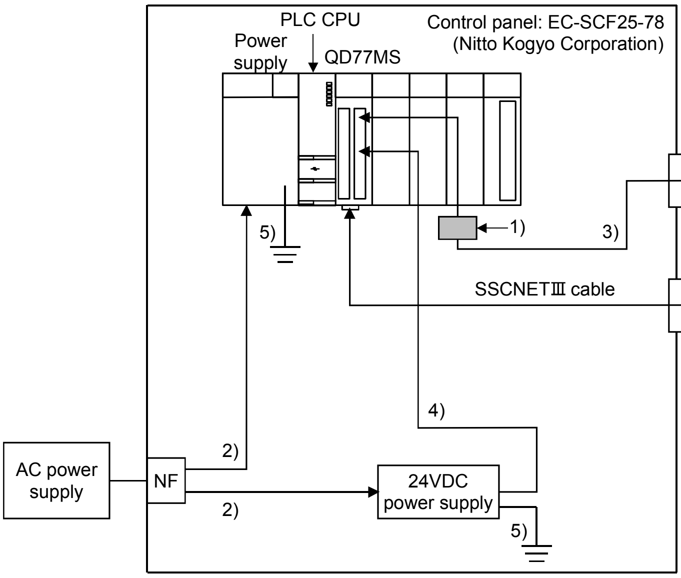
(Note-2): 20mm (0.79inch) or more when the adjacent module is not removed and the extension cable is connected.

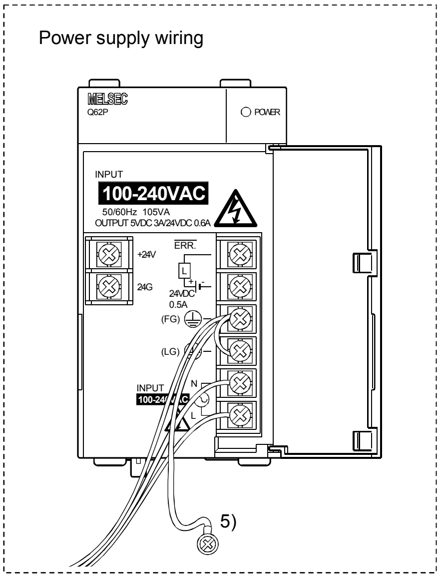
- Bundle fixing

  Optical cord should be given loose slack to avoid from becoming smaller than the minimum bend radius, and it should not be twisted. When laying cable, fix and hold it in position with using cushioning such as sponge or rubber which does not contain plasticizing material.



[3] Example of measure against noise for compliance with the EMC directive.





▨ : AD75CK cable clamp

1) Ground the cables at a position within 30cm (11.82inch) from the module with the cable clamp, etc.
2) Wire the power supply cable as short as possible using the twisted cable (2mm^2 or more).
3) Use the shielded twisted cable (cable length: 30m (98.43ft.) or less) for each I/O signal cable.
4) Wire the cable connected to secondary side of 24VDC power supply module as short as possible.
5) Wire the power supply and 24VDC power supply as short as possible using the cable of approx. 2mm^2, and ground to the control panel.

(1) Refer to this chapter or "EMC and Low Voltage Directives" of "QCPU User's Manual (Hardware Design, Maintenance and Inspection)" for basic wire. We examined QD77MS by the above example.

(2) In wiring inside the panel, the power line connected to the power or servo amplifier and the communication cable such as an expansion cable or a network cable must not be mixed. In the duct, leave 10cm (3.94inch) or more between the power line and the communication cable, and separate using a separator (made of metal), etc. It is required in the same control panel as well.
Mixing the power line and communication cable may cause increase of noise or malfunction due to noise influence.

4.4 Confirming the installation and wiring

4.4.1 Items to confirm when installation and wiring are completed

Check the following points when completed with the installation of Simple Motion module and wiring.

- Is the module correctly wired?

The following four points are confirmed using the positioning test function of GX Works2.
With this function, "whether the direction that the Simple Motion module recognizes as forward run matches the address increment direction in the actual positioning work", and "whether the Simple Motion module recognizes the external input signals such as the manual pulse generator and forced stop", etc., can be checked.

- Are the Simple Motion module and servo amplifier correctly connected?
- Are the servo amplifier and servomotor correctly connected?
- Are the Simple Motion module and external devices (input signals) correctly connected?
- Are the servo amplifier and external wiring (FLS, RLS, and DOG) correctly connected?

Refer to the "Simple Motion Module Setting Tool Help" of GX Works2 for details of "Positioning test function".

Note that the monitor data of the "Md.30 External input signal" in the GX Works2 may also be used to "confirm the connection between the Simple Motion module and external devices (input signals)".

Important

If the Simple Motion module is faulty, or when the required signals such as the near-point dog signal and forced stop signal are not recognized, unexpected accidents such as "not decelerating at the near-point dog during machine OPR and colliding with the stopper", or "not being able to stop with the forced stop signal" may occur. Execute a checking wiring of external input signal. The connection confirmation by positioning test function must be carried out not only when structuring the positioning system, but also when the system has been changed with module replacement or rewiring, etc.

4.5 Maintenance

4.5.1 Precautions for maintenance

The precautions for servicing the Simple Motion module are given below. Refer to this section as well as Section 4.1.3 "Handling precautions" when carrying out the work.

⚠DANGER

- Completely turn off the externally supplied power used in the system before clearing or tightening the connector screws.
  Not doing so could result in electric shocks.

⚠CAUTION

- Never try to disassemble or modify the modules.
  It may cause product failure, operation failure, injury or fires.
- Completely turn off the externally supplied power used in the system before installation or removing the module.
  Not doing so could result in electric shock, damage to the module or operation failure.

4.5.2 Disposal instructions

When you discard a Simple Motion module, a servo amplifier, a battery (primary battery) and other option articles, please follow the law of each country (area).

⚠CAUTION

- This product is not designed or manufactured to be used in equipment or systems in situations that can affect or endanger human life.
- When considering this product for operation in special applications such as machinery or systems used in passenger transportation, medical, aerospace, atomic power, electric power, or submarine repeating applications, please contact your nearest Mitsubishi sales representative.
- Although this product was manufactured under conditions of strict quality control, you are strongly advised to install safety devices to forestall serious accidents when it is used in facilities where a breakdown in the product is likely to cause a serious accident.

Chapter 5 Data Used for Positioning Control

The parameters and data used to carry out positioning control with the Simple Motion module are explained in this chapter.

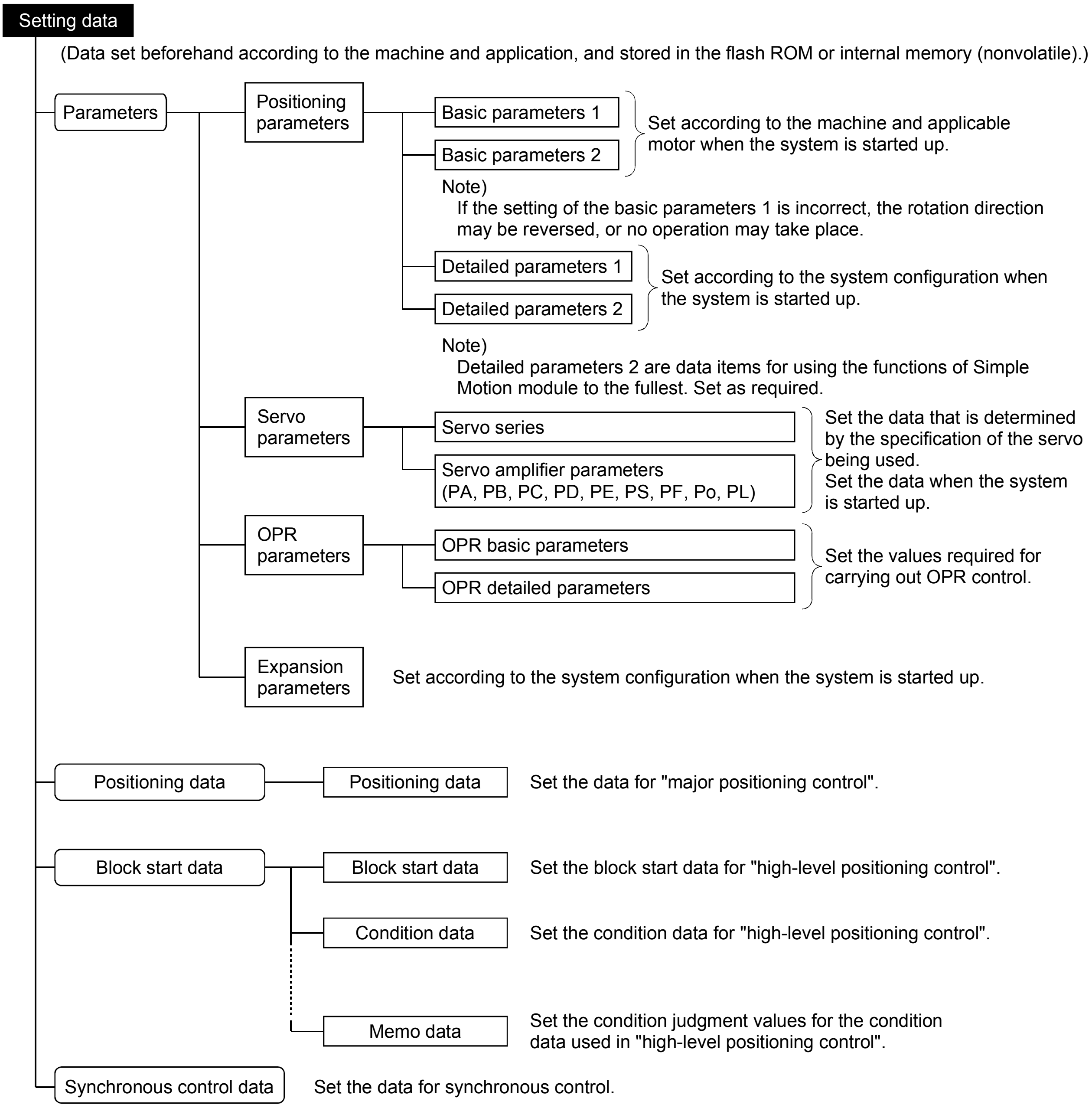
With the positioning system using the Simple Motion module, the various parameters and data explained in this chapter are used for control. The parameters and data include parameters set according to the device configuration, such as the system configuration, and parameters and data set according to each control. Read this section thoroughly and make settings according to each control or application.

∗: Refer to "Section 2" for details on each control.

5.1 Types of data

5.1.1 Parameters and data required for control

The parameters and data required to carry out control with the Simple Motion module include the "setting data", "monitor data" and "control data" shown below.



Setting data

(Data set beforehand according to the machine and application, and stored in the flash ROM or internal memory (nonvolatile).)

- Parameters
  - Positioning parameters
    - Basic parameters 1
    - Basic parameters 2

      Set according to the machine and applicable motor when the system is started up.

      Note)
      If the setting of the basic parameters 1 is incorrect, the rotation direction may be reversed, or no operation may take place.
    - Detailed parameters 1
    - Detailed parameters 2

      Set according to the system configuration when the system is started up.

      Note)
      Detailed parameters 2 are data items for using the functions of Simple Motion module to the fullest. Set as required.
  - Servo parameters
    - Servo series
    - Servo amplifier parameters (PA, PB, PC, PD, PE, PS, PF, Po, PL)

      Set the data that is determined by the specification of the servo being used.
      Set the data when the system is started up.
  - OPR parameters
    - OPR basic parameters
    - OPR detailed parameters

      Set the values required for carrying out OPR control.
  - Expansion parameters

    Set according to the system configuration when the system is started up.
- Positioning data
  - Positioning data

    Set the data for "major positioning control".
- Block start data
  - Block start data

    Set the block start data for "high-level positioning control".
  - Condition data

    Set the condition data for "high-level positioning control".
  - Memo data

    Set the condition judgment values for the condition data used in "high-level positioning control".
- Synchronous control data

  Set the data for synchronous control.

◇ The following methods are available for data setting:

- Set using GX Works2.
- Create the sequence program for data setting using GX Works2 and execute it.

In this manual, the method using the GX Works2 will be explained.
(Refer to "Point" on the next page.)

◇ The basic parameters 1, detailed parameters 1, OPR parameters, "Pr.83 Speed control 10 x multiplier setting for degree axis", "Pr.89 Manual pulse generator/Incremental synchronous encoder input type selection", "Pr.90 Operation setting for speed-torque control mode" and "Pr.95 External command signal selection" become valid when the PLC READY signal [Y0] turns from OFF to ON.

◇ The basic parameters 2, detailed parameters 2 (Note that this excludes "Pr.83 Speed control 10 x multiplier setting for degree axis", "Pr.89 Manual pulse generator/Incremental synchronous encoder input type selection", "Pr.90 Operation setting for speed-torque control mode" and "Pr.95 External command signal selection".) become valid immediately when they are written to the buffer memory, regardless of the state of the PLC READY signal [Y0].

◇ Even when the PLC READY signal [Y0] is ON, the values or contents of the following can be changed: basic parameters 2, detailed parameters 2, positioning data, and block start data.

◇ The expansion parameter and servo parameter is transmitted from the Simple Motion module to the servo amplifier when the initialized communication carried out after the power supply is turned ON or the PLC CPU is reset.

The power supply is turned ON or the PLC CPU is reset after writing servo parameter in flash ROM of Simple Motion module if the servo parameter is transmitted to the servo amplifier.

The following servo parameter in the buffer memory is transmitted to the servo amplifier when the PLC READY [Y0] turns from OFF to ON.

- "Auto tuning mode (PA08)"
- "Auto tuning response (PA09)"
- "Feed forward gain (PB04)"
- "Load to motor inertia ratio/load to motor mass ratio (PB06)"
- "Model loop gain (PB07)"
- "Position loop gain (PB08)"
- "Speed loop gain (PB09)"
- "Speed integral compensation (PB10)"
- "Speed differential compensation (PB11)"

◇ The only valid data assigned to basic parameter 2, detailed parameter 2, positioning data or block start data are the data read at the moment when a positioning or JOG operation is started. Once the operation has started, any modification to the data is ignored.

Exceptionally, however, modifications to the following are valid even when they are made during a positioning operation: acceleration time 0 to 3, deceleration time 0 to 3, and external command function.

- Acceleration time 0 to 3 and deceleration time 0 to 3:
  Positioning data are pre-read and pre-analyzed. Modifications to the data four or more steps after the current step are valid.
- External command function selection: The value at the time of detection is valid.

Monitor data (Data that indicates the control state. Stored in the buffer memory, and monitors as necessary.)

System monitor data	Monitors the specifications and the operation history of Simple Motion module.
Axis monitor data	Monitors the data related to the operating axis, such as the current position and speed.
Synchronous control data	Monitors the data for synchronous control.

◇ The following methods are available for data monitoring:
- Set using GX Works2.
- Create the sequence program for monitoring using GX Works2 and execute it.

In this manual, the method using the GX Works2 will be explained.

Control data (Data for user to control positioning system.)

System control data	Writes/initializes the "positioning data" in the module. Sets the setting for operation of all axes.
Axis control data	Makes settings related to the operation, and controls the speed change during operation, and stops/restarts the operation for each axis.
Expansion axis control data	Output signals (Axis stop signal, JOG start signal and execution prohibition flag) from PLC CPU to Simple Motion module.
Synchronous control data	Sets the data for synchronous control.

◇ Control using the control data is carried out with the sequence program.
" Cd.41 Deceleration start flag valid" is valid for only the value at the time when the PLC READY signal [Y0] turns from OFF to ON.

POINT

(1) The "setting data" is created for each axis.
(2) The "setting data" parameters have determined default values, and are set to the default values before shipment from the factory. (Parameters related to axes that are not used are left at the default value.)
(3) The "setting data" can be initialized with GX Works2 or the sequence program.
(4) It is recommended to set the "setting data" with GX Works2. The sequence program for data setting is complicated and many devices must be used. This will increase the scan time.

5.1.2 Setting items for positioning parameters

The table below lists items set to the positioning parameters. Setting of positioning parameters is similarly done for individual axes for all controls achieved by the Simple Motion module.

For details of controls, refer to "Section 2". For details of setting items, refer to Section 5.2 "List of parameters".

Control / Positioning parameter				Major positioning control							Manual control			Expansion control	
				Position control					Other control						
			OPR control	1-axis linear control 2/3/4-axis linear interpolation control	1-axis fixed-feed control 2/3/4-axis fixed-feed control	2-axis circular interpolation control	1 to 4 axis speed control	Speed-position or position-speed control	Current value changing	JUMP instruction, NOP instruction, LOOP to LEND	Manual pulse generator operation	Inching operation	JOG operation	Speed-torque control	Related sub function
Basic parameters 1	Pr.1	Unit setting	◎	◎	◎	△	◎	◎	◎	◎	◎	◎	◎	◎	–
	Pr.2	Number of pulses per rotation (AP) (Unit: PLS)	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	13.3.2
	Pr.3	Movement amount per rotation (AL)	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	
	Pr.4	Unit magnification (AM)	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	
	Pr.7	Bias speed at start	○	○	○	○	○	○	–	–	–	–	○	×	–
Basic parameters 2	Pr.8	Speed limit value	◎	◎	◎	◎	◎	◎	–	–	–	◎	◎	◎	13.4.1
	Pr.9	Acceleration time 0	◎	◎	◎	◎	◎	◎	–	–	–	–	◎	–	13.7.6
	Pr.10	Deceleration time 0	◎	◎	◎	◎	◎	◎	–	–	–	–	◎	–	
Detailed parameters 1	Pr.11	Backlash compensation amount	○	○	○	○	○	○	–	–	○	○	○	–	13.3.1
	Pr.12	Software stroke limit upper limit value	–	○	○	○	○	○	–	–	○	○	○	○	13.4.3
	Pr.13	Software stroke limit lower limit value	–	○	○	○	○	○	–	–	○	○	○	○	
	Pr.14	Software stroke limit selection	–	○	○	○	○	○	–	–	○	○	○	○	
	Pr.15	Software stroke limit valid/invalid setting	–	–	–	–	–	–	○	○	○	○	○	–	
	Pr.16	Command in-position width	–	○	○	○	–	○	–	–	–	–	–	–	13.7.5
	Pr.17	Torque limit setting value	△	○	○	○	○	○	–	–	△	△	△	○	13.4.2
	Pr.18	M code ON signal output timing	–	○	○	○	○	○	○	–	–	–	–	–	13.7.3
	Pr.19	Speed switching mode	–	○	○	○	–	–	–	–	–	–	–	–	–
	Pr.20	Interpolation speed designation method	–	△	△	△	△	–	–	–	–	–	–	–	–
	Pr.21	Current feed value during speed control	–	–	–	–	○	○	–	–	–	–	–	–	–
	Pr.22	Input signal logic selection	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	–
	Pr.24	Manual pulse generator/Incremental synchronous encoder input selection	–	–	–	–	–	–	–	–	◎	–	–	–	–
	Pr.80	External input signal selection	○	○	○	○	○	○	○	○	○	○	○	○	14.4
	Pr.81	Speed-position function selection	–	–	–	–	–	◎	–	–	–	–	–	–	–
	Pr.82	Forced stop valid/invalid selection	○	○	○	○	○	○	○	○	○	○	○	○	13.4.5

◎ : Always set
○ : Set as required ("–" when not required)
× : Setting not possible
△ : Setting restricted
– : Setting not required (This is an irrelevant item, so the setting value will be ignored. If the value is the default value or within the setting range, there is no problem.)

Control / Positioning parameter																
				Major positioning control							Manual control			Expansion control	
				Position control					Other control						
			OPR control	1-axis linear control 2/3/4-axis linear interpolation control	1-axis fixed-feed control 2/3/4-axis fixed-feed control	2-axis circular interpolation control	1 to 4 axis speed control	Speed-position or position-speed control	Current value changing	JUMP instruction, NOP instruction, LOOP to LEND	Manual pulse generator operation	Inching operation	JOG operation	Speed-torque control	Related sub function
Detailed parameters 2	Pr.25	Acceleration time 1	○	○	○	○	○	○	–	–	–	–	○	–	13.7.6
	Pr.26	Acceleration time 2	○	○	○	○	○	○	–	–	–	–	○	–	
	Pr.27	Acceleration time 3	○	○	○	○	○	○	–	–	–	–	○	–	
	Pr.28	Deceleration time 1	○	○	○	○	○	○	–	–	–	–	○	–	
	Pr.29	Deceleration time 2	○	○	○	○	○	○	–	–	–	–	○	–	
	Pr.30	Deceleration time 3	○	○	○	○	○	○	–	–	–	–	○	–	
	Pr.31	JOG speed limit value	–	–	–	–	–	–	–	–	–	◎	◎	–	13.4.1
	Pr.32	JOG operation acceleration time selection	–	–	–	–	–	–	–	–	–	–	◎	–	–
	Pr.33	JOG operation deceleration time selection	–	–	–	–	–	–	–	–	–	–	◎	–	–
	Pr.34	Acceleration/deceleration process selection	○	○	○	○	○	○	–	–	–	–	○	–	13.7. 6
	Pr.35	S-curve ratio	○	○	○	○	○	○	–	–	–	–	○	–	
	Pr.36	Sudden stop deceleration time	○	○	○	○	○	○	–	–	–	–	○	–	
	Pr.37	Stop group 1 sudden stop selection	○	○	○	○	○	○	–	–	–	–	○	–	–
	Pr.38	Stop group 2 sudden stop selection	○	○	○	○	○	○	–	–	–	–	○	–	–
	Pr.39	Stop group 3 sudden stop selection	○	○	○	○	○	○	–	–	–	–	○	–	–
	Pr.40	Positioning complete signal output time	–	○	○	○	○	○	○	–	–	–	–	–	–
	Pr.41	Allowable circular interpolation error width	–	–	–	○	–	–	–	–	–	–	–	–	–
	Pr.42	External command function selection	○	○	○	○	○	◎	○	–	–	–	○	–	13.5.1 13.7.2
	Pr.83	Speed control 10 x multiplier setting for degree axis	○	○	○	○	○	○	–	–	○	○	○	○	13.7.10
	Pr.84	Restart allowable range when servo OFF to ON	○	○	○	○	○	○	○	○	○	○	○	–	5.2.4
	Pr.89	Manual pulse generator/Incremental synchronous encoder input type selection	–	–	–	–	–	–	–	–	◎	–	–	–	5.2.4
	Pr.90	Operation setting for speed-torque control mode	–	–	–	–	–	–	–	–	–	–	–	○	12.1
	Pr.95	External command signal selection QD77MS16	○	○	○	○	○	◎	○	–	–	–	○	–	–

◎ : Always set

○ : Set as required ("–" when not required)

– : Setting not required (This is an irrelevant item, so the setting value will be ignored. If the value is the default value or within the setting range, there is no problem.)

■ Checking the positioning parameters

Pr.1 to Pr.90 , Pr.95 are checked with the following timing.

- When the "PLC READY signal [Y0]" output from the PLC CPU to the Simple Motion module changes from OFF to ON.
- When the positioning test of GX Works2 is executed.

REMARK

"High-level positioning control" is carried out in combination with the "major positioning control".
Refer to the "major positioning control" parameter settings for details on the parameters required for "high-level positioning control".

5.1.3 Setting items for OPR parameters

When carrying out "OPR control", the "OPR parameters" must be set. The setting items for the "OPR parameters" are shown below.
The "OPR parameters" are set commonly for each axis.
Refer to Chapter 8 "OPR control" for details on the "OPR control", and refer to Section 5.2 "List of parameters" for details on each setting item.

OPR parameters / OPR control			Machine OPR control					Fast OPR control
OPR basic parameters	Pr.43	OPR method	Near-point dog method	Count method 1)	Count method 2)	Data set method	Scale origin signal detection method	
	Pr.44	OPR direction	◎	◎	◎	◎	◎	Preset parameters are used for machine OPR control.
	Pr.45	OP address	◎	◎	◎	◎	◎	
	Pr.46	OPR speed	◎	◎	◎	–	◎	
	Pr.47	Creep speed	◎	◎	◎	–	◎	
	Pr.48	OPR retry	R	R	R	–	–	
OPR detailed parameters	Pr.50	Setting for the movement amount after near-point dog ON	–	◎	◎	–	–	
	Pr.51	OPR acceleration time selection	◎	◎	◎	–	◎	
	Pr.52	OPR deceleration time selection	◎	◎	◎	–	◎	
	Pr.53	OP shift amount	S	S	S	–	S	
	Pr.54	OPR torque limit value	○	○	○	–	○	
	Pr.55	Operation setting for incompletion of OPR	○	○	○	○	○	–
	Pr.56	Speed designation during OP shift	S	S	S	–	S	Preset parameters are used for machine OPR control.
	Pr.57	Dwell time during OPR retry	R	R	R	–	–	

◎ : Always set
○ : Set as required
– : Setting not required (This is an irrelevant item, so the setting value will be ignored. If the value is the default value or within the setting range, there is no problem.)
R : Set when using the "13.2.1 OPR retry function" ("–" when not set)
S : Set when using the "13.2.2 OP shift function" ("–" when not set)

■ Checking the OPR parameters

Pr.43 to Pr.57 are checked with the following timing.

- When the "PLC READY signal [Y0]" output from the PLC CPU to the Simple Motion module changes from OFF to ON.
- When the positioning test of GX Works2 is executed.

5.1.4 Setting items for expansion parameters

The setting items for the "expansion parameters" are shown below. The "expansion parameters" are set commonly for each axis.
Refer to "Section 2" for details on the each control, and refer to Section 5.2 "List of parameters" for details on each setting item.

Expansion parameter		Related sub function
Pr.91	Optional data monitor: Data type setting 1	14.11
Pr.92	Optional data monitor: Data type setting 2	
Pr.93	Optional data monitor: Data type setting 3	
Pr.94	Optional data monitor: Data type setting 4	
Pr.96	Operation cycle setting	—
Pr.97	SSCNET setting	—
Pr.114	External command signal compensation valid/invalid setting	—

5.1.5 Setting items for servo parameters

The servo parameters are used to control the servo motor and the data that is determined by the specification of the servo amplifier being used.
The setting item is different depending on the servo amplifier being used.
Refer to Section 5.2.8 "Servo parameters" for details.

Servo parameter		Remark
Pr.100	Servo series	Set the servo series connected to Simple Motion module.
PA01 to PA32	PA group	Setting items are different according to the servo series.
PB01 to PB64	PB group	
PC01 to PC64	PC group	
PD01 to PD48	PD group	
PE01 to PE64	PE group	
PS01 to PS32	PS group	
PF01 to PF48	PF group	
Po01 to Po32	Po group	
PL01 to PL48	PL group	

5.1.6 Setting items for positioning data

Positioning data must be set for carrying out any "major positioning control". The table below lists the items to be set for producing the positioning data.
One to 600 positioning data items can be set for each axis.
For details of the major positioning controls, refer to Chapter 9 "Major Positioning Control". For details of the individual setting items, refer to Section 5.3 "List of positioning data".

Major positioning control			Position control			1 to 4 axis speed control	Speed-position switching control	Position-speed switching control	Other control				
Positioning data			1-axis linear control 2/3/4-axis linear interpolation control	1-axis fixed-feed control 2/3/4-axis fixed-feed control	2-axis circular interpolation control				NOP instruction	Current value changing	JUMP instruction	LOOP	LEND
Da.1	Operation pattern	Independent positioning control	◎	◎	◎	◎	◎	◎	–	◎	–	–	–
		Continuous positioning control	◎	◎	◎	×	◎	×	–	◎	–	–	–
		Continuous path control	◎	×	◎	×	×	×	–	×	–	–	–
Da.2	Control system		Linear 1 Linear 2 Linear 3 Linear 4 *	Fixed-feed 1 Fixed-feed 2 Fixed-feed 3 Fixed-feed 4	Circular sub Circular right Circular left *	Forward run speed 1 Reverse run speed 1 Forward run speed 2 Reverse run speed 2 Forward run speed 3 Reverse run speed 3 Forward run speed 4 Reverse run speed 4	Forward run speed/ position Reverse run speed/ position	Forward run position/ speed Reverse run position/ speed	NOP instruction	Current value changing	JUMP instruction	LOOP	LEND
Da.3	Acceleration time No.		○	○	○	○	○	○	–	–	–	–	–
Da.4	Deceleration time No.		○	○	○	○	○	○	–	–	–	–	–
Da.5	Axis to be interpolated QD77MS2 QD77MS4		◎: 2 axes –: 1 axis, 3 axes, 4 axes			–	–	–	–	–	–	–	–
Da.6	Positioning address/ movement amount		◎	◎	◎	–	◎	◎	–	New address	–	–	–
Da.7	Arc address		–	–	◎	–	–	–	–	–	–	–	–
Da.8	Command speed		◎	◎	◎	◎	◎	◎	–	–	–	–	–
Da.9	Dwell time (JUMP destination positioning data No.)		○	○	○	○	○	○	–	–	JUMP destination positioning data No.	–	–
Da.10	M code (JUMP condition data No.)		○	○	○	○	○	○	–	○	JUMP condition data No.	Number of LOOP to LEND repetitions	–

◎ : Always set
○ : Set as required ("–" when not required)
× : Setting not possible
– : Setting not required
(This is an irrelevant item, so the setting value will be ignored. If the value is the default value or within the setting range, there is no problem.)
* : Two control systems are available: the absolute (ABS) system and incremental (INC) system.

Major positioning control Positioning data		Position control			1 to 4 axis speed control	Speed-position switching control	Position-speed switching control	Other control				
		1-axis linear control 2/3/4-axis linear interpolation control	1-axis fixed-feed control 2/3/4-axis fixed-feed control	2-axis circular interpolation control				NOP instruction	Current value changing	JUMP instruction	LOOP	LEND
Da.20	Axis to be interpolated 1 QD77MS16	◎: 2 axes, 3 axes, 4 axes –: 1 axis				–	–	–	–	–	–	–
Da.21	Axis to be interpolated 2 QD77MS16	◎: 3 axes, 4 axes –: 1 axis, 2 axes				–	–	–	–	–	–	–
Da.22	Axis to be interpolated 3 QD77MS16	◎: 4 axes –: 1 axis, 2 axes, 3 axes				–	–	–	–	–	–	–

◎ : Always set
○ : Set as required ("–" when not required)
× : Setting not possible
– : Setting not required
(This is an irrelevant item, so the setting value will be ignored. If the value is the default value or within the setting range, there is no problem.)
＊ : Two control systems are available: the absolute (ABS) system and incremental (INC) system.

■ Checking the positioning data

Da.1 to Da.10 , Da.20 to Da.22 are checked at the following timings:

- Startup of a positioning operation

5.1.7 Setting items for block start data

The "block start data" must be set when carrying out "high-level positioning control".
The setting items for the "block start data" are shown below.
Up to 50 points of "block start data" can be set for each axis.
Refer to Chapter 10 "High-Level Positioning Control" for details on the "high-level positioning control", and to Section 5.4 "List of block start data" for details on each setting item.

Block start data \ High-level positioning control		Block start (Normal start)	Condition start	Wait start	Simultaneous start	Repeated start (FOR loop)	Repeated start (FOR condition)
Da.11	Shape (end/continue)	○	○	○	○	○	○
Da.12	Start data No.	○	○	○	○	○	○
Da.13	Special start instruction	–	○	○	○	○	○
Da.14	Parameter	–	○	○	○	○	○

○ : Set as required ("–" when not required)
– : Setting not required (This is an irrelevant item, so the setting value will be ignored. If the value is the default value or within the setting range, there is no problem.)

■ Checking the block start data

Da.11 to Da.14 are checked with the following timing.

- When "Block start data" starts

5.1.8 Setting items for condition data

When carrying out "high-level positioning control" or using the JUMP instruction in the "major positioning control", the "condition data" must be set as required. The setting items for the "condition data" are shown below.

Up to 10 "condition data" items can be set for each axis.

Refer to Chapter 10 "High-Level Positioning Control" for details on the "high-level positioning control", and to Section 5.5 "List of condition data" for details on each setting item.

Control Condition data		Major positioning control		High-level positioning control					
		Other than JUMP instruction	JUMP instruction	Block start (Normal start)	Condition start	Wait start	Simultaneous start	Repeated start (FOR loop)	Repeated start (FOR condition)
Da.15	Condition target	–	○	–	○	○	○	–	○
Da.16	Condition operator	–	○	–	○	○	○	–	○
Da.17	Address	–	△	–	△	△	–	–	△
Da.18	Parameter 1	–	○	–	○	○	△	–	○
Da.19	Parameter 2	–	△	–	△	△	△	–	△
Da.23	Number of simultaneously starting axes QD77MS16	–	–	–	–	–	○	–	–
Da.24	Simultaneously starting axis No.1 QD77MS16	–	–	–	–	–	○	–	–
Da.25	Simultaneously starting axis No.2 QD77MS16	–	–	–	–	–	○	–	–
Da.26	Simultaneously starting axis No.3 QD77MS16	–	–	–	–	–	○	–	–

○ : Set as required ("–" when not required)

△ : Setting limited

– : Setting not required (This is an irrelevant item, so the setting value will be ignored. If the value is the default value or within the setting range, there is no problem.)

■ Checking the condition data

Da.15 to Da.19, Da.23 to Da.26 are checked with the following timing.

- When "Block start data" starts
- When "JUMP instruction" starts

5.1.9 Types and roles of monitor data

The monitor data area in the buffer memory stores data relating to the operating state of the positioning system, which are monitored as required while the positioning system is operating.
The following data are available for monitoring.

- System monitoring:

  Monitoring of the specification and operation history of Simple Motion module (system monitor data Md.1 to Md.19, Md.50 to Md.59, Md.130 to Md.135)

- Axis operation monitoring:

  Monitoring of the current position and speed, and other data related to the movements of axes (axis monitor data Md.20 to Md.48, Md.100 to Md.116, Md.120 to Md.125)

[1] Monitoring the system

■ Monitoring the positioning system operation history

Monitoring details			Corresponding item	
Whether the system is in the test mode or not			Md.1	In test mode flag
History of data that started an operation	Start information		Md.3	Start information
	Start No.		Md.4	Start No.
	Start	Year: month	Md.54	Start Year: month
		Day: hour	Md.5	Start Day: hour
		Minute: second	Md.6	Start Minute: second
	Error upon starting		Md.7	Error judgment
	Pointer No. next to the pointer No. where the latest history is stored		Md.8	Start history pointer
History of all errors	Axis in which the error occurred		Md.9	Axis in which the error occurred
	Axis error No.		Md.10	Axis error No.
	Servo alarm		Md.57	Servo alarm
	Axis error occurrence	Year: month	Md.55	Axis error occurrence (Year: month)
		Day: hour	Md.11	Axis error occurrence (Day: hour)
		Minute: second	Md.12	Axis error occurrence (Minute: second)
	Pointer No. next to the pointer No. where the latest history is stored		Md.13	Error history pointer
History of all warnings	Axis in which the warning occurred		Md.14	Axis in which the warning occurred
	Axis warning No.		Md.15	Axis warning No.
	Servo warning		Md.58	Servo warning
	Axis warning occurrence	Year: month	Md.56	Axis warning occurrence (Year: month)
		Day: hour	Md.16	Axis warning occurrence (Day: hour)
		Minute: second	Md.17	Axis warning occurrence (Minute: second)
	Pointer No. next to the pointer No. where the latest history is stored		Md.18	Warning history pointer

Monitoring details		Corresponding item	
Number of write accesses to the flash ROM after the power is switched ON	Number of write accesses to flash ROM	Md.19	Number of write accesses to flash ROM
Forced stop input signal (EMI) turn ON/OFF	Forced stop input signal (EMI) information	Md.50	Forced stop input
Monitor whether the system is in amplifier-less operation		Md.51	Amplifier-less operation mode status
Monitor the detection status of axis that set communication between amplifiers		Md.52	Communication between amplifiers axes searching flag
Monitor the connect/disconnect status of SSCNET communication		Md.53	SSCNET control status
Monitor the first five digits of product information		Md.130	OS version
Monitor the RUN status of digital oscilloscope		Md.131	Digital oscilloscope executing
Monitor the current operation cycle.		Md.132	Operation cycle setting
Monitor whether the operation cycle time exceeds operation cycle.		Md.133	Operation cycle over flag
Monitor the time that took for operation every operation cycle.		Md.134	Operation time
Monitor the maximum value of operation time after each module's power supply ON.		Md.135	Maximum operation time
Store the module information		Md.59	Module information

[2] Monitoring the axis operation state

■ Monitoring the position

Monitor details	Corresponding item
Monitor the current machine feed value	Md.21 Machine feed value
Monitor the current "current feed value"	Md.20 Current feed value
Monitor the current target value	Md.32 Target value

■ Monitoring the speed

<table>
<tr><th colspan="4">Monitor details</th><th>Corresponding item</th></tr>
<tr><td rowspan="5">Monitor the current speed</td><td colspan="2">During independent axis control</td><td>Indicates the speed of each axis</td><td rowspan="3">Md.22 Feedrate</td></tr>
<tr><td rowspan="2">During interpolation control</td><td>When "0: Composite speed" is set for "Pr.20 Interpolation speed designation method"</td><td>Indicates the composite speed</td></tr>
<tr><td>When "1: Reference axis speed" is set for "Pr.20 Interpolation speed designation method"</td><td>Indicates the reference axis speed</td></tr>
<tr><td colspan="3">Monitor "Da.8 Command speed" currently being executed.</td><td>Md.27 Current speed</td></tr>
<tr><td colspan="3">Constantly indicates the speed of each axis</td><td>Md.28 Axis feedrate</td></tr>
<tr><td colspan="4">Monitor the current target speed</td><td>Md.33 Target speed</td></tr>
<tr><td colspan="4">Monitor the command speed at speed control mode or continuous operation to torque control mode in the speed-torque control</td><td>Md.122 Speed during command</td></tr>
</table>

■ Monitoring the status of servo amplifier

Monitor details	Corresponding item
Monitor the real current value (current feed value - deviation counter).	Md.101 Real current value
Monitor the difference between current feed value and real current value.	Md.102 Deviation counter value
Monitor the motor speed of servo motor.	Md.103 Motor rotation speed
Monitor the current value of servo motor.	Md.104 Motor current value
Monitor the software No. of servo amplifier.	Md.106 Servo amplifier software No.
Monitor the parameter No. that an error occurred.	Md.107 Parameter error No.
Monitor the status (servo status) of servo amplifier.	Md.108 Servo status Md.125 Servo status3
• Monitor the percentage of regenerative power to permissible regenerative value. • Monitor the content of "Pr.91 Optional data monitor: Data type setting 1" at optional data monitor data type setting.	Md.109 Regenerative load ratio/Optional data monitor output 1
• Monitor the continuous effective load torque. • Monitor the content of "Pr.92 Optional data monitor: Data type setting 2" at optional data monitor data type setting.	Md.110 Effective load torque/Optional data monitor output 2
• Monitor the maximum generated torque. • Monitor the content of "Pr.93 Optional data monitor: Data type setting 3" at optional data monitor data type setting.	Md.111 Peak torque ratio/Optional data monitor output 3
Monitor the content of "Pr.94 Optional data monitor: Data type setting 4" at optional data monitor data type setting.	Md.112 Optional data monitor output 4
Monitor the status of semi closed loop control/fully closed loop control.	Md.113 Semi/Fully closed loop status
Monitor the alarm of servo amplifier.	Md.114 Servo alarm
Monitor the option information of encoder.	Md.116 Encoder option information

■ Monitoring the state

Monitor details	Corresponding item
Monitor the axis operation state	Md.26 Axis operation status
Monitor the latest error code that occurred with the axis	Md.23 Axis error No.
Monitor the latest warning code that occurred with the axis	Md.24 Axis warning No.
Monitor the external input/output signal and flag	Md.30 Md.31 External input signal Status
Monitor the valid M codes	Md.25 Valid M code
Monitor whether the speed is being limited	Md.39 In speed limit flag
Monitor whether the speed is being changed	Md.40 In speed change processing flag
Monitor the "start data" point currently being executed	Md.43 Start data pointer being executed
Monitor the "positioning data No." currently being executed	Md.44 Positioning data No. being executed
Monitor the remaining number of repetitions (special start)	Md.41 Special start repetition counter
Monitor the remaining number of repetitions (control system)	Md.42 Control system repetition counter

Monitor details	Corresponding item	
Monitor the block No.	Md.45	Block No. being executed
Monitor the current torque limit value	Md.35	Torque limit stored value/forward torque limit stored value
	Md.120	Reverse torque limit stored value
Monitor the command torque at torque control mode or continuous operation to torque control mode in the speed-torque control.	Md.123	Torque during command
Monitor the switching status of control mode.	Md.124	Control mode switching status
Monitor the "instruction code" of the special start data when using special start	Md.36	Special start data instruction code setting value
Monitor the "instruction parameter" of the special start data when using special start	Md.37	Special start data instruction parameter setting value
Monitor the "start data No." of the special start data when using special start	Md.38	Start positioning data No. setting value
Monitor the "positioning data No." executed last	Md.46	Last executed positioning data No.
Monitor the positioning data currently being executed	Md.47	Positioning data being executed
Monitor the movement amount after the current position control switching when using "speed-position switching control".	Md.29	Speed-position switching control positioning amount
Monitor switching from the constant speed status or acceleration status to the deceleration status during position control whose operation pattern is "Positioning complete"	Md.48	Deceleration start flag
Monitor the movement amount from near-point dog ON to machine OPR completion.	Md.34	Movement amount after near-point dog ON
Monitor the distance that travels to zero point after stop once at OPR.	Md.100	OPR re-travel value

5.1.10 Types and roles of control data

Operation of the positioning system is achieved through the execution of necessary controls. (Data required for controls are given through the default values when the power is switched ON, which can be modified as required by the sequence program.) Items that can be controlled are described below.

- Controlling the system data :
  Setting and resetting "setting data" of Simple Motion module (system control data Cd.1 , Cd.2 , Cd.47)
- Controlling the operation :
  Setting operation parameters, changing speed during operation, interrupting or restarting operation, etc. (system control data Cd.41 , Cd.42 , Cd.44 , Cd.102 , Cd.137 , axis control data Cd.3 to Cd.40 , Cd.43 , Cd.45 , Cd.46 , Cd.100 , Cd.101 , Cd.108 , Cd.112 , Cd.113 , Cd.130 to Cd.133 , Cd.136 to Cd.154 , expansion axis control data Cd.180 to Cd.183)

[1] Controlling the system data

■ Setting and resetting the setting data

Control details	Controlled data item
Write setting data from buffer memory to flash ROM.	Cd.1 Flash ROM write request
Reset (initialize) parameters.	Cd.2 Parameter initialization request
Set initial value of QD75MH in setting data.	Cd.47 QD75MH initial value setting request

[2] Controlling the operation

■ Controlling the operation

Control details	Corresponding item	
Set which positioning to execute (start No.).	Cd.3	Positioning start No.
Clear (reset) the axis error (Md.23) and warning (Md.24).	Cd.5	Axis error reset
Issue instruction to restart (When axis operation is stopped).	Cd.6	Restart command
Stop axis in control.	Cd.180	Axis stop QD77MS16
Execute start request of JOG operation or inching operation.	Cd.181	Forward run JOG start QD77MS16
	Cd.182	Reverse run JOG start QD77MS16
Execute pre-reading at positioning start.	Cd.183	Execution prohibition flag QD77MS16
Set start point No. for executing block start.	Cd.4	Positioning starting point No.
Stop continuous control.	Cd.18	Interrupt request during continuous operation
Set number of simultaneous starting axes and target axis.	Cd.43	Simultaneous starting axis QD77MS16
Set axis 1 start data Nos. for axes that start up simultaneously.	Cd.30	Simultaneous starting axis start data No. (axis 1 start data No.) QD77MS2 QD77MS4
Set start data No. of own axis at multiple axes simultaneous starting.		Simultaneous starting own axis start data No. QD77MS16
Set axis 2 start data Nos. for axes that start up simultaneously.	Cd.31	Simultaneous starting axis start data No. (axis 2 start data No.) QD77MS2 QD77MS4
Set start data No.1 for axes that start up simultaneously.		Simultaneous starting axis start data No.1 QD77MS16
Set axis 3 start data Nos. for axes that start up simultaneously.	Cd.32	Simultaneous starting axis start data No. (axis 3 start data No.) QD77MS4
Set start data No.2 for axes that start up simultaneously.		Simultaneous starting axis start data No.2 QD77MS16
Set axis 4 start data Nos. for axes that start up simultaneously.	Cd.33	Simultaneous starting axis start data No. (axis 4 start data No.) QD77MS4
Set start data No.3 for axes that start up simultaneously.		Simultaneous starting axis start data No.3 QD77MS16
Specify write destination for teaching results.	Cd.38	Teaching data selection
Specify data to be taught.	Cd.39	Teaching positioning data No.
Set the status of the external input signal (upper/lower limit switch signal, near-point dog signal, stop signal).	Cd.44	External input signal operation device

■ Controlling operation per step

Control details	Corresponding item	
Stop positioning operation after each operation.	Cd.35	Step valid flag
Set unit to carry out step.	Cd.34	Step mode
Continuous operation from stopped step.	Cd.36	Step start information

■ Controlling the speed

Control details	Corresponding item
Set new speed when changing speed during operation.	Cd.14 New speed value
Issue instruction to change speed in operation to Cd.14 value. (Only during positioning operation and JOG operation).	Cd.15 Speed change request
Change positioning operation speed between 1 and 300% range.	Cd.13 Positioning operation speed override
Set inching movement amount.	Cd.16 Inching movement amount
Set JOG speed.	Cd.17 JOG speed
When changing acceleration time during speed change, set new acceleration time.	Cd.10 New acceleration time value
When changing deceleration time during speed change, set new deceleration time.	Cd.11 New deceleration time value
Set acceleration/deceleration time validity during speed change.	Cd.12 Acceleration/deceleration time change during speed change, enable/disable selection

■ Change operation mode

Control details	Corresponding item
Change operation mode.	Cd.137 Amplifier-less operation mode switching request

■ Making settings related to operation

Control details	Corresponding item
Turn M code ON signal OFF.	Cd.7 M code OFF request
Set new value when changing current value.	Cd.9 New current value
Validate switching signal set in "Cd.45 Speed-position switching device selection".	Cd.24 Speed-position switching enable flag
Change movement amount for position control during speed-position switching control (INC mode).	Cd.23 Speed-position switching control movement amount change register
Validate switching signal set in "Cd.45 Speed-position switching device selection".	Cd.26 Position-speed switching enable flag
Change speed for speed control during position-speed switching control.	Cd.25 Position-speed switching control speed change register
Set up a flag when target position is changed during positioning.	Cd.29 Target position change request flag
Set new positioning address when changing target position during positioning.	Cd.27 Target position change value(New address)
Set new speed when changing target position during positioning.	Cd.28 Target position change value(New speed)
Set absolute (ABS) moving direction in degrees.	Cd.40 ABS direction in degrees
Set manual pulse generator operation validity.	Cd.21 Manual pulse generator enable flag
Set scale per pulse of number of input pulses from manual pulse generator.	Cd.20 Manual pulse generator 1 pulse input magnification
Change OPR request flag from "ON to OFF".	Cd.19 OPR request flag OFF request
Validate external command signal.	Cd.8 External command valid

Control details		Corresponding item	
Set "same setting/individual setting" of the forward torque limit value or reverse torque limit value in the torque change function.		Cd.112	Torque change function switching request
Change "Md.35 Torque limit stored value/forward torque limit stored value".		Cd.22	New torque value/forward new torque value
Change "Md.120 Reverse torque limit stored value".		Cd.113	Reverse new torque value
Set whether "Md.48 Deceleration start flag" is valid or invalid		Cd.41	Deceleration start flag valid
Set the stop command processing for deceleration stop function (deceleration curve re-processing/deceleration curve continuation)		Cd.42	Stop command processing for deceleration stop selection
Set the device used for speed-position switching.		Cd.45	Speed-position switching device selection
Switch speed-position control.		Cd.46	Speed-position switching command
Turn Servo ON/OFF command OFF by the buffer memory ON.		Cd.100	Servo OFF command
Set torque limit value		Cd.101	Torque output setting value
Set the connect/disconnect of SSCNET communication.		Cd.102	SSCNET control command
Set whether gain changing is execution or not.		Cd.108	Gain changing command
Set the semi closed loop control/fully closed loop control.		Cd.133	Semi/Fully closed loop switching request
Set the PI-PID switching to servo amplifier.		Cd.136	PI-PID switching request
Speed-torque control	Switch the control mode.	Cd.138	Control mode switching request
	Set the control mode to switch.	Cd.139	Control mode setting
	Set the command speed during speed control mode.	Cd.140	Command speed at speed control mode
	Set the acceleration time during speed control mode.	Cd.141	Acceleration time at speed control mode
	Set the deceleration time during speed control mode.	Cd.142	Deceleration time at speed control mode
	Set the command torque during torque control mode.	Cd.143	Command torque at torque control mode
	Set the time constant at driving of torque control mode.	Cd.144	Torque time constant at torque control mode (Forward direction)
	Set the time constant at regeneration of torque control mode.	Cd.145	Torque time constant at torque control mode (Negative direction)
	Set the speed limit value during torque control mode.	Cd.146	Speed limit value at torque control mode
	Set the command speed during continuous operation to torque control mode.	Cd.147	Speed limit value at continuous operation to torque control mode
	Set the acceleration time during continuous operation to torque control mode.	Cd.148	Acceleration time at continuous operation to torque control mode
	Set the deceleration time during continuous operation to torque control mode.	Cd.149	Deceleration time at continuous operation to torque control mode
	Set the target torque during continuous operation to torque control mode.	Cd.150	Target torque at continuous operation to torque control mode
	Set the time constant at driving of continuous operation to torque control mode.	Cd.151	Torque time constant at continuous operation to torque control mode (Forward direction)
	Set the time constant at regeneration of continuous operation to torque control mode.	Cd.152	Torque time constant at continuous operation to torque control mode (Negative direction)
	Set the switching conditions for switching to continuous operation to torque control mode.	Cd.153	Control mode auto-shift selection
	Set the condition value when "Cd.153 Control mode auto-shift selection" is set.	Cd.154	Control mode auto-shift parameter

5.2 List of parameters

The setting items of the positioning parameter, OPR parameter or servo parameter are explained in this section.

- Guide to buffer memory address

  In the buffer memory address, "n" in "1+150n", etc. indicates a value corresponding to axis No. such as the following table.

Axis No.	n	Axis No.	n	Axis No.	n	Axis No.	n
1	0	5	4	9	8	13	12
2	1	6	5	10	9	14	13
3	2	7	6	11	10	15	14
4	3	8	7	12	11	16	15

(Note-1): Calculate as follows for the buffer memory address corresponding to each axis.
(Example) For axis No. 16
1+150n (Pr.4 Unit magnification (AM))=1+150×15=2251

(Note-2): The range from axis No.1 to 2 (n=0 to 1) is valid in the QD77MS2.

(Note-3): The range from axis No.1 to 4 (n=0 to 3) is valid in the QD77MS4.

5.2.1 Basic parameters 1

<table>
<tr><th colspan="2" rowspan="2">Item</th><th colspan="2">Setting value, setting range</th><th rowspan="2">Default value</th><th colspan="2">Buffer memory address</th></tr>
<tr><th>Value set with GX Works2</th><th>Value set with sequence program</th><th>QD77MS2
QD77MS4</th><th>QD77MS16</th></tr>
<tr><td colspan="2" rowspan="4">Pr.1 Unit setting</td><td>0 : mm</td><td>0</td><td rowspan="4">3</td><td colspan="2" rowspan="4">0+150n</td></tr>
<tr><td>1 : inch</td><td>1</td></tr>
<tr><td>2 : degree</td><td>2</td></tr>
<tr><td>3 : PLS</td><td>3</td></tr>
<tr><td rowspan="6">Movement amount per pulse</td><td>Pr.2
Number of pulses per rotation (AP)
(Unit : PLS)</td><td>1 to 200000000</td><td>1 to 200000000</td><td>20000</td><td colspan="2">2+150n
3+150n</td></tr>
<tr><td>Pr.3
Movement amount per rotation (AL)</td><td colspan="2">The setting value range differs according to the "Pr.1 Unit setting".</td><td>20000</td><td colspan="2">4+150n
5+150n</td></tr>
<tr><td rowspan="4">Pr.4
Unit magnification (AM)</td><td>1 : 1 times</td><td>1</td><td rowspan="4">1</td><td colspan="2" rowspan="4">1+150n</td></tr>
<tr><td>10 : 10 times</td><td>10</td></tr>
<tr><td>100 : 100 times</td><td>100</td></tr>
<tr><td>1000 : 1000 times</td><td>1000</td></tr>
<tr><td colspan="2">Pr.7
Bias speed at start</td><td colspan="2">The setting value range differs according to the "Pr.1 Unit setting".</td><td>0</td><td colspan="2">6+150n
7+150n</td></tr>
</table>

n: Axis No.-1

Pr.1 Unit setting

Set the unit used for defining positioning operations. Choose from the following units depending on the type of the control target: mm, inch, degree, or PLS. Different units can be defined for different axes.

(Example) Different units (mm, inch, degree, and PLS) are applicable to different systems:

- mm or inch...... X-Y table, conveyor (Select mm or inch depending on the machine specifications.)
- degree .... Rotating body (360 degrees/rotation)
- PLS................. X-Y table, conveyor

＊: When you change the unit, note that the values of other parameters and data will not be changed automatically.
After changing the unit, check if the parameter and data values are within the allowable range.
Set "degree" to exercise speed-position switching control (ABS mode).

Pr.2 to Pr.4 Electronic gear (Movement amount per pulse)

Mechanical system value used when the Simple Motion module performs positioning control.

The settings are made using Pr.2 to Pr.4.

The electronic gear is expressed by the following equation.

$$\text{Electronic gear} = \frac{\text{Number of pulses per rotation (AP)}}{\text{Movement amount per rotation (AL)} \times \text{Unit magnification (AM)}}$$

＊: When positioning has been performed, an error (mechanical system error) may be produced between the specified movement amount and the actual movement amount. (Refer to Section 13.3.2 "Electronic gear function".)

POINT

(1) Set the electronic gear within the following range.
If the value outside the setting range is set, the "Outside electronic gear setting range (error code: 907)" will occur.

- Product information is before 150410000000000.

$$0.001 \leq \text{Electronic gear} \left(\frac{AP}{AL \times AM}\right) \leq 20000$$

- Product information is 150410000000000 or later.

$$0.001 \leq \text{Electronic gear} \left(\frac{AP}{AL \times AM}\right) \leq 320000$$

(2) The result of below calculation (round up after decimal point) is a minimum pulse when the current feed value is updated at follow-up processing. (The movement amount for droop pulse is reflected as the current feed value when the droop pulse becomes more than above calculated value in pulse unit of motor end.)

Number of pulses per rotation (AP) ÷ (Movement amount per rotation (AL) × Unit magnification (AM) × 3375)[PLS]

Refer to Section 13.8.2 for the follow-up processing.

Pr.2 Number of pulses per rotation (AP)

Set the number of pulses required for a complete rotation of the motor shaft.
If you are using the Mitsubishi servo amplifier MR-J4(W)-B/MR-J3(W)-B, set the value given as the "resolution per servomotor rotation" in the speed/position detector specifications.

Number of pulses per rotation (AP) = Resolution per servomotor rotation

Pr.3 Movement amount per rotation (AL), Pr.4 Unit magnification (AM)

The amount how the workpiece moves with one motor rotation is determined by the mechanical structure.
If the worm gear lead (μm/rev) is PB and the deceleration rate is 1/n, then

Movement amount per rotation (AL) = PB × 1/n

However, the maximum value that can be set for this "movement amount per rotation (AL)" parameter is 20000000.0μm (20m). Set the "movement amount per rotation (AL)" as shown below so that the "movement amount per rotation (AL)" does not exceed this maximum value.

Movement amount per rotation (AL)
= PB × 1/n
= Movement amount per rotation (AL) × Unit magnification (AM)

Note) The unit magnification (AM) is a value of 1, 10, 100 or 1000. If the "PB × 1/n" value exceeds 20000000.0μm (20m), adjust with the unit magnification so that the "movement amount per rotation (AL)" does not exceed 20000000.0μm (20m).

＊1: Refer to Section 13.3.2 "Electronic gear function" information about electric gear.

Pr.1 setting value	Value set with GX Works2 (unit)	Value set with sequence program (unit)
0 : mm	0.1 to 2000000.0 (μm)	1 to 200000000 ($\times 10^{-1}$μm)
1 : inch	0.00001 to 2000.00000 (inch)	1 to 200000000 ($\times 10^{-5}$inch)
2 : degree	0.00001 to 2000.00000 (degree)	1 to 200000000 ($\times 10^{-5}$degree)
3 : PLS	1 to 200000000 (PLS)	1 to 200000000 (PLS)

Pr.7 Bias speed at start

Set the bias speed (minimum speed) upon starting. When using a stepping motor, etc., set it to start the motor smoothly. (If the motor speed at start is low, the stepping motor does not start smoothly.)
The specified "bias speed at start" will be valid during the following operations:

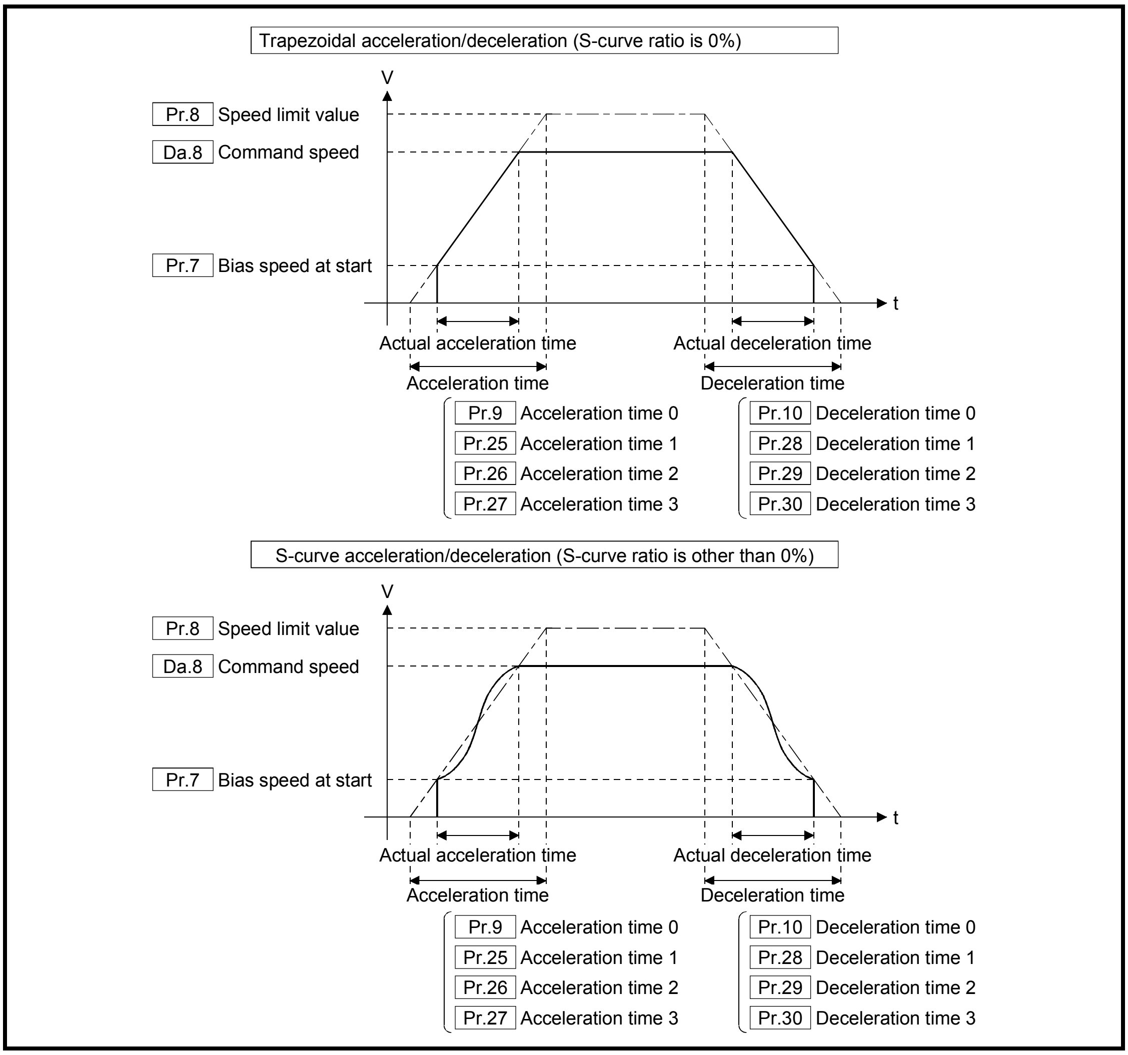
- Positioning operation
- OPR operation
- JOG operation

Set the value that the bias speed should not exceed "Pr.8 Speed limit value".

Pr.1 setting value	Value set with GX Works2 (unit)	Value set with sequence program (unit)
0 : mm	0.00 to 20000000.00 (mm/min)	0 to 2000000000 (×10^{-2}mm/min)
1 : inch	0.000 to 2000000.000 (inch/min)	0 to 2000000000 (×10^{-3}inch/min)
2 : degree	0.000 to 2000000.000 (degree/min) ∗1	0 to 2000000000 (×10^{-3}degree/min) ∗2
3 : PLS	0 to 1000000000 (PLS/s)	0 to 1000000000 (PLS/s)

∗1: Range of speed limit value when "Pr.83 Speed control 10 x multiplier setting for degree axis" is set to valid: 0.00 to 20000000.00 (degree/min)

∗2: Range of speed limit value when "Pr.83 Speed control 10 x multiplier setting for degree axis" is set to valid: 0 to 2000000000 (×10^{-2}degree/min)



POINT

For the 2-axis or more interpolation control, the bias speed at start is applied by the setting of "Pr.20 Interpolation speed designation method".

- "0: Composite speed" : Bias speed at start set to the reference axis is applied to the composite command speed.
- "1: Reference axis speed": Bias speed at start is applied to the reference axis.

(1) Precautionary notes

(a) "Pr.7 Bias speed at start" is valid regardless of motor type. Set "0" when using the motor other than the stepping motor. Otherwise, it may cause vibration or impact even though an error does not occur.

(b) Set "Pr.7 Bias speed at start" according to the specification of stepping motor driver. If the setting is outside the range, it may cause the following troubles by rapid speed change or overload.

- Stepping motor steps out.
- An error occurs in the stepping motor driver.

(c) In synchronous control, when "Pr.7 Bias speed at start" is set to the servo input axis, the bias speed at start is applied to the servo input axis. Note that the unexpected operation might be generated to the output axis.

(d) Set "Pr.7 Bias speed at start" within the following range.

"Pr.8 Speed limit value" >= "Pr.46 OPR speed" >= "Pr.47 Creep speed" >= "Pr.7 Bias speed at start"

(e) If following data are less than "Pr.7 Bias speed at start", a warning "Below bias speed" (warning code: 114) will occur, and it will operate at "Pr.7 Bias speed at start".

- "Da.8 Command speed" of positioning data
- "Da.8 Command speed" of next point for continuous path control
- "Cd.14 New speed value" for speed change function

(f) When using S-curve acceleration/deceleration processing and bias speed at start together, S-curve acceleration/deceleration processing is carried out based on the acceleration/deceleration time set by user, "Pr.8 Speed limit value" and "Pr.35 S-curve ratio" (1 to 100%) in the section of acceleration/deceleration from bias speed at start to command speed.

5.2.2 Basic parameters 2

Item	Setting value, setting range		Default value	Buffer memory address	
	Value set with GX Works2	Value set with sequence program		QD77MS2 QD77MS4	QD77MS16
Pr.8 Speed limit value	The setting range differs depending on the "Pr.1 Unit setting".		200000	10+150n 11+150n	
Pr.9 Acceleration time 0	1 to 8388608 (ms)	1 to 8388608 (ms)	1000	12+150n 13+150n	
Pr.10 Deceleration time 0	1 to 8388608 (ms)	1 to 8388608 (ms)	1000	14+150n 15+150n	

n: Axis No.-1

Pr.8 Speed limit value

Set the maximum speed during positioning, OPR and speed-torque operations.

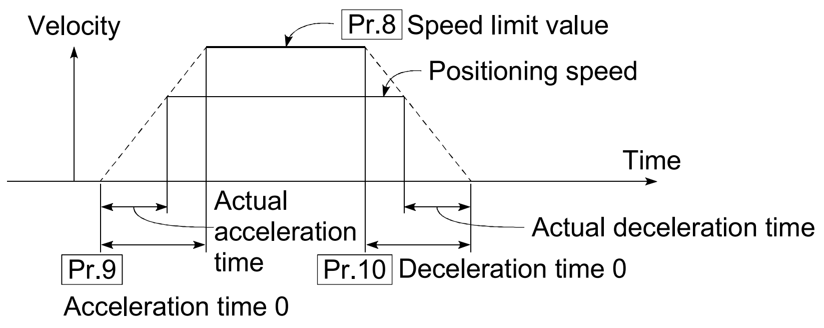
Pr.1 setting value	Value set with GX Works2 (unit)	Value set with sequence program (unit)
0 : mm	0.01 to 20000000.00 (mm/min)	1 to 2000000000 (×10^{-2}mm/min)
1 : inch	0.001 to 2000000.000 (inch/min)	1 to 2000000000 (×10^{-3}inch/min)
2 : degree	0.001 to 2000000.000 (degree/min) ∗1	1 to 2000000000 (×10^{-3}degree/min) ∗2
3 : PLS	1 to 1000000000 (PLS/s)	1 to 1000000000 (PLS/s)

∗1: Range of speed limit value when "Pr.83 Speed control 10 x multiplier setting for degree axis" is set to valid: 0.01 to 20000000.00 (degree/min).

∗2: Range of speed limit value when "Pr.83 Speed control 10 x multiplier setting for degree axis" is set to valid: 1 to 2000000000 (×10^{-2} degree/min)

Pr.9 Acceleration time 0, Pr.10 Deceleration time 0

"Pr.9 Acceleration time 0" specifies the time for the speed to increase from zero to the "Pr.8 Speed limit value" ("Pr.31 JOG speed limit value" at JOG operation control). "Pr.10 Deceleration time 0" specifies the time for the speed to decrease from the "Pr.8 Speed limit value" ("Pr.31 JOG speed limit value" at JOG operation control) to zero.

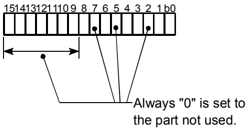


1) If the positioning speed is set lower than the parameter-defined speed limit value, the actual acceleration/deceleration time will be relatively short. Thus, set the maximum positioning speed equal to or only a little lower than the parameter-defined speed limit value.
2) These settings are valid for OPR, positioning and JOG operations.
3) When the positioning involves interpolation, the acceleration/deceleration time defined for the reference axis is valid.

5.2.3 Detailed parameters 1

Item	Setting value, setting range		Default value	Buffer memory address	
	Value set with GX Works2	Value set with sequence program		QD77MS2 QD77MS4	QD77MS16
Pr.11 Backlash compensation amount	The setting value range differs according to the "Pr.1 Unit setting".		0	17+150n	
Pr.12 Software stroke limit upper limit value			2147483647	18+150n 19+150n	
Pr.13 Software stroke limit lower limit value			–2147483648	20+150n 21+150n	
Pr.14 Software stroke limit selection	0: Apply software stroke limit on current feed value	0	0	22+150n	
	1: Apply software stroke limit on machine feed value	1			
Pr.15 Software stroke limit valid/invalid setting	0: Software stroke limit valid during JOG operation, inching operation and manual pulse generator operation	0	0	23+150n	
	1: Software stroke limit invalid during JOG operation, inching operation and manual pulse generator operation	1			
Pr.16 Command in-position width	The setting value range differs depending on the "Pr.1 Unit setting".		100	24+150n 25+150n	
Pr.17 Torque limit setting value	1 to 1000 (%)	1 to 1000 (%)	300	26+150n	
Pr.18 M code ON signal output timing	0: WITH mode	0	0	27+150n	
	1: AFTER mode	1			
Pr.19 Speed switching mode	0: Standard speed switching mode	0	0	28+150n	
	1: Front-loading speed switching mode	1			
Pr.20 Interpolation speed designation method	0: Composite speed	0	0	29+150n	
	1: Reference axis speed	1			
Pr.21 Current feed value during speed control	0: Do not update current feed value	0	0	30+150n	
	1: Update current feed value	1			
	2: Clear current feed value to zero	2			

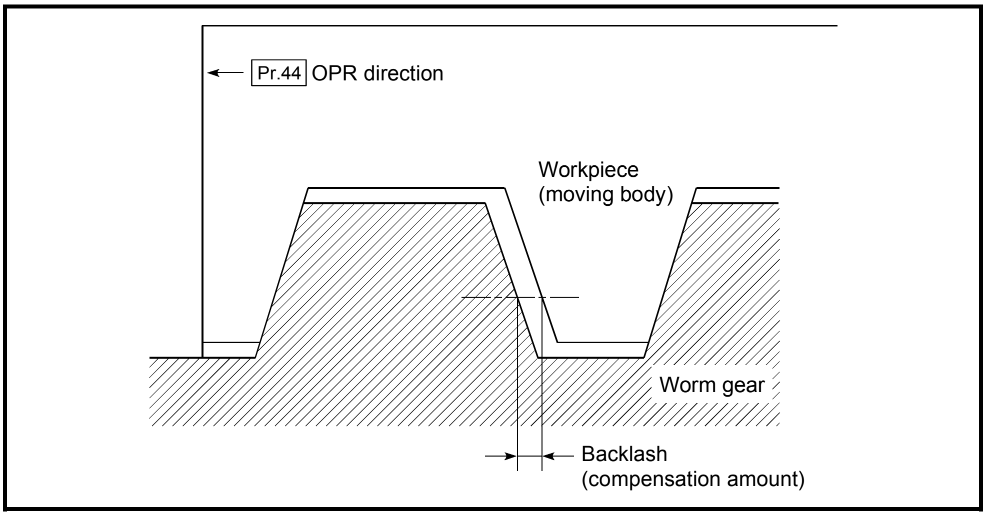
n: Axis No.-1

<table>
<tr><th rowspan="2">Item</th><th colspan="4">Setting value, setting range</th><th rowspan="2">Default value</th><th colspan="2">Buffer memory address</th></tr>
<tr><th colspan="3">Value set with GX Works2</th><th>Value set with sequence program</th><th>QD77MS2
QD77MS4</th><th>QD77MS16</th></tr>
<tr><td rowspan="10">Pr.22
Input signal logic selection</td><td>b0</td><td>Lower limit</td><td rowspan="10">0: Negative logic
1: Positive logic
(Note-1): Only the value specified against the axis 1 is valid.</td><td rowspan="10"> Always "0" is set to the part not used.</td><td rowspan="10">0</td><td colspan="2" rowspan="10">31+150n</td></tr>
<tr><td>b1</td><td>Upper limit</td></tr>
<tr><td>b2</td><td>Not used</td></tr>
<tr><td>b3</td><td>Stop signal</td></tr>
<tr><td>b4</td><td>External command/ switching signal</td></tr>
<tr><td>b5</td><td>Not used</td></tr>
<tr><td>b6</td><td>Near-point dog signal</td></tr>
<tr><td>b7</td><td>Not used</td></tr>
<tr><td>b8</td><td>Manual pulse generator input (Note-1)</td></tr>
<tr><td>b9 to b15</td><td>Not used</td></tr>
<tr><td rowspan="7">Pr.80
External input signal selection</td><td colspan="3">0: External input signal of QD77MS QD77MS2 QD77MS4</td><td>0</td><td rowspan="7">QD77MS2 : 0
QD77MS4 : 0
QD77MS16: 1</td><td colspan="2" rowspan="7">32+150n</td></tr>
<tr><td colspan="3">1: External input signal of servo amplifier</td><td>1</td></tr>
<tr><td colspan="3">2: Buffer memory of QD77MS</td><td>2</td></tr>
<tr><td colspan="3">3: External input signal 1 of QD77MS QD77MS16</td><td>3</td></tr>
<tr><td colspan="3">4: External input signal 2 of QD77MS QD77MS16</td><td>4</td></tr>
<tr><td colspan="3">5: External input signal 3 of QD77MS QD77MS16</td><td>5</td></tr>
<tr><td colspan="3">6: External input signal 4 of QD77MS QD77MS16</td><td>6</td></tr>
<tr><td rowspan="4">Pr.24
Manual pulse generator/ Incremental synchronous encoder input selection</td><td colspan="3">0: A-phase/B-phase multiplied by 4</td><td>0</td><td rowspan="4">0</td><td colspan="2" rowspan="4">33</td></tr>
<tr><td colspan="3">1: A-phase/B-phase multiplied by 2</td><td>1</td></tr>
<tr><td colspan="3">2: A-phase/B-phase multiplied by 1</td><td>2</td></tr>
<tr><td colspan="3">3: PLS/SIGN</td><td>3</td></tr>
<tr><td rowspan="2">Pr.81
Speed-position function selection</td><td colspan="3">0: Speed-position switching control (INC mode)</td><td>0</td><td rowspan="2">0</td><td colspan="2" rowspan="2">34+150n</td></tr>
<tr><td colspan="3">2: Speed-position switching control (ABS mode)</td><td>2</td></tr>
<tr><td rowspan="2">Pr.82
Forced stop valid/invalid selection</td><td colspan="3">0: Valid</td><td>0</td><td rowspan="2">0</td><td colspan="2" rowspan="2">35</td></tr>
<tr><td colspan="3">1: Invalid</td><td>1</td></tr>
</table>

n: Axis No.-1

Pr.11 Backlash compensation amount

The error that occurs due to backlash when moving the machine via gears can be compensated.
(When the backlash compensation amount is set, commands equivalent to the compensation amount will be output each time the direction changes during positioning.)



1) The backlash compensation is valid after machine OPR. Thus, if the backlash compensation amount is set or changed, always carry out machine OPR once.
2) "Pr.2 Number of pulses per rotation", "Pr.3 Movement amount per rotation", "Pr.4 Unit magnification" and "Pr.11 Backlash compensation amount" which satisfies the following (1) can be set up.

- Product information is before 141220000000000.

$$0 \leq \frac{(\text{Pr.11 Backlash compensation amount}) \times (\text{Pr.2 Number of pulses per rotation})}{(\text{Pr.3 Movement amount per rotation}) \times (\text{Pr.4 Unit magnification})} (= A) \leq 65535 \text{ (PLS)} \ldots(1)$$

(round down after decimal point)

- Product information is 141220000000000 or later.

$$0 \leq \frac{(\text{Pr.11 Backlash compensation amount}) \times (\text{Pr.2 Number of pulses per rotation})}{(\text{Pr.3 Movement amount per rotation}) \times (\text{Pr.4 Unit magnification})} (= A) \leq 4194303 \text{ (PLS)} \ldots(1)$$

(round down after decimal point)

An error (error code: 920) occurs when the setting is outside the range of the calculation result of (1).
A servo alarm (error code: 2031, 2035, etc.) may occur by kinds of servo amplifier (servomotor), load inertia moment and the amount of command of a cycle time (Simple Motion module) even if the setting is within the calculation result of (1).

Reduce the setting value of "Pr.11 Backlash compensation amount" or increase the operation cycle by "Pr.96 Operation cycle setting" if a servo alarm occurs. Use the value of the following (2) as a measure that a servo alarm does not occur.

$$A \leq \frac{(\text{Maximum motor speed (r/min)}) \times 1.2 \times (\text{Encoder resolution (PLS/r)}) \times (\text{Operation cycle (ms)})}{60\text{(s)} \times 1000\text{ (ms)}} \text{(PLS)} \ldots(2)$$

Pr.1 setting value	Value set with GX Works2 (unit)	Value set with sequence program (unit) ∗
0 : mm	0 to 6553.5 (μm)	0 to 65535 (×10^{-1}μm)
1 : inch	0 to 0.65535 (inch)	0 to 65535 (×10^{-5}inch)
2 : degree	0 to 0.65535 (degree)	0 to 65535 (×10^{-5}degree)
3 : PLS	0 to 65535 (PLS)	0 to 65535 (PLS)

∗ 0 to 32767 : Set as a decimal
32768 to 65535 : Convert into hexadecimal and set

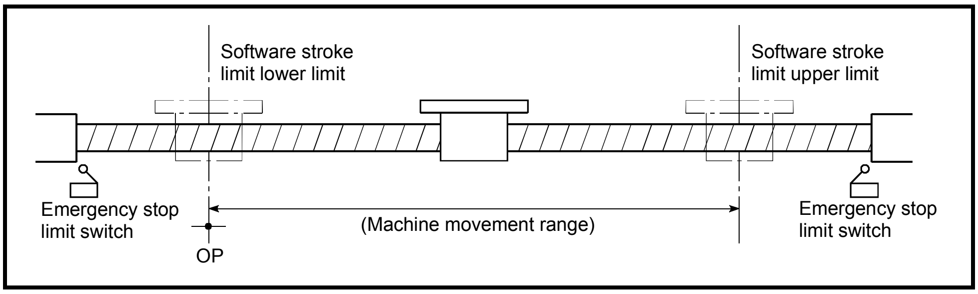
Pr.12 Software stroke limit upper limit value

Set the upper limit for the machine's movement range during positioning control.

Pr.1 setting value	Value set with GX Works2 (unit)	Value set with sequence program (unit)
0 : mm	-214748364.8 to 214748364.7 (μm)	-2147483648 to 2147483647 (×10^{-1}μm)
1 : inch	-21474.83648 to 21474.83647(inch)	-2147483648 to 2147483647 (×10^{-5}inch)
2 : degree	0 to 359.99999 (degree)	0 to 35999999 (×10^{-5}degree)
3 : PLS	-2147483648 to 2147483647(PLS)	-2147483648 to 2147483647 (PLS)

Pr.13 Software stroke limit lower limit value

Set the lower limit for the machine's movement range during positioning control.



1) Generally, the OP is set at the lower limit or upper limit of the stroke limit.
2) By setting the upper limit value or lower limit value of the software stroke limit, overrun can be prevented in the software. However, an emergency stop limit switch must be installed nearby outside the range.
   To invalidate the software stroke limit, set the setting value to "upper limit value = lower limit value". (If it is within the setting range, the setting value can be anything.)
   When the unit is "degree", the software stroke limit check is invalid during speed control (including the speed control in speed-position and position-speed switching control) or during manual control.

Pr.14 Software stroke limit selection

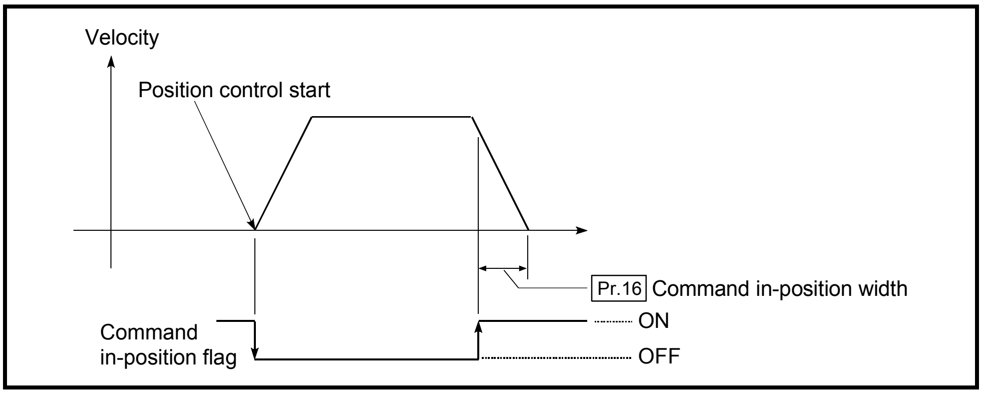
Set whether to apply the software stroke limit on the "current feed value" or the "machine feed value". The software stroke limit will be validated according to the set value.
To invalidate the software stroke limit, set the setting value to "current feed value".
When "2: degree" is set in " Pr.1 Unit setting", set the setting value of software stroke limit to "current feed value".
The "Software stroke limit error" (error code: 923) will occur if "machine feed value" is set.

Pr.15 Software stroke limit valid/invalid setting

Set whether to validate the software stroke limit during JOG/Inching operation and manual pulse generator operation.

Pr.16 Command in-position width

Set the remaining distance that turns the command in-position ON. The command in-position signal is used as a front-loading signal of the positioning complete signal. When positioning control is started, the "Command in-position flag (Md.31 Status: b2)" turns OFF, and the "command in-position flag" turns ON at the set position of the command in-position signal.



Pr.1 setting value	Value set with GX Works2 (unit)	Value set with sequence program (unit)
0 : mm	0.1 to 214748364.7 (μm)	1 to 2147483647 ($\times 10^{-1}$μm)
1 : inch	0.00001 to 21474.83647 (inch)	1 to 2147483647 ($\times 10^{-5}$inch)
2 : degree	0.00001 to 21474.83647 (degree)	1 to 2147483647 ($\times 10^{-5}$degree)
3 : PLS	1 to 2147483647 (PLS)	1 to 2147483647 (PLS)

Pr.17 Torque limit setting value

Set the maximum value of the torque generated by the servomotor as a percentage between 1 and 1000%.

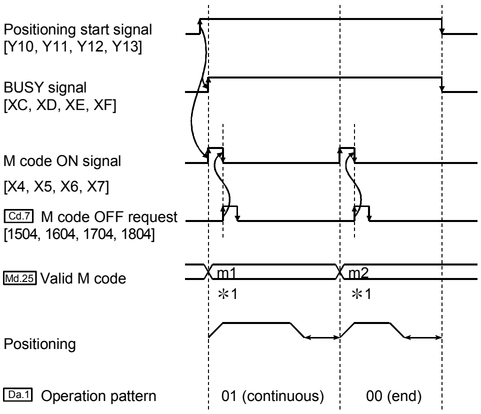
＊ The torque limit function limits the torque generated by the servomotor within the set range.
If the torque required for control exceeds the torque limit value, it is controlled with the set torque limit value.
(Refer to Section 13.4.2 "Torque limit function".)

Pr.18 M code ON signal output timing

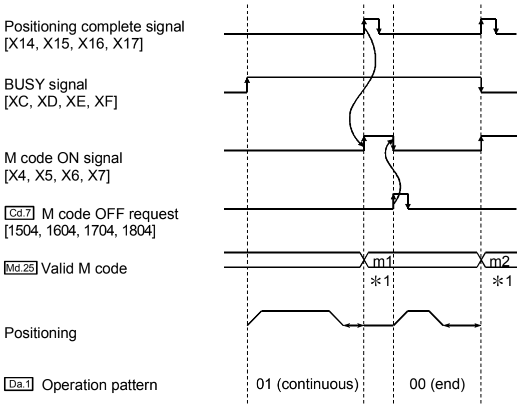
This parameter sets the M code ON signal output timing.
Choose either WITH mode or AFTER mode as the M code ON signal output timing.

[QD77MS4 operation example]

WITH mode .... An M code is output and the M code ON signal is turned ON when a positioning operation starts.



AFTER mode ....An M code is output and the M code ON signal is turned ON when a positioning operation completes.



*1: m1 and m2 indicate set M codes.

(Note): Refer to Section 3.3 for input/output signal of QD77MS16 and Chapter 5 for buffer memory address.

Note: If AFTER mode is used with speed control, an M code will not be output and the M code ON signal will not be turned ON.

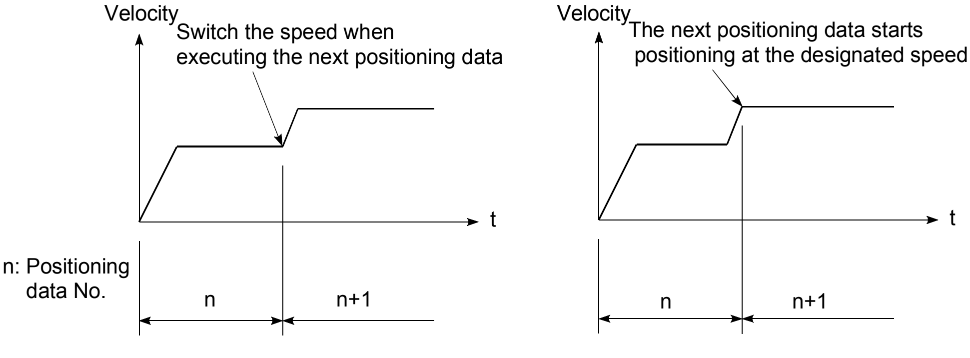
An M code is a number between 0 and 65535 that can be assigned to each positioning data (Da.10).

The sequence program can be coded to read an M code from the buffer memory address specified by "Md.25 Valid M code" whenever the M code ON signal turns ON so that a command for the sub work (e.g. clamping, drilling, or tool change) associated with the M code can be issued.

Pr.19 Speed switching mode

Set whether to switch the speed switching mode with the standard switching or front-loading switching mode.

0 : Standard switching	Switch the speed when executing the next positioning data.
1 : Front-loading switching........	The speed switches at the end of the positioning data currently being executed.

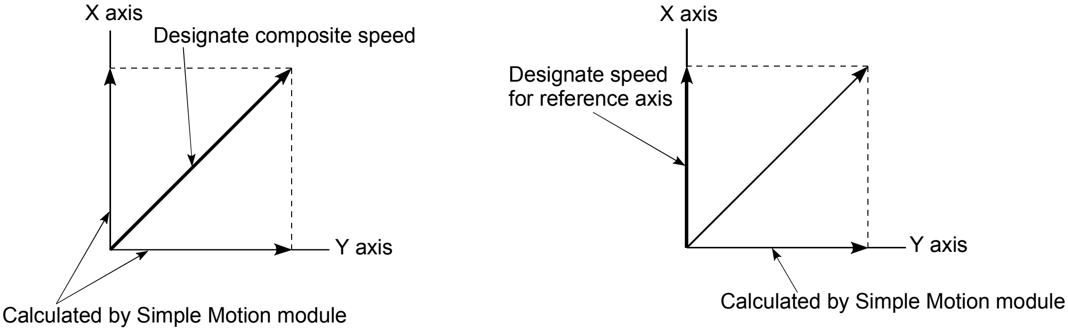


<For standard switching> <For front-loading switching>

Pr.20 Interpolation speed designation method

When carrying out linear interpolation/circular interpolation, set whether to designate the composite speed or reference axis speed.

0: Composite speed	The movement speed for the control target is designated, and the speed for each axis is calculated by the Simple Motion module.
1: Reference axis speed	The axis speed set for the reference axis is designated, and the speed for the other axis carrying out interpolation is calculated by the Simple Motion module.



<When composite speed is designated> <When reference axis speed is designated>

Note: Always specify the reference axis speed if the 4-axis linear interpolation or 2 to 4 axis speed control has to be performed.
If you specify the composite speed for a positioning operation that involves the 4-axis linear interpolation or 2 to 4 axis speed control, the error code 523 "interpolation mode error" will be output when the positioning operation is attempted.
For a positioning operation that involves the circular interpolation, specify the composite speed always.

Pr.21 Current feed value during speed control

Specify whether you wish to enable or disable the update of "Md.20 Current feed value" while operations are performed under the speed control (including the speed control in speed-position and position-speed switching control).

0: The update of the current feed value is disabled
The current feed value will not change.
(The value at the beginning of the speed control will be kept.)

1: The update of the current feed value is enabled
The current feed value will be updated.
(The current feed value will change from the initial.)

2: The current feed value is cleared to zero
The current feed value will be set initially to zero and change from zero while the speed control is in effect.

Note1: When the speed control is performed over two to four axes, the choice between enabling and disabling the update of "Md.20 Current feed value" depends on how the reference axis is set.

Note2: Set "1" to exercise speed-position switching control (ABS mode).

Pr.22 Input signal logic selection

Set the input signal logic that matches the signaling specification of the connected external device, "Cd.44 External input signal operation device" or external input signal of servo amplifier (upper/lower limit switch, near-point dog).

Negative logic

(1) The current is not flowed through the input signal contact.
  (a) FLS, RLS .... Limit signal ON
  (b) DOG, DI, STOP .... Invalid

(2) The current is flowed through the input signal contact.
  (a) FLS, RLS .... Limit signal OFF
  (b) DOG, DI, STOP .... Valid

Positive logic

Opposite the concept of negative logic.

Note1: A mismatch in the signal logic will disable normal operation. Be careful of this when you change from the default value.

Note2: Set the manual pulse generator input logic selection (b8) to axis 1. (Setting of any of axes 2 to 4 is invalid.)

Note3: If the same external input signal is set to use to "Pr.80 External input signal selection" or "Pr.95 External command signal selection" for the multiple axes in the QD77MS16, "Input signal logic selection" of those axes should be the same. Otherwise, "Input signal logic selection error" (error code: 938) will occur when the PLC READY signal [Y0] is turned ON, and the READY signal [X0] will not be turned ON.

Pr.80 External input signal selection

Set whether to use "external input signal of QD77MS", "external input signal of servo amplifier", or "buffer memory of QD77MS" as an external input signal (upper/lower limit signal, near-point dog signal, or stop signal).

0: External input signal of QD77MS QD77MS2 QD77MS4
1: External input signal of servo amplifier
2: Buffer memory of QD77MS
3: External input signal 1 of QD77MS QD77MS16
4: External input signal 2 of QD77MS QD77MS16
5: External input signal 3 of QD77MS QD77MS16
6: External input signal 4 of QD77MS QD77MS16

POINT

(1) When "2: Buffer memory of QD77MS" is set, operation is affected by the PLC scan time.
(2) When "3" to "6" is set in the QD77MS2/QD77MS4, "External signal selection error" (error code: 936) occurs at turning the PLC READY signal [Y0] ON, and the READY signal [X0] is not turned ON. Set "0" to use the external input signal of QD77MS2/QD77MS4.
(3) When "0" is set in the QD77MS16, "External signal selection error" (error code: 936) occurs at turning the PLC READY signal [Y0] ON, and the READY signal [X0] is not turned ON. Set "3" to "6" to use the external input signal of QD77MS16.

Pr.24 Manual pulse generator/Incremental synchronous encoder input selection

Set the manual pulse generator/incremental synchronous encoder input pulse mode. (Only the value specified against the axis 1 is valid.)

0: A-phase/B-phase multiplied by 4
1: A-phase/B-phase multiplied by 2
2: A-phase/B-phase multiplied by 1
3: PLS/SIGN

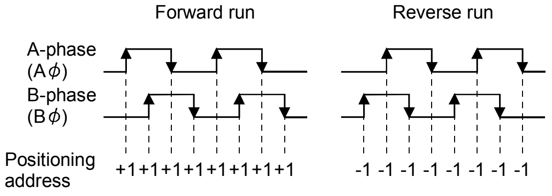
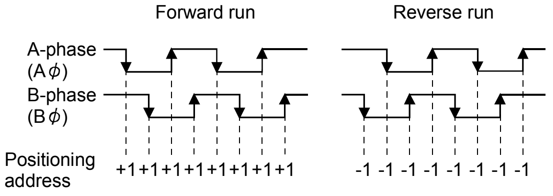
Set the positive logic or negative logic in "Pr.22 Input signal logic selection".

(1) A-phase/B-phase mode

- When the A-phase is 90° ahead of the B-phase, the motor will forward run.
- When the B-phase is 90° ahead of the A-phase, the motor will reverse run.

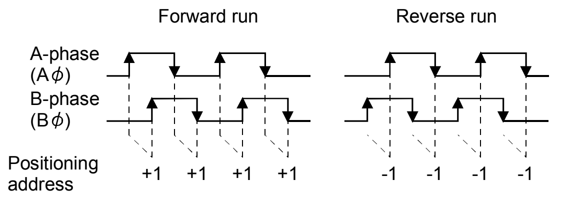
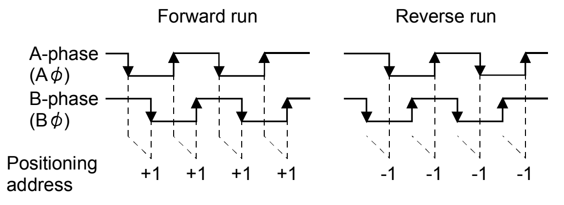
(a) A-phase/B-phase multiplied by 4

The positioning address increases or decreases at rising or falling edges of A-phase/B-phase.

Pr.22 Input signal logic selection	
Positive logic	Negative logic
	

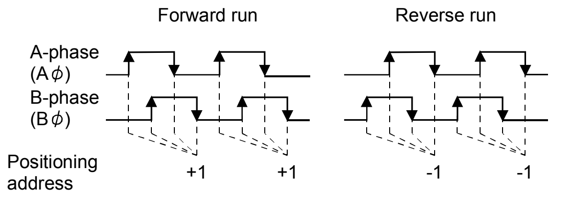
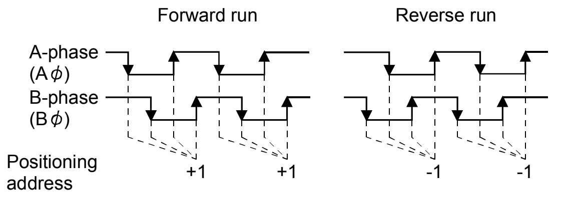
(b) A-phase/B-phase multiplied by 2

The positioning address increases or decreases at twice rising or twice falling edges of A-phase/B-phase.

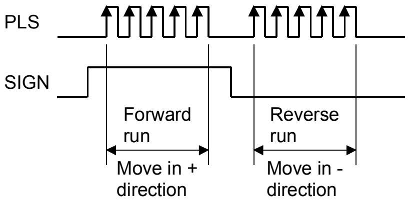
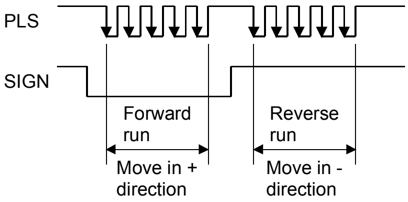
Pr.22 Input signal logic selection	
Positive logic	Negative logic
	

(c) A-phase/B-phase multiplied by 1

The positioning address increases or decreases at twice rising or twice falling edges of A-phase/B-phase.

Pr.22 Input signal logic selection	
Positive logic	Negative logic
	

(2) PLS/SIGN

Pr.22 Input signal logic selection	
Positive logic	Negative logic
Forward run and reverse run are controlled with the ON/OFF of the direction sign (SIGN). • The motor will forward run when the direction sign is HIGH. • The motor will reverse run when the direction sign is LOW.	Forward run and reverse run are controlled with the ON/OFF of the direction sign (SIGN). • The motor will forward run when the direction sign is LOW. • The motor will reverse run when the direction sign is HIGH.
	

Pr.81 Speed-position function selection

Select the mode of speed-position switching control.

0: INC mode
2: ABS mode

Note1: If the setting is other than 0 and 2, operation is performed in the INC mode with the setting regarded as 0.

Pr.82 Forced stop valid/invalid selection

Set the forced stop valid/invalid. (Only the value specified against the axis 1 is valid.)

All axis of the servo amplifier are made to batch forced stop when the forced stop input signal is turned on.

But "Servo READY signal OFF during operation" (error code: 102) does not occur even if the forced input signal is turned on during operation.

0: Valid (Forced stop is used)
1: Invalid (Forced stop is not used)

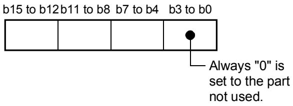
Note1: If the setting is other than 0 and 1, "Forced stop valid/invalid setting error" (error code: 937) occurs.

Note2: The " Md.50 Forced stop input" is stored "1" by setting "Forced stop valid/invalid selection" to invalid.

5.2.4 Detailed parameters 2

Item	Setting value, setting range		Default value	Buffer memory address	
	Value set with GX Works2	Value set with sequence program		QD77MS2 QD77MS4	QD77MS16
Pr.25 Acceleration time 1	1 to 8388608 (ms)	1 to 8388608 (ms)	1000	36+150n 37+150n	
Pr.26 Acceleration time 2				38+150n 39+150n	
Pr.27 Acceleration time 3				40+150n 41+150n	
Pr.28 Deceleration time 1				42+150n 43+150n	
Pr.29 Deceleration time 2				44+150n 45+150n	
Pr.30 Deceleration time 3				46+150n 47+150n	
Pr.31 JOG speed limit value	The setting range differs depending on the "Pr.1 Unit setting".		20000	48+150n 49+150n	
Pr.32 JOG operation acceleration time selection	0: Pr.9 Acceleration time 0	0	0	50+150n	
	1: Pr.25 Acceleration time 1	1			
	2: Pr.26 Acceleration time 2	2			
	3: Pr.27 Acceleration time 3	3			
Pr.33 JOG operation deceleration time selection	0: Pr.10 Deceleration time 0	0	0	51+150n	
	1: Pr.28 Deceleration time 1	1			
	2: Pr.29 Deceleration time 2	2			
	3: Pr.30 Deceleration time 3	3			
Pr.34 Acceleration/deceleration process selection	0 : Trapezoid acceleration/ deceleration process	0	0	52+150n	
	1 : S-curve acceleration/ deceleration process	1			
Pr.35 S-curve ratio	1 to 100 (%)	1 to 100 (%)	100	53+150n	
Pr.36 Sudden stop deceleration time	1 to 8388608 (ms)	1 to 8388608 (ms)	1000	54+150n 55+150n	
Pr.37 Stop group 1 sudden stop selection	0 : Normal deceleration stop	0	0	56+150n	
Pr.38 Stop group 2 sudden stop selection	1 : Sudden stop	1		57+150n	
Pr.39 Stop group 3 sudden stop selection				58+150n	
Pr.40 Positioning complete signal output time	0 to 65535 (ms)	0 to 65535 (ms) 0 to 32767 : Set as a decimal 32768 to 65535 : Convert into hexadecimal and set	300	59+150n	

n: Axis No.-1

Item	Setting value, setting range		Default value	Buffer memory address	
	Value set with GX Works2	Value set with sequence program		QD77MS2 QD77MS4	QD77MS16
Pr.41 Allowable circular interpolation error width	The setting value range differs depending on the "Pr.1 Unit setting".		100	60+150n 61+150n	
Pr.42 External command function selection	0: External positioning start	0	0	62+150n	
	1: External speed change request	1			
	2: Speed-position, position-speed switching request	2			
	3: Skip request	3			
	4: High speed input request	4			
Pr.83 Speed control 10 x multiplier setting for degree axis	0: Invalid	0	0	63+150n	
	1: Valid	1			
Pr.84 Restart allowable range when servo OFF to ON	0, 1 to 327680 [PLS] 0: restart not allowed		0	64+150n 65+150n	
Pr.89 Manual pulse generator/ Incremental synchronous encoder input type selection	0: Differential output type	0	1	67	
	1: Voltage output/open collector type	1			
Pr.90 Operation setting for speed-torque control mode	b0 to b3: Not used		0000H	68+150n	
	b4 to b7: Torque initial value selection 0: Command torque 1: Feedback torque				
	b8 to b11: Speed initial value selection 0: Command speed 1: Feedback speed 2: Automatic selection				
	b12 to b15: Condition selection at mode switching 0: Switching conditions valid (for switching control mode) 1: Zero speed ON condition invalid (for switching control mode)				
Pr.95 External command signal selection QD77MS16	0: Not used	0	0		69+150n
	1: DI1	1			
	2: DI2	2			
	3: DI3	3			
	4: DI4	4			

n: Axis No.-1

Pr.25 Acceleration time 1 to Pr.27 Acceleration time 3

These parameters set the time for the speed to increase from zero to the "Pr.8 Speed limit value" ("Pr.31 JOG speed limit value" at JOG operation control) during a positioning operation.

Pr.28 Deceleration time 1 to Pr.30 Deceleration time 3

These parameters set the time for the speed to decrease from the "Pr.8 Speed limit value" ("Pr.31 JOG speed limit value" at JOG operation control) to zero during a positioning operation.

Pr.31 JOG speed limit value

Set the maximum speed for JOG operation.

Note) Set the "JOG speed limit value" to a value less than "Pr.8 Speed limit value". If the "speed limit value" is exceeded, the "JOG speed limit value error" (error code: 956) will occur.

Pr.1 setting value	Value set with GX Works2 (unit)	Value set with sequence program (unit)
0 : mm	0.01 to 20000000.00 (mm/min)	1 to 2000000000 (×10^{-2}mm/min)
1 : inch	0.001 to 2000000.000 (inch/min)	1 to 2000000000 (×10^{-3}inch/min)
2 : degree	0.001 to 2000000.000 (degree/min) ∗1	1 to 2000000000 (×10^{-3}degree/min) ∗2
3 : PLS	1 to 1000000000 (PLS/s)	1 to 1000000000 (PLS/s)

∗1: The JOG speed limit value setting range is 0.001 to 2000000.000[degree/min], but it will be decupled and become 0.01 to 20000000.00[degree/min] by setting "Pr.83 Speed control 10 x multiplier setting for degree axis" to valid.

∗2: The JOG speed limit value setting range is 1 to 2000000000(×10^{-3}degree/min), but it will be decupled and become 1 to 2000000000 (×10^{-2}degree/min) by setting "Pr.83 Speed control 10 x multiplier setting for degree axis" to valid.

Pr.32 JOG operation acceleration time selection

Set which of "acceleration time 0 to 3" to use for the acceleration time during JOG operation.

0: Use value set in "Pr.9 Acceleration time 0".

1: Use value set in "Pr.25 Acceleration time 1".

2: Use value set in "Pr.26 Acceleration time 2".

3: Use value set in "Pr.27 Acceleration time 3".

Pr.33 JOG operation deceleration time selection

Set which of "deceleration time 0 to 3" to use for the deceleration time during JOG operation.

0: Use value set in "Pr.10 Deceleration time 0".

1: Use value set in "Pr.28 Deceleration time 1".

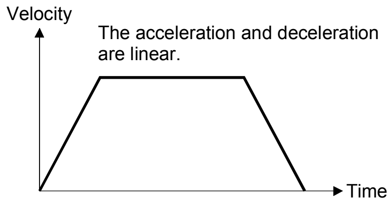
2: Use value set in "Pr.29 Deceleration time 2".

3: Use value set in "Pr.30 Deceleration time 3".

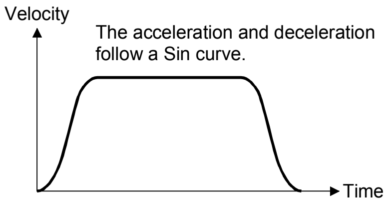
Pr.34 Acceleration/deceleration process selection

Set whether to use trapezoid acceleration/deceleration or S-curve acceleration/deceleration for the acceleration/deceleration process.

Note) Refer to Section 13.7.6 "Acceleration/deceleration processing function" for details.



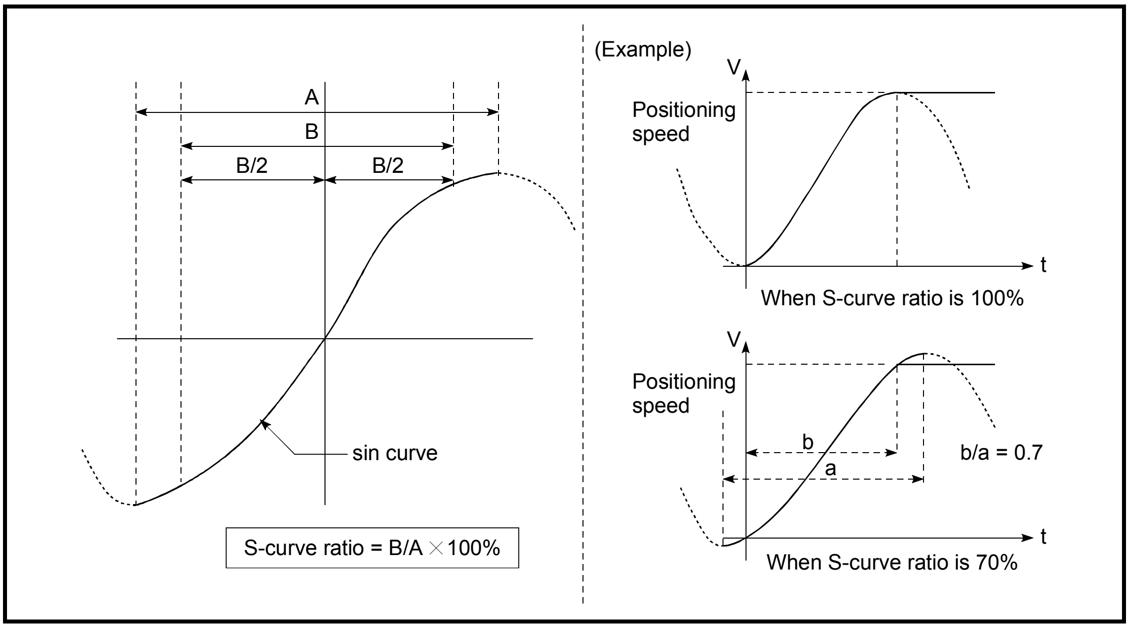
<Trapezoid acceleration/deceleration>



<S-curve acceleration/deceleration>

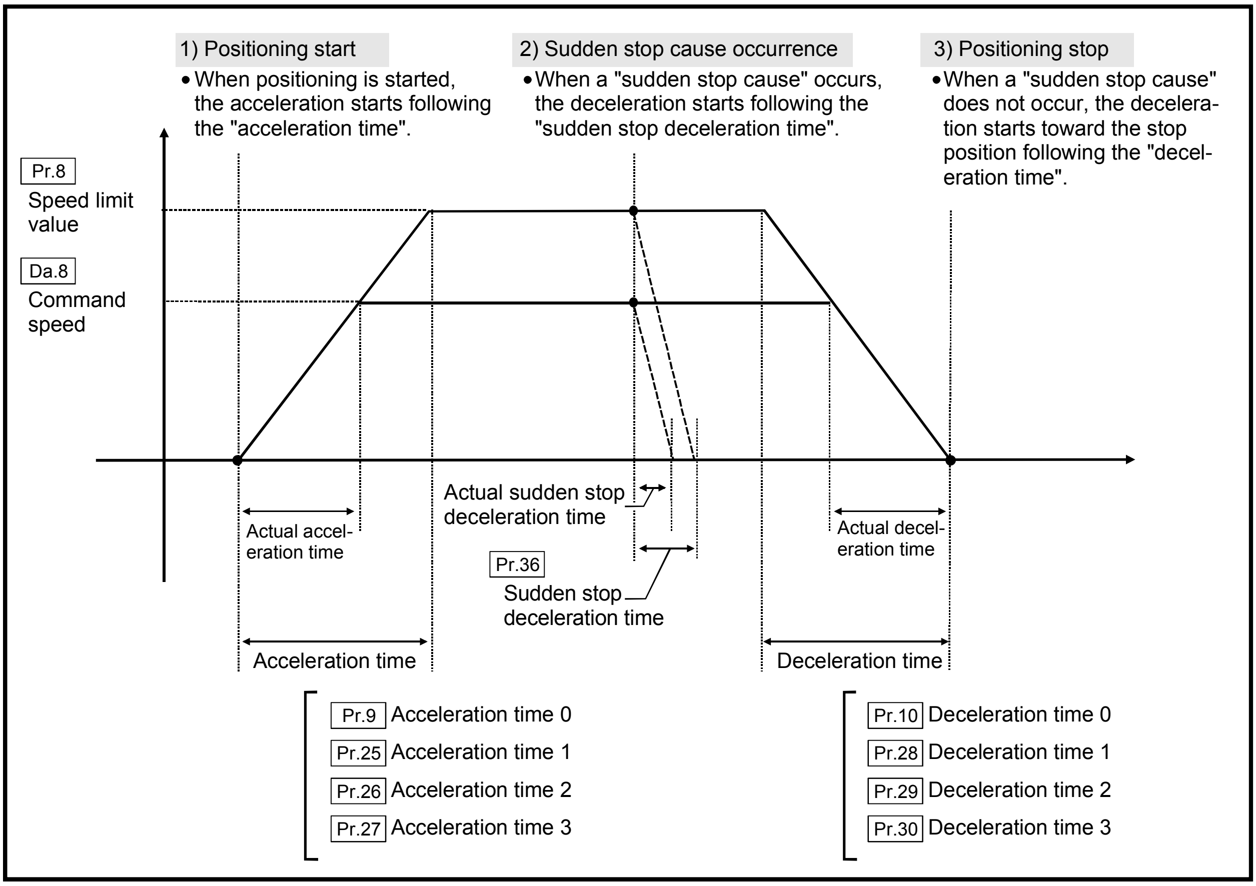
Pr.35 S-curve ratio

Set the S-curve ratio (1 to 100%) for carrying out the S-curve acceleration/deceleration process.
The S-curve ratio indicates where to draw the acceleration/deceleration curve using the Sin curve as shown below.



Pr.36 Sudden stop deceleration time

Set the time to reach speed 0 from "Pr.8 Speed limit value" ("Pr.31 JOG speed limit value" at JOG operation control) during the sudden stop. The illustration below shows the relationships with other parameters.



Pr.37 Stop group 1 sudden stop selection
to
Pr.39 Stop group 3 sudden stop selection

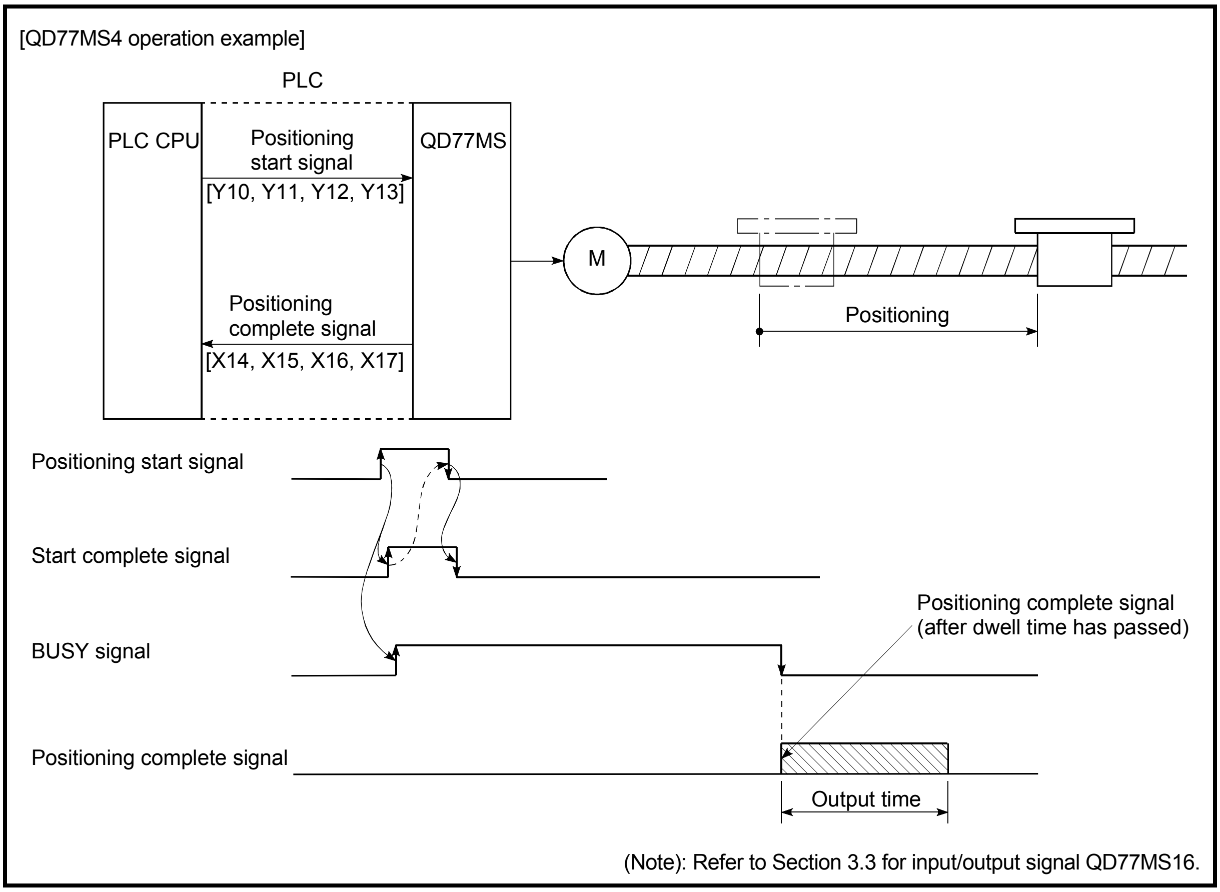
Set the method to stop when the stop causes in the following stop groups occur.

- Stop group 1 .... Stop with hardware stroke limit
- Stop group 2 .... Error occurrence of the PLC CPU, PLC READY signal [Y0] OFF, Fault in test mode
- Stop group 3 .... Axis stop signal from PLC CPU
  Stop signal from test function of GX Works2
  Error occurrence (excludes errors in stop groups 1 and 2: includes only the software stroke limit errors during JOG operation, speed control, speed-position switching control, and position-speed switching control)

The methods of stopping include "0: Normal deceleration stop" and "1: Sudden stop".
If "1: Sudden stop" is selected, the axis will suddenly decelerate to a stop when the stop cause occurs.

Pr.40 Positioning complete signal output time

Set the output time of the positioning complete signal output from the Simple Motion module.
A positioning completes when the specified dwell time has passed after the Simple Motion module had terminated the command output.
For the interpolation control, the positioning completed signal of interpolation axis is output only during the time set to the reference axis.



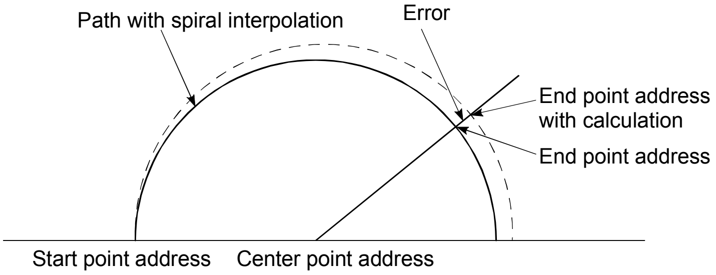
(Note): Refer to Section 3.3 for input/output signal QD77MS16.

Positioning complete signal output time

Pr.41 Allowable circular interpolation error width

The allowable error range of the calculated arc path and end point address is set. ∗1 If the error of the calculated arc path and end point address is within the set range, circular interpolation will be carried out to the set end point address while compensating the error with spiral interpolation.
The allowable circular interpolation error width is set in the following axis buffer memory addresses.

(Example)
- If axis 1 is the reference axis, set in the axis 1 buffer memory address [60, 61].
- If axis 4 is the reference axis, set in the axis 4 buffer memory address [510, 511].



∗1: With circular interpolation control using the center point designation, the arc path calculated with the start point address and center point address and the end point address may deviate.

Pr.1 setting value	Value set with GX Works2 (unit)	Value set with sequence program (unit)
0 : mm	0 to 10000.0 (μm)	0 to 100000 (×10^{-1}μm)
1 : inch	0 to 1.00000 (inch)	0 to 100000 (×10^{-5}inch)
2 : degree	0 to 1.00000 (degree)	0 to 100000 (×10^{-5}degree)
3 : PLS	0 to 100000 (PLS)	0 to 100000 (PLS)

Pr.42 External command function selection

Select a command with which the external command signal should be associated.

0: External positioning start
The external command signal input is used to start a positioning operation.

1: External speed change request
The external command signal input is used to change the speed in the current positioning operation. The new speed should be set in the "Cd.14 New speed value"

2: Speed-position, position-speed switching request
The external command signal input is used to switch from the speed control to the position control while in the speed-position switching control mode, or from the position control to the speed control while in the position-speed switching control mode.
To enable the speed-position switching control, set the "Cd.24 Speed-position switching enable flag" to "1".
To enable the position-speed switching control, set the "Cd.26 Position-speed switching enable flag" to "1".

3: Skip request
The external command signal input is used skip the current positioning operation.

4: High speed input request
The external command signal input is used to execute the mark detection. And, also set to use the external command signal in the synchronous control.

POINT

To enable the external command signal, set the "Cd.8 External command valid" to "1".

Pr.83 Speed control 10 x multiplier setting for degree axis

Set the speed control 10 x multiplier setting for degree axis when you use command speed and speed limit value set by the positioning data and the parameter at "Pr.1 Unit setting" setup degree by ten times at the speed.

0: Invalid
1: Valid

Normally, the speed specification range is 0.001 to 2000000.000[degree/min], but it will be decupled and become 0.01 to 20000000.00[degree/min] by setting "Pr.83 Speed control 10 x multiplier setting for degree axis" to valid.

Note) The speed control 10 x multiplier setting for degree axis is included in detailed parameters 2, but it will be valid at the rising edge (OFF to ON) of the PLC READY signal [Y0].

＊1: Refer to Section 13.7.10 "Speed control 10 x multiplier setting for degree axis function" about speed control 10 x multiplier setting for degree axis.

Pr.83 setting value	Value set with GX Works2 (unit)	Value set with sequence program (unit)
0 : Invalid	0.001 to 2000000.000 (degree/min)	1 to 2000000000 ($\times 10^{-3}$degree/min)
1 : Valid	0.01 to 20000000.00 (degree/min)	1 to 2000000000 ($\times 10^{-2}$degree/min)

Pr.84 Restart allowable range when servo OFF to ON

(1) Restart function at switching servo OFF to ON

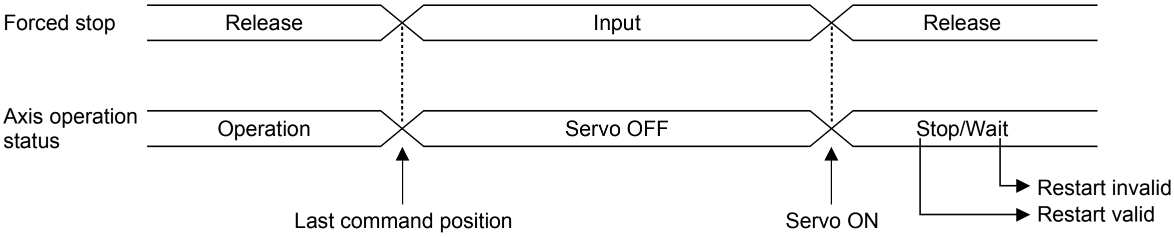
The restart function at switching servo OFF to ON performs continuous positioning operation (positioning start, restart) when switching servo OFF to ON while the Simple Motion module is stopped (including forced stop, servo forced stop).

Restart at switching servo OFF to ON can be performed when the difference between the last command position of Simple Motion module at stop and the present value at switching servo OFF to ON is equal to or less than the value set in the buffer memory for the restart allowable range setting.

(a) Servo emergency stop processing

1) When the difference between the last command position of Simple Motion module at the forced stop input or the servo forced stop input and the present value at the forced stop release or the servo forced stop release is equal to or less than the value set in the buffer memory for the restart allowable range setting, the positioning operation is judged as stopped and can be restarted.

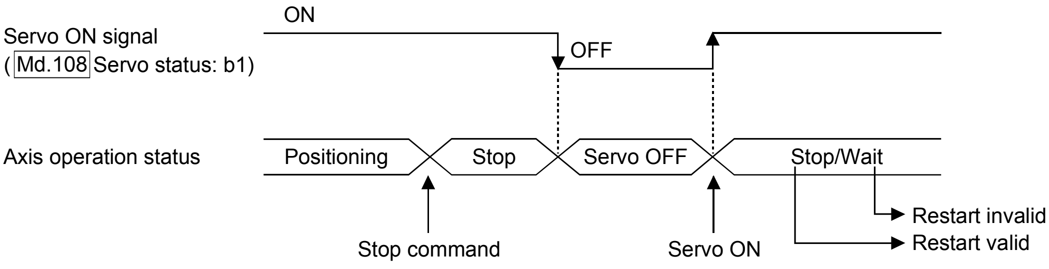
2) When the difference between the last command position of Simple Motion module at the forced stop input or the servo forced stop input and the present value at the forced stop release or the servo forced stop release is greater than the value set in the buffer memory for the restart allowable range setting, the positioning operation is judged as on-standby and cannot be restarted.



(b) Processing at switching the servo ON signal from OFF to ON

1) When the difference between the last command position of Simple Motion module at switching the servo ON signal from ON to OFF and the present value at switching the servo ON signal from OFF to ON is equal to or less than the value set in the buffer memory for the restart allowable range setting, the positioning operation is judged as stopped and can be restarted.

2) When the difference between the last command position of Simple Motion module at switching the servo ON signal from ON to OFF and the present value at switching the servo ON signal from OFF to ON is greater than the value set in the buffer memory for the restart allowable range setting, the positioning operation is judged as on-standby and cannot be restarted.



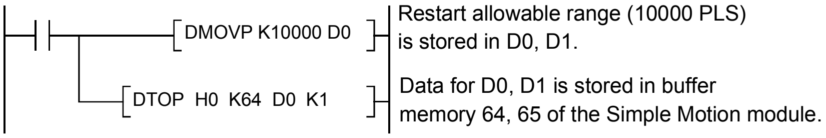
(2) Setting method

For performing restart at switching servo OFF to ON, set the restart allowable range in the following buffer memory.

Buffer memory address		Item	Setting range	Default value
QD77MS2 QD77MS4	QD77MS16			
64+150n 65+150n		Pr.84 Restart allowable range when servo OFF to ON	0, 1 to 327680 (PLS) 0: restart not allowed	0

[Setting example]

A program to set the restart allowable range for axis 1 to 10000 PLS is shown below.



```
DMOVP K10000 D0
DTOP  H0  K64  D0  K1
```

Restart allowable range (10000 PLS) is stored in D0, D1.

Data for D0, D1 is stored in buffer memory 64, 65 of the Simple Motion module.

(3) Precautionary notes

(a) The difference between the last command position at servo OFF and the present value at servo ON is output at once at the first restart. If the restart allowable range is large at this time, an overload may occur on the servo side.
Set a value which does not affect the mechanical system by output once to the restart allowable range when switching servo OFF to ON.

(b) The restart at switching servo OFF to ON is valid only at switching servo OFF to ON at the first time. At the second time or later, the setting for restart allowable range when switching servo OFF to ON is disregarded.

(c) Execute servo OFF when the mechanical system is in complete stop state. The restart at switching servo OFF to ON cannot be applied to a system in which the mechanical system is operated by external pressure or other force during servo OFF.

(d) Restart can be executed only while the axis operation status is "stop". Restart cannot be executed when the axis operation status is other than "stop".

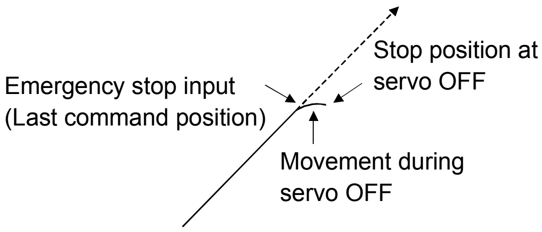
(e) When the PLC READY signal is switched from OFF to ON during servo OFF, restart cannot be executed.
If restart is requested, a warning "Restart not possible" (warning code: 104) occurs.

(f) Do not restart while a stop command is ON.
When restart is executed during a stop, an error "Stop signal ON at start" (error code: 106) occurs and the axis operation status becomes "ERR". Therefore, restart cannot be performed even if the error is reset.

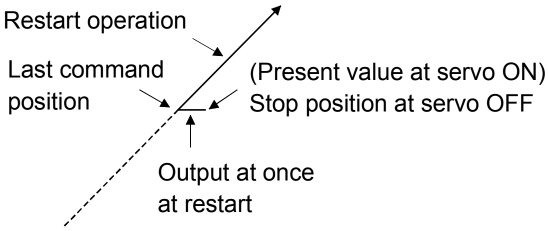
(g) Restart can also be executed while the positioning starts signal is ON. However, do not set the positioning start signal from OFF to ON during a stop.
If the positioning start signal is switched from OFF to ON, positioning is performed from the positioning data number set in "Cd.3 Positioning start No." or from the positioning data number of the specified point.

(h) When positioning is terminated by a continuous-operation interrupt request, restart cannot be performed.
If a restart request is executed, a warning "Restart disabled" (warning code: 104) occurs.

[Operation at emergency stop input]



[Operation at restart]



Pr.89 Manual pulse generator/Incremental synchronous encoder input type selection

Set the input type from the manual pulse generator/incremental synchronous encoder. (Only the value specified against the axis 1 is valid.)
0: Differential output type
1: Voltage output/open collector type

Note) The "Manual pulse generator/Incremental synchronous encoder input type selection" is included in detailed parameters 2, but it will be valid at the rising edge (OFF to ON) of the PLC READY signal [Y0].

Refer to Section 3.4 "Specifications of interfaces with external devices" for details.

Pr.90 Operation setting for speed-torque control mode

Operation setting of the speed control mode, torque control mode or continuous operation to torque control mode at the speed-torque control is executed.

(1) Torque initial value selection

Set the torque initial value at switching to torque control mode or to continuous operation to torque control mode.

0: Command torque ....Command torque value at switching. (following axis control data)
Switching to torque control mode:
"Cd.143 Command torque at torque control mode"
Switching to continuous operation to torque control mode:
"Cd.150 Target torque at continuous operation to torque control mode"

1: Feedback torque..........Motor torque value at switching.

(2) Speed initial value selection

Set the initial speed at switching from position control mode to speed control mode or the initial speed at switching from position control mode or from speed control mode to continuous operation to torque control mode.

0: Command speed ....Speed that position command at switching is converted into the motor speed.

1: Feedback speed ....Motor speed received from servo amplifier at switching

2: Automatic selection......The lower speed between speed that position command at switching is converted into the motor speed and motor speed received from servo amplifier at switching. (This setting is valid only when continuous operation to torque control mode is used. At switching from position control mode to speed control mode, operation is the same as "0: Command speed".)

(3) Condition selection at mode switching

Set the valid/invalid of switching conditions for switching control mode.

0: Switching conditions valid (for switching control mode)
1: Zero speed ON condition invalid (for switching control mode)

Note) The "Operation setting for speed-torque control mode" is included in detailed parameters 2, but it will be valid at the rising edge (OFF to ON) of the PLC READY signal [Y0].

POINT

Set normally "0". Set "1" to shift to torque control without waiting for stop of servo motor immediately after positioning completion.

Pr.95 External command signal selection QD77MS16

Set the external command signal.

0: Not used........ External command signal is not used.
1: DI1................. DI1 is used as external command signal.
2: DI2................. DI2 is used as external command signal.
3: DI3................. DI3 is used as external command signal.
4: DI4................. DI4 is used as external command signal.

Note) The "External command signal selection" is included in detailed parameters 2, but it will be valid at the rising edge (OFF to ON) of the PLC READY signal [Y0].

POINT

Same external command signal can be used in the multiple axes.

5.2.5 OPR basic parameters

Item	Setting value, setting range		Default value	Buffer memory address	
	Value set with GX Works2	Value set with sequence program		QD77MS2 QD77MS4	QD77MS16
Pr.43 OPR method	0 : Near-point dog method	0	0	70+150n	
	4 : Count method 1)	4			
	5 : Count method 2)	5			
	6 : Data set method	6			
	7 : Scale origin signal detection method	7			
Pr.44 OPR direction	0 : Positive direction (address increment direction)	0	0	71+150n	
	1 : Negative direction (address decrement direction)	1			
Pr.45 OP address	The setting value range differs depending on the "Pr.1 Unit setting".		0	72+150n 73+150n	
Pr.46 OPR speed			1	74+150n 75+150n	
Pr.47 Creep speed			1	76+150n 77+150n	
Pr.48 OPR retry	0 : Do not retry OPR with limit switch	0	0	78+150n	
	1 : Retry OPR with limit switch	1			

n: Axis No.-1

Pr.43 OPR method

Set the "OPR method" for carrying out machine OPR.

0: Near-point dog method	After decelerating at the near-point dog ON, stop at the zero signal and complete the machine OPR.
4: Count method 1)	After decelerating at the near-point dog ON, move the designated distance, and complete the machine OPR with the zero signal.
5: Count method 2)	After decelerating at the near-point dog ON, move the designated distance, and complete the machine OPR.
6: Data set method	The position where the machine OPR has been made will be the OP.
7: Scale origin signal detection method	If it moves in the opposite direction against of OPR direction after deceleration stop at the near-point dog ON, And it moves in OPR direction after deceleration stop once at the detection of the first zero signal. Then, it stops at the detected nearest zero signal, and complete the machine OPR.

Note) Refer to Section 8.2 "Machine OPR" for details on the OPR methods.

OPR method

0 : Near-point dog method

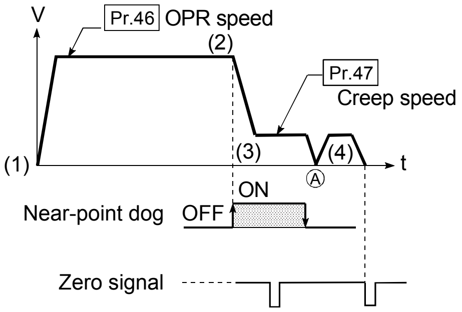
(1) Start machine OPR.
(Start movement at the "Pr.46 OPR speed" in the "Pr.44 OPR direction".)

(2) Detect the near-point dog ON, and start deceleration.

(3) Decelerate to "Pr.47 Creep speed", and move with the creep speed.
(At this time, the near-point dog must be ON. If the near-point dog is OFF, the axis will decelerate to a stop.)

(4) At the first zero signal after the near-point dog turned OFF, machine OPR is completed.

Note) After the home position return (OPR) has been started, the zero point of the encoder must be passed at least once before point A is reached.
However, if selecting "1: Not need to pass servo motor Z-phase after power on" with "Function selection C-4 (PC17)", it is possible to carry out the home position return (OPR) without passing the zero point.



4 : Count method 1)

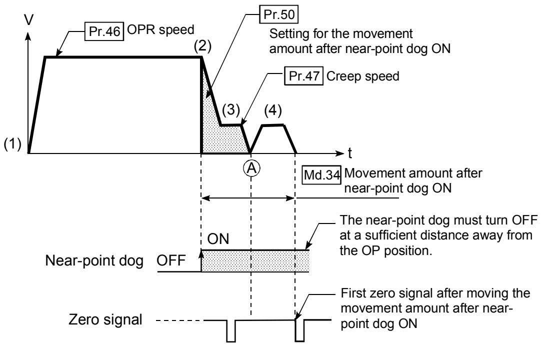
(1) Start machine OPR.
(Start movement at the "Pr.46 OPR speed" in the "Pr.44 OPR direction".)

(2) Detect the near-point dog ON, and start deceleration.

(3) Decelerate to "Pr.47 Creep speed", and move with the creep speed.

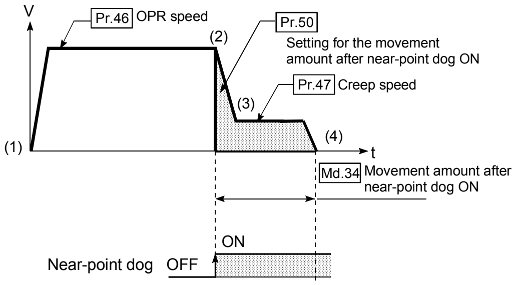
(4) After the near-point dog turns ON and the movement amount set in "Pr.50 Setting for the movement amount after near-point dog ON" has passed, the Simple Motion module stops with the first zero signal, and the machine OPR is completed.

Note) After the home position return (OPR) has been started, the zero point of the encoder must be passed at least once before point A is reached.
However, if selecting "1: Not need to pass servo motor Z-phase after power on" with "Function selection C-4 (PC17)", it is possible to carry out the home position return (OPR) without passing the zero point.



5 : Count method 2)

(1) Start machine OPR.
(Start movement at the "Pr.46 OPR speed" in the "Pr.44 OPR direction".)
(2) Detect the near-point dog ON, and start deceleration.
(3) Decelerate to "Pr.47 Creep speed", and move with the creep speed.
(4) After the near-point dog turns ON and the movement amount set in "Pr.50 Setting for the movement amount after near-point dog ON" has passed, machine OPR is completed.

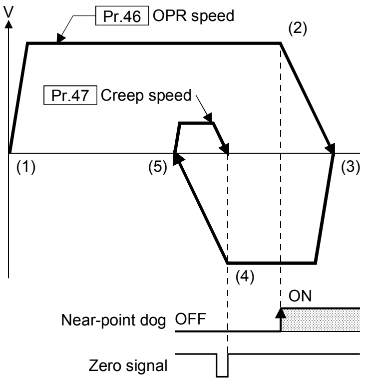


6 : Data set method

The position where the machine OPR has been made will be the OP.
(Perform after the servo amplifier has been turned ON and the servomotor has been rotated at least once using the JOG or similar operation. However, if selecting "1: Not need to pass servo motor Z-phase after power on" with "Function selection C-4 (PC17)", it is possible to carry out the home position return (OPR) without passing the zero point.)

7 : Scale origin signal detection method

(1) Start machine OPR.
(Start movement at the "Pr.46 OPR speed" in the "Pr.44 OPR direction".)
(2) Detect the near-point dog ON, and start deceleration.
(3) After deceleration stop, it moves in the opposite direction against of OPR at the "Pr.46 OPR speed".
(4) During movement, the machine begins decelerating when the first zero signal is detected.
(5) After deceleration stop, it moves in direction of OPR at the speed set in "Pr.47 Creep speed", and stops at the detected nearest zero signal to complete the machine OPR.

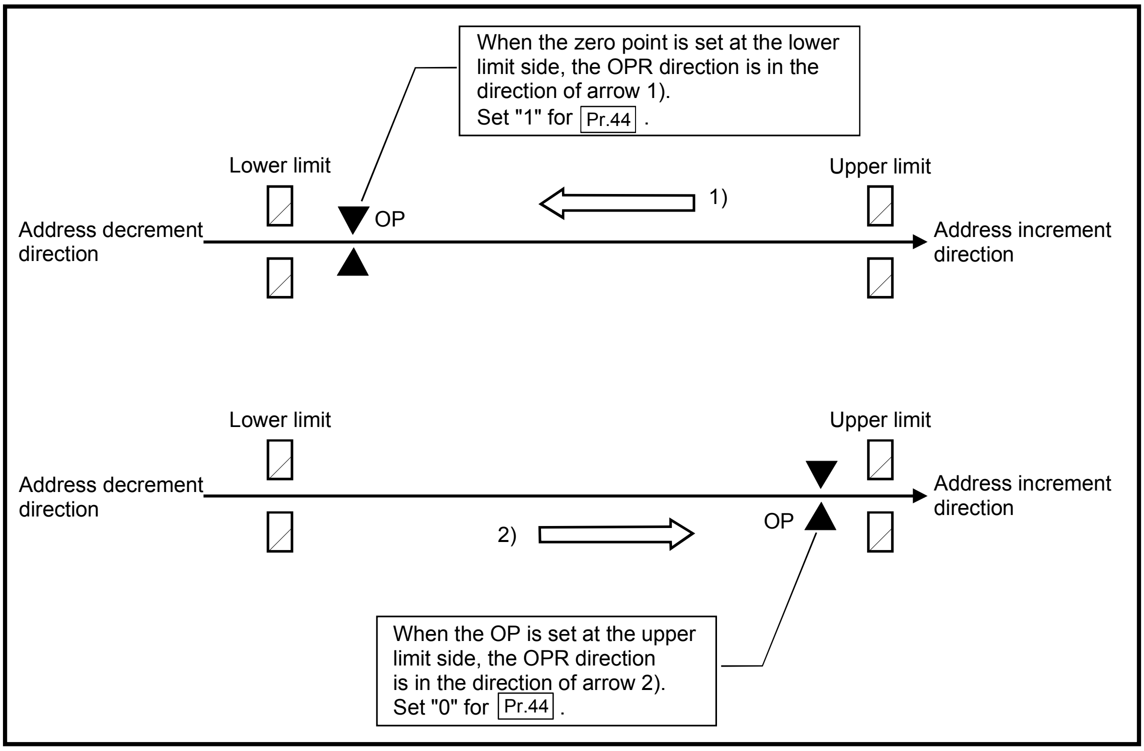


Pr.44 OPR direction

Set the direction to start movement when starting machine OPR.

0: Positive direction (address increment direction)
Moves in the direction that the address increments. (Arrow 2))
1: Negative direction (address decrement direction)
Moves in the direction that the address decrements. (Arrow 1))

Normally, the OP is set near the lower limit or the upper limit, so "Pr.44 OPR direction" is set as shown below.



Pr.45 OP address

Set the address used as the reference point for positioning control (ABS system). (When the machine OPR is completed, the stop position address is changed to the address set in "Pr.45 OP address". At the same time, the "Pr.45 OP address" is stored in "Md.20 Current feed value" and "Md.21 Machine feed value".)

Pr.1 setting value	Value set with GX Works2 (unit)	Value set with sequence program (unit)
0 : mm	-214748364.8 to 214748364.7 (μm)	-2147483648 to 2147483647 ($\times 10^{-1}$μm)
1 : inch	-21474.83648 to 21474.83647 (inch)	-2147483648 to 2147483647 ($\times 10^{-5}$inch)
2 : degree	0 to 359.99999 (degree)	0 to 35999999 ($\times 10^{-5}$degree)
3 : PLS	-2147483648 to 2147483647 (PLS)	-2147483648 to 2147483647 (PLS)

Pr.46 OPR speed

Set the speed for OPR.

Note) Set the "OPR speed" to less than "Pr.8 Speed limit value". If the "speed limit value" is exceeded, the error "outside speed limit value range" (error code: 910) will occur, and OPR will not be executed.
The "OPR speed" should be equal to or faster than the "Pr.7 Bias speed at start" and "Pr.47 Creep speed".

Pr.1 setting value	Value set with GX Works2 (unit)	Value set with sequence program (unit)
0 : mm	0.01 to 20000000.00 (mm/min)	1 to 2000000000 ($\times 10^{-2}$mm/min)
1 : inch	0.001 to 2000000.000 (inch/min)	1 to 2000000000 ($\times 10^{-3}$inch/min)
2 : degree	0.001 to 2000000.000 (degree/min)` ∗1	1 to 2000000000 ($\times 10^{-3}$degree/min) ∗2
3 : PLS	1 to 1000000000 (PLS/s)	1 to 1000000000 (PLS/s)

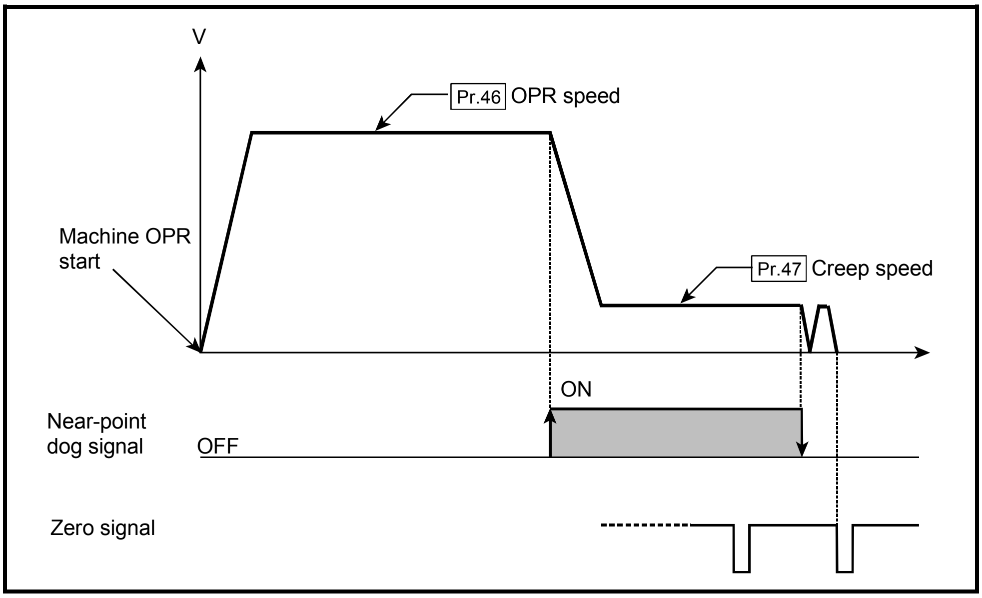
∗1: The OPR speed setting range is 0.001 to 2000000.000[degree/min], but it will be decupled and become 0.01 to 20000000.00[degree/min] by setting "Pr.83 Speed control 10 x multiplier setting for degree axis" to valid.

∗2: The OPR speed setting range is 1 to 2000000000($\times 10^{-3}$degree/min), but it will be decupled and become 1 to 2000000000 ($\times 10^{-2}$degree/min) by setting "Pr.83 Speed control 10 x multiplier setting for degree axis" to valid.

Pr.47 Creep speed

Set the creep speed after near-point dog ON (the low speed just before stopping after decelerating from the OPR speed).
The creep speed is set within the following range.

(Pr.46 OPR speed) ≥ (Pr.47 Creep speed) ≥ (Pr.7 Bias speed at start)



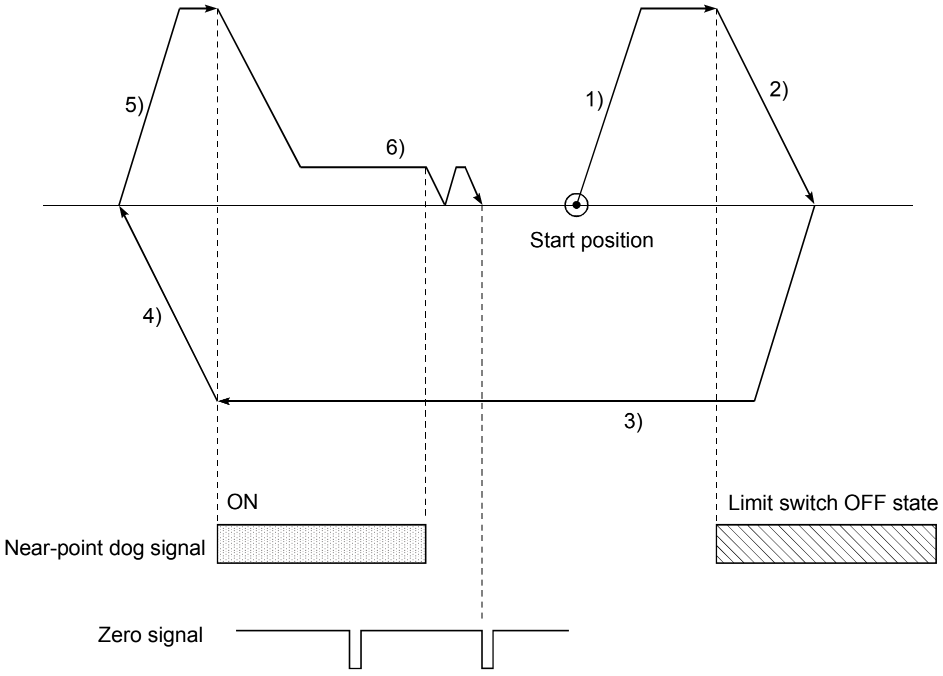
Pr.1 setting value	Value set with GX Works2 (unit)	Value set with sequence program (unit)
0 : mm	0.01 to 20000000.00 (mm/min)	1 to 2000000000 (×10^{-2}mm/min)
1 : inch	0.001 to 2000000.000 (inch/min)	1 to 2000000000 (×10^{-3}inch/min)
2 : degree	0.001 to 2000000.000 (degree/min) ∗1	1 to 2000000000 (×10^{-3}degree/min) ∗2
3 : PLS	1 to 1000000000 (PLS/s)	1 to 1000000000 (PLS/s)

∗1: The creep speed setting range is 0.001 to 2000000.000[degree/min], but it will be decupled and become 0.01 to 20000000.00[degree/min] by setting " Pr.83 Speed control 10 x multiplier setting for degree axis" to valid.

∗2: The creep speed setting range is 1 to 2000000000(×10^{-3}degree/min), but it will be decupled and become 1 to 2000000000 (×10^{-2}degree/min) by setting " Pr.83 Speed control 10 x multiplier setting for degree axis" to valid.

Pr.48 OPR retry

Set whether to carry out OPR retry.
When the OPR retry function is validated and the machine OPR is started, first the axis will move in the OPR direction (1)). If the upper/lower limit signal turns OFF before the near-point dog signal ON is detected (2)), the axis will decelerate to a stop, and then will move in the direction opposite the OPR direction (3)). If the following edge of the near-point dog signal is detected during movement in the opposite direction, the axis will decelerate to a stop (4)), and then will carry out machine OPR again (5), 6)).



[Operation for OPR retry function]

1) Movement in the OPR direction starts with the machine OPR start.
2) The axis decelerates when the limit signal OFF is detected.
3) After stopping at detection the limit signal OFF, the axis moves at the OPR speed in the direction opposite to the specified OPR direction.
4) The axis decelerates when the near-point dog signal turns OFF.
5) After stopping with the near-point dog signal OFF, start machine OPR in the OPR direction.
6) The machine begins decelerating when the near-point dog ON is detected and completes machine OPR.

5.2.6 OPR detailed parameters

Item	Setting value, setting range		Default value	Buffer memory address	
	Value set with GX Works2	Value set with sequence program		QD77MS2 QD77MS4	QD77MS16
Pr.50 Setting for the movement amount after near-point dog ON	The setting value range differs depending on the "Pr.1 Unit setting".		0	80+150n 81+150n	
Pr.51 OPR acceleration time selection	0 : Pr.9 Acceleration time 0	0	0	82+150n	
	1 : Pr.25 Acceleration time 1	1			
	2 : Pr.26 Acceleration time 2	2			
	3 : Pr.27 Acceleration time 3	3			
Pr.52 OPR deceleration time selection	0 : Pr.10 Deceleration time 0	0	0	83+150n	
	1 : Pr.28 Deceleration time 1	1			
	2 : Pr.29 Deceleration time 2	2			
	3 : Pr.30 Deceleration time 3	3			
Pr.53 OP shift amount	The setting value range differs depending on the "Pr.1 Unit setting".		0	84+150n 85+150n	
Pr.54 OPR torque limit value	1 to 1000 (%)	1 to 1000 (%)	300	86+150n	
Pr.55 Operation setting for incompletion of OPR	0 : Positioning control is not executed.	0	0	87+150n	
	1 : Positioning control is executed.	1			
Pr.56 Speed designation during OP shift	0 : OPR speed	0	0	88+150n	
	1 : Creep speed	1			
Pr.57 Dwell time during OPR retry	0 to 65535 (ms)	0 to 65535 (ms) 0 to 32767 : Set as a decimal 32768 to 65535 : Convert into hexadecimal and set	0	89+150n	

n: Axis No.-1

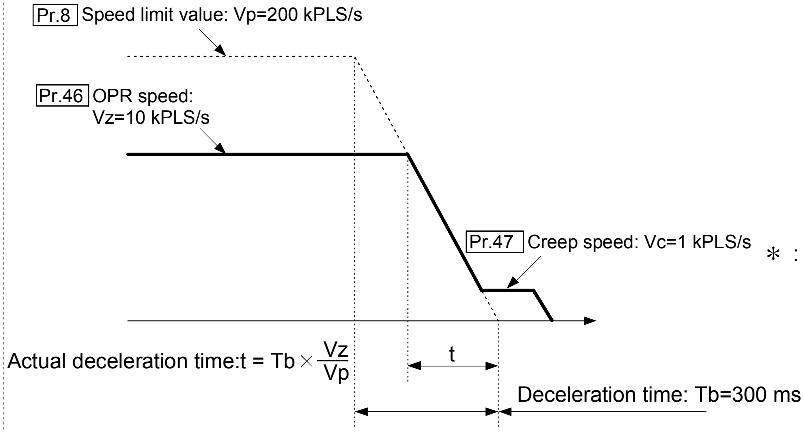
Pr.50 Setting for the movement amount after near-point dog ON

When using the count method 1) or 2), set the movement amount to the OP after the near-point dog signal turns ON.
(The movement amount after near-point dog ON should be equal to or greater than the sum of the "distance covered by the deceleration from the OPR speed to the creep speed" and "distance of movement in 10 ms at the OPR speed".)

Example of setting for "Pr. 50 Setting for the movement amount after near-point dog ON"

Assuming that the "Pr. 8 Speed limit value" is set to 200 kPLS/s, "Pr. 46 OPR speed" to 10 kPLS/s, "Pr. 47 Creep speed" to 1 kPLS/s, and deceleration time to 300 ms, the minimum value of "Pr. 50 Setting for the movement amount after near-point dog ON" is calculated as follows:

[OPR operation]



$$[\text{Deceleration distance}] = \frac{1}{2} \times \frac{Vz}{1000} \times t + \underbrace{0.01 \times Vz}_{\text{Movement amount for 10ms at OPR speed.}}$$

$$= \frac{Vz}{2000} \times \frac{Tb \times Vz}{Vp} + 0.01 \times Vz$$

$$= \frac{10 \times 10^3}{2000} \times \frac{300 \times 10 \times 10^3}{200 \times 10^3} + 0.01 \times 10 \times 10^3$$

$$= 75 + 100$$

$$= 175$$

↓

＊ : "Pr.50 Setting for the movement amount after near-point dog ON" should be equal to or larger than 175.

Pr.1 setting value	Value set with GX Works2 (unit)	Value set with sequence program (unit)
0 : mm	0 to 214748364.7 (μm)	0 to 2147483647 ($\times 10^{-1}$μm)
1 : inch	0 to 21474.83647 (inch)	0 to 2147483647 ($\times 10^{-5}$inch)
2 : degree	0 to 21474.83647 (degree)	0 to 2147483647 ($\times 10^{-5}$degree)
3 : PLS	0 to 2147483647 (PLS)	0 to 2147483647 (PLS)

Pr.51 OPR acceleration time selection

Set which of "acceleration time 0 to 3" to use for the acceleration time during OPR.

0 : Use the value set in "Pr.9 Acceleration time 0".

1 : Use the value set in "Pr.25 Acceleration time 1".

2 : Use the value set in "Pr.26 Acceleration time 2".

3 : Use the value set in "Pr.27 Acceleration time 3".

Pr.52 OPR deceleration time selection

Set which of "deceleration time 0 to 3" to use for the deceleration time during OPR.

0 : Use the value set in "Pr.10 Deceleration time 0".

1 : Use the value set in "Pr.28 Deceleration time 1".

2 : Use the value set in "Pr.29 Deceleration time 2".

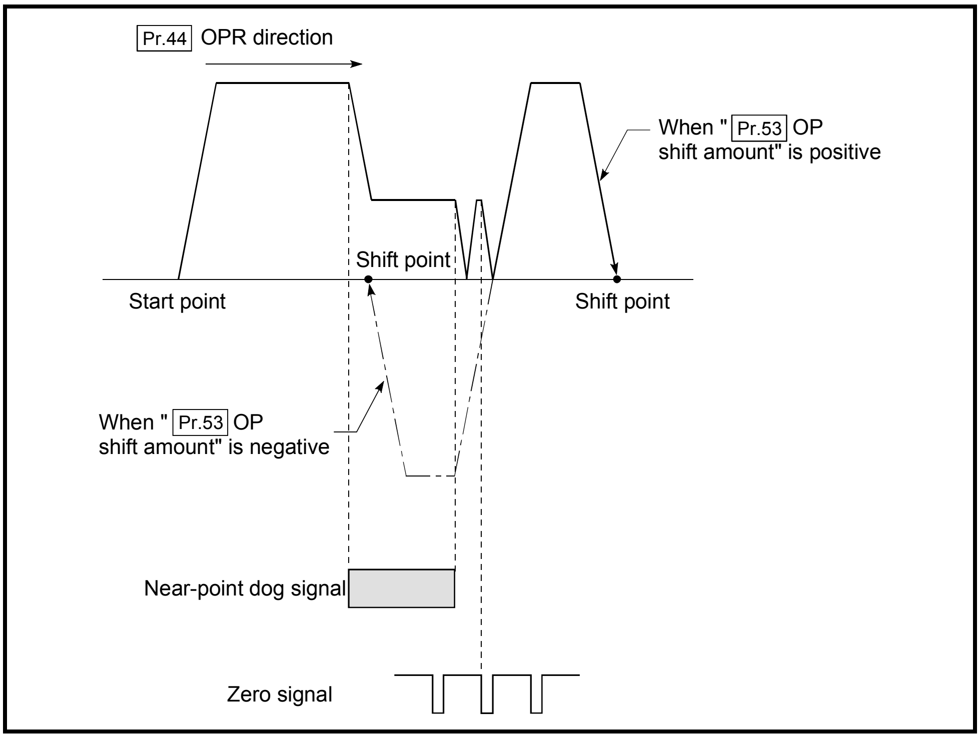
3 : Use the value set in "Pr.30 Deceleration time 3".

Pr.53 OP shift amount

Set the amount to shift (move) from the position stopped at with machine OPR.

＊ The OP shift function is used to compensate the OP position stopped at with machine OPR.

If there is a physical limit to the OP position, due to the relation of the near-point dog installation position, use this function to compensate the OP to an optimum position.



Pr.1 setting value	Value set with GX Works2 (unit)	Value set with sequence program (unit)
0 : mm	-214748364.8 to 214748364.7 (μm)	-2147483648 to 2147483647 ($\times 10^{-1}$μm)
1 : inch	-21474.83648 to 21474.83647 (inch)	-2147483648 to 2147483647 ($\times 10^{-5}$inch)
2 : degree	-21474.83648 to 21474.83647 (degree)	-2147483648 to 2147483647 ($\times 10^{-5}$degree)
3 : PLS	-2147483648 to 2147483647 (PLS)	-2147483648 to 2147483647 (PLS)

Pr.54 OPR torque limit value

Set the value to limit the servomotor torque after reaching the creep speed during machine OPR.
Refer to Section 13.4.2 "Torque limit function" for details on the torque limits.

Pr.55 Operation setting for incompletion of OPR

Set whether the positioning control is executed or not (When the OPR request flag is ON.).
0: Positioning control is not executed.
1: Positioning control is executed.

(1) When OPR request flag is ON, selecting "0: Positioning control is not executed" will result in an "Operation starting at incompletion of OPR" error (error code: 547), and positioning control will not be performed. At this time, operation with the manual control (JOG operation, inching operation, manual pulse generator operation) is available.
The positioning control can be executed even if the OPR request flag is ON when selecting "1: Positioning control is executed".

(2) The following shows whether the positioning control is possible to start/restart or not when selecting "0: Positioning control is not executed".
  (a) Start possible
  Machine OPR, JOG operation, inching operation, manual pulse generator operation, current value changing using current value changing start No. (9003).

  (b) Start/restart impossible control
  The positioning control is impossible to start/restart in the following case.
  1-axis linear control, 2/3/4-axis linear interpolation control, 1/2/3/4-axis fixed-feed control, 2-axis circular interpolation control with sub point designation, 2-axis circular interpolation control with center point designation, 1/2/3/4-axis speed control, Speed-position switching control (INC mode/ ABS mode), Position-speed switching control, current value changing using current value changing (No.1 to 600).

(3) When OPR request flag is ON, starting Fast OPR will result in an “Home positioning return (OPR) request flag ON” error (error code: 207) despite the setting value of “Operation setting incompletion of OPR”, and Fast OPR will not be executed.

⚠CAUTION

- Do not execute the positioning control in home position return request signal ON for the axis which uses in the positioning control.
  Failure to observe this could lead to an accident such as a collision.

Pr.56 Speed designation during OP shift

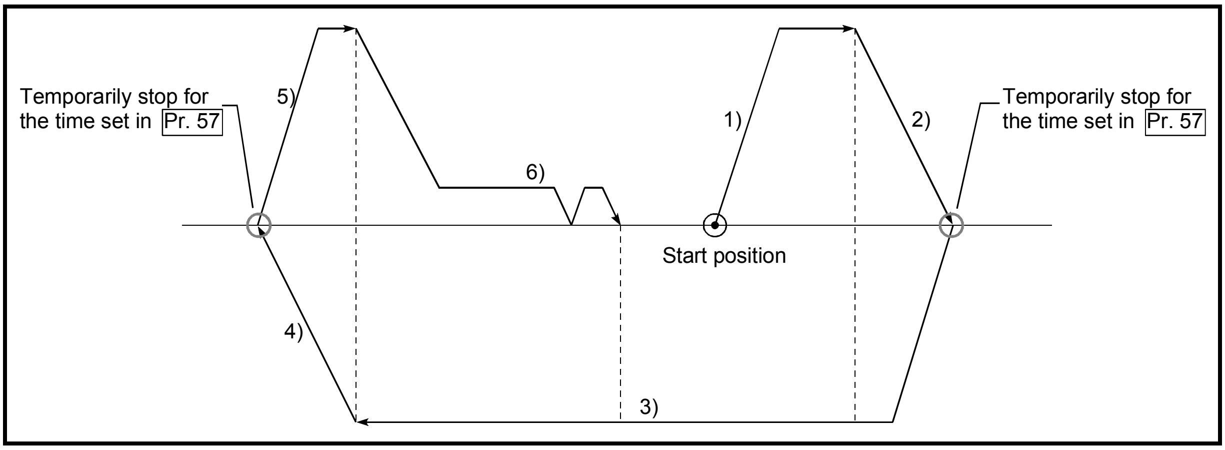
Set the operation speed for when a value other than "0" is set for "Pr.53 OP shift amount". Select the setting from "Pr.46 OPR speed" or "Pr.47 Creep speed".

0 : Designate "Pr.46 OPR speed" as the setting value.

1 : Designate "Pr.47 Creep speed" as the setting value.

Pr.57 Dwell time during OPR retry

When OPR retry is validated (when "1" is set for Pr.48), set the stop time after decelerating in 2) and 4) in the following drawing.



5.2.7 Expansion parameters

Item	Setting value, setting range		Default value	Buffer memory address	
	Value set with GX Works2	Value set with sequence program		QD77MS2 QD77MS4	QD77MS16
Pr.91 Optional data monitor: Data type setting 1	0 : No setting 1 : Effective load ratio 2 : Regenerative load ratio 3 : Peak load ratio 4 : Load inertia moment ratio 5 : Position loop gain 1 6 : Bus voltage 7 : Servo motor speed 8 : Absolute position encoder multiple revolution counter 9 : Unit power consumption 10 : Instantaneous torque 12 : Motor thermistor temperature 13 : Equivalent disturbance torque 14 : Overload alarm margin 15 : Error excessive alarm margin 16 : Settling time 17 : Overshoot amount 20 : Position feedback (Note-1) 21 : Absolute position encoder single revolution position (Note-1) 22 : Select droop pulses (Note-1) 23 : Unit integral power consumption (Note-1) 24 : Load side encoder information 1 (Note-1) 25 : Load side encoder information 2 (Note-1) 26 : Z-phase counter (Note-1) 27 : Motor-side/load-side position deviation (Note-1) 28 : Motor-side/load-side speed deviation (Note-1)	0 1 2 3 4 5 6 7 8 9 10 12 13 14 15 16 17 20 21 22 23 24 25 26 27 28	0	100+150n	
Pr.92 Optional data monitor: Data type setting 2			0	101+150n	
Pr.93 Optional data monitor: Data type setting 3			0	102+150n	
Pr.94 Optional data monitor: Data type setting 4			0	103+150n	
Pr.96 Operation cycle setting	0: 0.88ms 1: 1.77ms	0 1	QD77MS2 : 0 QD77MS4 : 0 QD77MS16: 1	147 (Note-2)	105 (Note-2)
Pr.97 SSCNET setting	0: SSCNETⅢ 1: SSCNETⅢ/H	0 1	1	106 (Note-2)	
Pr.114 External command signal compensation valid/invalid setting	0: Invalid 1: Valid	0 1	0	114 (Note-2)	

n: Axis No. -1

(Note-1): Used point: 2 words

(Note-2): Only the value specified against the axis 1 is valid.

Pr.91 Optional data monitor: Data type setting 1 to Pr.94 Optional data monitor: Data type setting 4

Set the data type monitored in optional data monitor function.

Setting value	Data type	Used point
0	No setting (Note)	1 word
1	Effective load ratio	
2	Regenerative load ratio	
3	Peak load ratio	
4	Load inertia moment ratio	
5	Position loop gain 1	
6	Bus voltage	
7	Servo motor speed	
8	Absolute position encoder multiple revolution counter	
9	Unit power consumption	
10	Instantaneous torque	
12	Motor thermistor temperature	
13	Equivalent disturbance torque	
14	Overload alarm margin	
15	Error excessive alarm margin	
16	Settling time	
17	Overshoot amount	
20	Position feedback	2 words
21	Absolute position encoder single revolution position	
22	Select droop pulses	
23	Unit integral power consumption	
24	Load side encoder information 1	
25	Load side encoder information 2	
26	Z-phase counter	
27	Motor-side/load-side position deviation	
28	Motor-side/load-side speed deviation	

(Note): The stored value of "Md.109 Regenerative load ratio/Optional data monitor output 1" to "Md.112 Optional data monitor output 4" is different every data type setting 1 to 4. (Refer to Section 5.6.2)

POINT

(1) The monitor address of optional data monitor is registered to servo amplifier with initialized communication after power supply ON or PLC CPU reset.

(2) Set the data type of "used point: 2 words" in "Pr.91 Optional data monitor: Data type setting 1" or "Pr.93 Optional data monitor: Data type setting 3". If it is set in "Pr.92 Optional data monitor: Data type setting 2" or "Pr.94 Optional data monitor: Data type setting 4", the warning (warning code: 116) will occur with initialized communication to servo amplifier, and "0" is set in Md.109 to Md.112.

(3) Set "0" in "Pr.92 Optional data monitor: Data type setting 2" when the data type of "used point: 2 words" is set in "Pr.91 Optional data monitor: Data type setting 1", and set "0" in "Pr.94 Optional data monitor: Data type setting 4" when the data type of "used point: 2 words" is set in "Pr.93 Optional data monitor: Data type setting 3". When setting other than "0", the warning (warning code: 116) will occur with initialized communication to servo amplifier, and "0" is set in Md.109 to Md.112.

(4) When the data type of "used point: 2 words" is set, the monitor data of low-order is "Md.109 Regenerative load ratio/Optional data monitor output 1" or "Md.111 Peak torque ratio/Optional data monitor output 3".

(5) Refer to Section 14.11 for the data type that can be monitored on each servo amplifier. When the data type that cannot be monitored is set, "0" is stored to the monitor output.

Pr.96 Operation cycle setting

Set the operation cycle. (Only the value specified against the axis 1 is valid.)
0: 0.88ms
1: 1.77ms

POINT

(1) In this parameter, the value set in flash ROM of Simple Motion module is valid at power supply ON or PLC CPU reset. Fetch by PLC READY signal OFF to ON is not executed. Execute flash ROM writing to change after setting a value to buffer memory. Confirm the current operation cycle in "Md.132 Operation cycle setting".
(2) When "0: 0.88ms" is set, confirm that "Md.133 Operation cycle over flag" does not turn ON. If the flag is ON, the operation cycle over has been generated. Correct the positioning content or set "1: 1.77ms".

Pr.97 SSCNET setting

Set the servo network. (Only the value specified against the axis 1 is valid.)
0: SSCNETⅢ
1: SSCNETⅢ/H

The connectable servo amplifier differs by this parameter. When unconnectable servo amplifier is set in "Pr.100 Servo series", "SSCNET setting error" (error code: 1003) occurs, and communication with the servo amplifier is not executed.
The following shows about this parameter and connectable servo amplifier (setting value of "Pr.100 Servo series").

Setting value of "Pr.97 SSCNET setting"	Servo amplifier	Setting value of "Pr.100 Servo series"
0: SSCNETⅢ	MR-J3(W)-B	1: MR-J3-□B MR-J3W-□B (2-axis type) 3: MR-J3-□B-RJ006 (For fully closed loop control) MR-J3-□BS (For safety servo) 4: MR-J3-□B-RJ004 (For linear servo) 6: MR-J3-□B-RJ080W (For direct drive motor)
	FR-A700	64: FR-A700 series (Inverter)
	VCII (NIKKI)	96: VCII series (manufactured by Nikki Denso Co., Ltd.)
	Virtual servo amplifier	4097: Virtual servo amplifier (MR-J3)
1: SSCNETⅢ/H	MR-J4(W)-B	32: MR-J4-□B MR-J4W-□B (2-axis type, 3-axis type)
	Virtual servo amplifier	4128: Virtual servo amplifier (MR-J4)

POINT

In this parameter, the value set in flash ROM of Simple Motion module is valid at power supply ON or PLC CPU reset. Fetch by PLC READY signal OFF to ON is not executed. Execute flash ROM writing to change after setting a value to buffer memory.

Pr.114 External command signal compensation valid/invalid setting

Set the input compensation of external command input signal valid/invalid. (Only the value specified against the axis 1 is valid.)

0: Invalid
1: Valid (The response time from the external command signal is compensated and the latch accuracy will be enhanced.)

Note) If the setting is other than "0" and "1", operation is performed with the setting regarded as "0: Invalid".

POINT

In this parameter, the value set in flash ROM of Simple Motion module is valid at power supply ON or PLC CPU reset. Fetch by PLC READY signal OFF to ON is not executed. Execute flash ROM writing to change the value after setting a value to buffer memory.

5.2.8 Servo parameters

(1) Servo series

Item		Setting details	Setting range	Default value	Buffer memory address	
					QD77MS2 QD77MS4	QD77MS16
Pr.100	Servo series	Used to select the servo amplifier series to connect to the Simple Motion module. POINT • Be sure to set up servo series. Communication with servo amplifier isn't started by the initial value "0" in default value. (The LED indication of servo amplifier indicates "Ab".) • The connectable servo amplifier differs by the setting of "Pr.97 SSCNET setting".	0: Servo series is not set 1: MR-J3-☐B MR-J3W-☐B (2-axis type) 3: MR-J3-☐B-RJ006 (For fully closed loop control) MR-J3-☐BS (For safety servo) 4: MR-J3-☐B-RJ004 (For linear servo) 6: MR-J3-☐B-RJ080W (For direct drive motor) 32: MR-J4-☐B MR-J4W-☐B (2-axis type and 3-axis type) 64: FR-A700 series (Inverter) 96: VCII series (manufactured by Nikki Denso Co., Ltd.) 4097: Virtual servo amplifier (MR-J3) 4128: Virtual servo amplifier (MR-J4)	0	30100+200n	28400+100n

n: Axis No. -1

(2) Parameters of MR-J4(W)-B

The parameter list for MR-J4(W)-B is shown below.
Refer to each servo amplifier instruction manual for details of setting items.
Do not change other than the buffer memory addresses of the parameters described in each servo amplifier instruction manual.

POINT

Set the parameter value and switch power off once (The parameter is transferred to servo amplifier from Simple Motion module), and then switch it on again to make that parameter setting valid.

(a) Basic setting parameters

Servo amplifier Parameter No.	Buffer memory address	
	QD77MS2 QD77MS4	QD77MS16
PA01	30101+200n	28401+100n
PA02	30102+200n	28402+100n
PA03	30103+200n	28403+100n
PA04	30104+200n	28404+100n
PA05	30105+200n	28405+100n
PA06	30106+200n	28406+100n
PA07	30107+200n	28407+100n
PA08	30108+200n	28408+100n
PA09	30109+200n	28409+100n
PA10	30110+200n	28410+100n
PA11	30111+200n	28411+100n
PA12	30112+200n	28412+100n
PA13	30113+200n	28413+100n
PA14	30114+200n	28414+100n
PA15	30115+200n	28415+100n
PA16	30116+200n	28416+100n
PA17	30117+200n	28417+100n

Servo amplifier Parameter No.	Buffer memory address	
	QD77MS2 QD77MS4	QD77MS16
PA18	30118+200n	28418+100n
PA19	30932+50n	Set with GX Works2
PA20	64400+250n	64400+70n
PA21	64401+250n	64401+70n
PA22	64402+250n	64402+70n
PA23	64403+250n	64403+70n
PA24	64404+250n	64404+70n
PA25	64405+250n	64405+70n
PA26	64406+250n	64406+70n
PA27	64407+250n	64407+70n
PA28	64408+250n	64408+70n
PA29	64409+250n	64409+70n
PA30	64410+250n	64410+70n
PA31	64411+250n	64411+70n
PA32	64412+250n	64412+70n

n: Axis No.-1

(b) Gain/filter setting parameters

Servo amplifier Parameter No.	Buffer memory address	
	QD77MS2 QD77MS4	QD77MS16
PB01	30119+200n	28419+100n
PB02	30120+200n	28420+100n
PB03	30121+200n	28421+100n
PB04	30122+200n	28422+100n
PB05	30123+200n	28423+100n
PB06	30124+200n	28424+100n
PB07	30125+200n	28425+100n
PB08	30126+200n	28426+100n
PB09	30127+200n	28427+100n
PB10	30128+200n	28428+100n
PB11	30129+200n	28429+100n
PB12	30130+200n	28430+100n
PB13	30131+200n	28431+100n
PB14	30132+200n	28432+100n
PB15	30133+200n	28433+100n
PB16	30134+200n	28434+100n
PB17	30135+200n	28435+100n
PB18	30136+200n	28436+100n
PB19	30137+200n	28437+100n
PB20	30138+200n	28438+100n
PB21	30139+200n	28439+100n
PB22	30140+200n	28440+100n
PB23	30141+200n	28441+100n
PB24	30142+200n	28442+100n
PB25	30143+200n	28443+100n
PB26	30144+200n	28444+100n
PB27	30145+200n	28445+100n
PB28	30146+200n	28446+100n
PB29	30147+200n	28447+100n
PB30	30148+200n	28448+100n
PB31	30149+200n	28449+100n
PB32	30150+200n	28450+100n
PB33	30151+200n	28451+100n
PB34	30152+200n	28452+100n
PB35	30153+200n	28453+100n
PB36	30154+200n	28454+100n
PB37	30155+200n	28455+100n
PB38	30156+200n	28456+100n
PB39	30157+200n	28457+100n
PB40	30158+200n	28458+100n
PB41	30159+200n	28459+100n
PB42	30160+200n	28460+100n
PB43	30161+200n	28461+100n
PB44	30162+200n	28462+100n
PB45	30163+200n	28463+100n
PB46	64413+250n	64413+70n
PB47	64414+250n	64414+70n
PB48	64415+250n	64415+70n
PB49	64416+250n	64416+70n
PB50	64417+250n	64417+70n
PB51	64418+250n	64418+70n
PB52	64419+250n	64419+70n
PB53	64420+250n	64420+70n
PB54	64421+250n	64421+70n
PB55	64422+250n	64422+70n
PB56	64423+250n	64423+70n
PB57	64424+250n	64424+70n
PB58	64425+250n	64425+70n
PB59	64426+250n	64426+70n
PB60	64427+250n	64427+70n
PB61	64428+250n	64428+70n
PB62	64429+250n	64429+70n
PB63	64430+250n	64430+70n
PB64	64431+250n	64431+70n

n: Axis No.-1

(c) Extension setting parameters

Servo amplifier Parameter No.	Buffer memory address	
	QD77MS2 QD77MS4	QD77MS16
PC01	30164+200n	28464+100n
PC02	30165+200n	28465+100n
PC03	30166+200n	28466+100n
PC04	30167+200n	28467+100n
PC05	30168+200n	28468+100n
PC06	30169+200n	28469+100n
PC07	30170+200n	28470+100n
PC08	30171+200n	28471+100n
PC09	30172+200n	28472+100n
PC10	30173+200n	28473+100n
PC11	30174+200n	28474+100n
PC12	30175+200n	28475+100n
PC13	30176+200n	28476+100n
PC14	30177+200n	28477+100n
PC15	30178+200n	28478+100n
PC16	30179+200n	28479+100n
PC17	30180+200n	28480+100n
PC18	30181+200n	28481+100n
PC19	30182+200n	28482+100n
PC20	30183+200n	28483+100n
PC21	30184+200n	28484+100n
PC22	30185+200n	28485+100n
PC23	30186+200n	28486+100n
PC24	30187+200n	28487+100n
PC25	30188+200n	28488+100n
PC26	30189+200n	28489+100n
PC27	30190+200n	28490+100n
PC28	30191+200n	28491+100n
PC29	30192+200n	28492+100n
PC30	30193+200n	28493+100n
PC31	30194+200n	28494+100n
PC32	30195+200n	28495+100n
PC33	64432+250n	64432+70n
PC34	64433+250n	64433+70n
PC35	64434+250n	64434+70n
PC36	64435+250n	64435+70n
PC37	64436+250n	64436+70n
PC38	64437+250n	64437+70n
PC39	64438+250n	64438+70n
PC40	64439+250n	64439+70n
PC41	64440+250n	64440+70n
PC42	64441+250n	64441+70n
PC43	64442+250n	64442+70n
PC44	64443+250n	64443+70n
PC45	64444+250n	64444+70n
PC46	64445+250n	64445+70n
PC47	64446+250n	64446+70n
PC48	64447+250n	64447+70n
PC49	64448+250n	64448+70n
PC50	64449+250n	64449+70n
PC51	64450+250n	64450+70n
PC52	64451+250n	64451+70n
PC53	64452+250n	64452+70n
PC54	64453+250n	64453+70n
PC55	64454+250n	64454+70n
PC56	64455+250n	64455+70n
PC57	64456+250n	64456+70n
PC58	64457+250n	64457+70n
PC59	64458+250n	64458+70n
PC60	64459+250n	64459+70n
PC61	64460+250n	64460+70n
PC62	64461+250n	64461+70n
PC63	64462+250n	64462+70n
PC64	64463+250n	64463+70n

n: Axis No.-1

(d) I/O setting parameters

Servo amplifier Parameter No.	Buffer memory address	
	QD77MS2 QD77MS4	QD77MS16
PD01	30196+200n	Set with GX Works2
PD02	30197+200n	
PD03	30198+200n	
PD04	30199+200n	
PD05	30200+200n	
PD06	30201+200n	
PD07	30202+200n	
PD08	30203+200n	
PD09	30204+200n	
PD10	30205+200n	
PD11	30206+200n	
PD12	30207+200n	
PD13	30208+200n	
PD14	30209+200n	
PD15	30210+200n	
PD16	30211+200n	
PD17	30212+200n	
PD18	30213+200n	
PD19	30214+200n	
PD20	30215+200n	
PD21	30216+200n	
PD22	30217+200n	
PD23	30218+200n	
PD24	30219+200n	
PD25	30220+200n	Set with GX Works2
PD26	30221+200n	
PD27	30222+200n	
PD28	30223+200n	
PD29	30224+200n	
PD30	30225+200n	
PD31	30226+200n	
PD32	30227+200n	
PD33	64464+250n	
PD34	64465+250n	
PD35	64466+250n	
PD36	64467+250n	
PD37	64468+250n	
PD38	64469+250n	
PD39	64470+250n	
PD40	64471+250n	
PD41	64472+250n	
PD42	64473+250n	
PD43	64474+250n	
PD44	64475+250n	
PD45	64476+250n	
PD46	64477+250n	
PD47	64478+250n	
PD48	64479+250n	

n: Axis No.-1

(e) Extension setting 2 parameters

Servo amplifier Parameter No.	Buffer memory address	
	QD77MS2 QD77MS4	QD77MS16
PE01	30228+200n	Set with GX Works2
PE02	30229+200n	
PE03	30230+200n	
PE04	30231+200n	
PE05	30232+200n	
PE06	30233+200n	
PE07	30234+200n	
PE08	30235+200n	
PE09	30236+200n	
PE10	30237+200n	
PE11	30238+200n	
PE12	30239+200n	
PE13	30240+200n	
PE14	30241+200n	
PE15	30242+200n	
PE16	30243+200n	
PE17	30244+200n	
PE18	30245+200n	
PE19	30246+200n	
PE20	30247+200n	
PE21	30248+200n	
PE22	30249+200n	
PE23	30250+200n	
PE24	30251+200n	
PE25	30252+200n	
PE26	30253+200n	
PE27	30254+200n	
PE28	30255+200n	
PE29	30256+200n	
PE30	30257+200n	
PE31	30258+200n	
PE32	30259+200n	
PE33	30260+200n	Set with GX Works2
PE34	30261+200n	
PE35	30262+200n	
PE36	30263+200n	
PE37	30264+200n	
PE38	30265+200n	
PE39	30266+200n	
PE40	30267+200n	
PE41	64480+250n	
PE42	64481+250n	
PE43	64482+250n	
PE44	64483+250n	
PE45	64484+250n	
PE46	64485+250n	
PE47	64486+250n	
PE48	64487+250n	
PE49	64488+250n	
PE50	64489+250n	
PE51	64490+250n	
PE52	64491+250n	
PE53	64492+250n	
PE54	64493+250n	
PE55	64494+250n	
PE56	64495+250n	
PE57	64496+250n	
PE58	64497+250n	
PE59	64498+250n	
PE60	64499+250n	
PE61	64500+250n	
PE62	64501+250n	
PE63	64502+250n	
PE64	64503+250n	

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(f) Special setting parameters

Servo amplifier Parameter No.	Buffer memory address	
	QD77MS2 QD77MS4	QD77MS16
PS01	30268+200n	Set with GX Works2
PS02	30269+200n	
PS03	30270+200n	
PS04	30271+200n	
PS05	30272+200n	
PS06	30273+200n	
PS07	30274+200n	
PS08	30275+200n	
PS09	30276+200n	
PS10	30277+200n	
PS11	30278+200n	
PS12	30279+200n	
PS13	30280+200n	
PS14	30281+200n	
PS15	30282+200n	
PS16	30283+200n	

Servo amplifier Parameter No.	Buffer memory address	
	QD77MS2 QD77MS4	QD77MS16
PS17	30284+200n	Set with GX Works2
PS18	30285+200n	
PS19	30286+200n	
PS20	30287+200n	
PS21	30288+200n	
PS22	30289+200n	
PS23	30290+200n	
PS24	30291+200n	
PS25	30292+200n	
PS26	30293+200n	
PS27	30294+200n	
PS28	30295+200n	
PS29	30296+200n	
PS30	30297+200n	
PS31	30298+200n	
PS32	30299+200n	

n: Axis No.-1

(g) Extension setting 3 parameters

Servo amplifier Parameter No.	Buffer memory address	
	QD77MS2 QD77MS4	QD77MS16
PF01	30900+50n	Set with GX Works2
PF02	30901+50n	
PF03	30902+50n	
PF04	30903+50n	
PF05	30904+50n	
PF06	30905+50n	
PF07	30906+50n	
PF08	30907+50n	
PF09	30908+50n	
PF10	30909+50n	
PF11	30910+50n	
PF12	30911+50n	
PF13	30912+50n	
PF14	30913+50n	
PF15	30914+50n	
PF16	30915+50n	
PF17	64504+250n	
PF18	64505+250n	
PF19	64506+250n	
PF20	64507+250n	
PF21	64508+250n	
PF22	64509+250n	
PF23	64510+250n	
PF24	64511+250n	

Servo amplifier Parameter No.	Buffer memory address	
	QD77MS2 QD77MS4	QD77MS16
PF25	64512+250n	Set with GX Works2
PF26	64513+250n	
PF27	64514+250n	
PF28	64515+250n	
PF29	64516+250n	
PF30	64517+250n	
PF31	64518+250n	
PF32	64519+250n	
PF33	64520+250n	
PF34	64521+250n	
PF35	64522+250n	
PF36	64523+250n	
PF37	64524+250n	
PF38	64525+250n	
PF39	64526+250n	
PF40	64527+250n	
PF41	64528+250n	
PF42	64529+250n	
PF43	64530+250n	
PF44	64531+250n	
PF45	64532+250n	
PF46	64533+250n	
PF47	64534+250n	
PF48	64535+250n	

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(h) Option setting parameters

Servo amplifier Parameter No.	Buffer memory address	
	QD77MS2 QD77MS4	QD77MS16
Po01	30916+50n	Set with GX Works2
Po02	30917+50n	
Po03	30918+50n	
Po04	30919+50n	
Po05	30920+50n	
Po06	30921+50n	
Po07	30922+50n	
Po08	30923+50n	
Po09	30924+50n	
Po10	30925+50n	
Po11	30926+50n	
Po12	30927+50n	
Po13	30928+50n	
Po14	30929+50n	
Po15	30930+50n	
Po16	30931+50n	
Po17	64536+250n	Set with GX Works2
Po18	64537+250n	
Po19	64538+250n	
Po20	64539+250n	
Po21	64540+250n	
Po22	64541+250n	
Po23	64542+250n	
Po24	64543+250n	
Po25	64544+250n	
Po26	64545+250n	
Po27	64546+250n	
Po28	64547+250n	
Po29	64548+250n	
Po30	64549+250n	
Po31	64550+250n	
Po32	64551+250n	

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(i) Linear servo motor/DD motor setting parameters

Servo amplifier Parameter No.	Buffer memory address	
	QD77MS2 QD77MS4	QD77MS16
PL01	64552+250n	Set with GX Works2
PL02	64553+250n	
PL03	64554+250n	
PL04	64555+250n	
PL05	64556+250n	
PL06	64557+250n	
PL07	64558+250n	
PL08	64559+250n	
PL09	64560+250n	
PL10	64561+250n	
PL11	64562+250n	
PL12	64563+250n	
PL13	64564+250n	
PL14	64565+250n	
PL15	64566+250n	
PL16	64567+250n	
PL17	64568+250n	
PL18	64569+250n	
PL19	64570+250n	
PL20	64571+250n	
PL21	64572+250n	
PL22	64573+250n	
PL23	64574+250n	
PL24	64575+250n	
PL25	64576+250n	Set with GX Works2
PL26	64577+250n	
PL27	64578+250n	
PL28	64579+250n	
PL29	64580+250n	
PL30	64581+250n	
PL31	64582+250n	
PL32	64583+250n	
PL33	64584+250n	
PL34	64585+250n	
PL35	64586+250n	
PL36	64587+250n	
PL37	64588+250n	
PL38	64589+250n	
PL39	64590+250n	
PL40	64591+250n	
PL41	64592+250n	
PL42	64593+250n	
PL43	64594+250n	
PL44	64595+250n	
PL45	64596+250n	
PL46	64597+250n	
PL47	64598+250n	
PL48	64599+250n	

n: Axis No.-1

(3) Parameters of MR-J3(W)-☐B

The parameter list for MR-J3(W)-☐B is shown below.
Refer to each servo amplifier instruction manual for details of setting items.
Do not change other than the buffer memory addresses of the parameters described in each servo amplifier instruction manual.

POINT

Set the parameter value and switch power off once (The parameter is transferred to servo amplifier from Simple Motion module), and then switch it on again to make that parameter setting valid.

(a) Basic setting parameters

Servo amplifier Parameter No.	Buffer memory address	
	QD77MS2 QD77MS4	QD77MS16
PA01	30101+200n	28401+100n
PA02	30102+200n	28402+100n
PA03	30103+200n	28403+100n
PA04	30104+200n	28404+100n
PA05	30105+200n	28405+100n
PA06	30106+200n	28406+100n
PA07	30107+200n	28407+100n
PA08	30108+200n	28408+100n
PA09	30109+200n	28409+100n
PA10	30110+200n	28410+100n

Servo amplifier Parameter No.	Buffer memory address	
	QD77MS2 QD77MS4	QD77MS16
PA11	30111+200n	28411+100n
PA12	30112+200n	28412+100n
PA13	30113+200n	28413+100n
PA14	30114+200n	28414+100n
PA15	30115+200n	28415+100n
PA16	30116+200n	28416+100n
PA17	30117+200n	28417+100n
PA18	30118+200n	28418+100n
PA19	30932+50n	Set with GX Works2

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(b) Gain/filter parameters

Servo amplifier Parameter No.	Buffer memory address	
	QD77MS2 QD77MS4	QD77MS16
PB01	30119+200n	28419+100n
PB02	30120+200n	28420+100n
PB03	30121+200n	28421+100n
PB04	30122+200n	28422+100n
PB05	30123+200n	28423+100n
PB06	30124+200n	28424+100n
PB07	30125+200n	28425+100n
PB08	30126+200n	28426+100n
PB09	30127+200n	28427+100n
PB10	30128+200n	28428+100n
PB11	30129+200n	28429+100n
PB12	30130+200n	28430+100n
PB13	30131+200n	28431+100n
PB14	30132+200n	28432+100n
PB15	30133+200n	28433+100n
PB16	30134+200n	28434+100n
PB17	30135+200n	28435+100n
PB18	30136+200n	28436+100n
PB19	30137+200n	28437+100n
PB20	30138+200n	28438+100n
PB21	30139+200n	28439+100n
PB22	30140+200n	28440+100n
PB23	30141+200n	28441+100n

Servo amplifier Parameter No.	Buffer memory address	
	QD77MS2 QD77MS4	QD77MS16
PB24	30142+200n	28442+100n
PB25	30143+200n	28443+100n
PB26	30144+200n	28444+100n
PB27	30145+200n	28445+100n
PB28	30146+200n	28446+100n
PB29	30147+200n	28447+100n
PB30	30148+200n	28448+100n
PB31	30149+200n	28449+100n
PB32	30150+200n	28450+100n
PB33	30151+200n	28451+100n
PB34	30152+200n	28452+100n
PB35	30153+200n	28453+100n
PB36	30154+200n	28454+100n
PB37	30155+200n	28455+100n
PB38	30156+200n	28456+100n
PB39	30157+200n	28457+100n
PB40	30158+200n	28458+100n
PB41	30159+200n	28459+100n
PB42	30160+200n	28460+100n
PB43	30161+200n	28461+100n
PB44	30162+200n	28462+100n
PB45	30163+200n	28463+100n

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(c) Expansion setting parameters

Servo amplifier Parameter No.	Buffer memory address	
	QD77MS2 QD77MS4	QD77MS16
PC01	30164+200n	28464+100n
PC02	30165+200n	28465+100n
PC03	30166+200n	28466+100n
PC04	30167+200n	28467+100n
PC05	30168+200n	28468+100n
PC06	30169+200n	28469+100n
PC07	30170+200n	28470+100n
PC08	30171+200n	28471+100n
PC09	30172+200n	28472+100n
PC10	30173+200n	28473+100n
PC11	30174+200n	28474+100n
PC12	30175+200n	28475+100n
PC13	30176+200n	28476+100n
PC14	30177+200n	28477+100n
PC15	30178+200n	28478+100n
PC16	30179+200n	28479+100n

Servo amplifier Parameter No.	Buffer memory address	
	QD77MS2 QD77MS4	QD77MS16
PC17	30180+200n	28480+100n
PC18	30181+200n	28481+100n
PC19	30182+200n	28482+100n
PC20	30183+200n	28483+100n
PC21	30184+200n	28484+100n
PC22	30185+200n	28485+100n
PC23	30186+200n	28486+100n
PC24	30187+200n	28487+100n
PC25	30188+200n	28488+100n
PC26	30189+200n	28489+100n
PC27	30190+200n	28490+100n
PC28	30191+200n	28491+100n
PC29	30192+200n	28492+100n
PC30	30193+200n	28493+100n
PC31	30194+200n	28494+100n
PC32	30195+200n	28495+100n

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(d) Input/output setting parameters

Servo amplifier Parameter No.	Buffer memory address	
	QD77MS2 QD77MS4	QD77MS16
PD01	30196+200n	Set with GX Works2
PD02	30197+200n	
PD03	30198+200n	
PD04	30199+200n	
PD 05	30200+200n	
PD06	30201+200n	
PD07	30202+200n	
PD08	30203+200n	
PD09	30204+200n	
PD10	30205+200n	
PD11	30206+200n	
PD12	30207+200n	
PD13	30208+200n	
PD14	30209+200n	
PD15	30210+200n	
PD16	30211+200n	

Servo amplifier Parameter No.	Buffer memory address	
	QD77MS2 QD77MS4	QD77MS16
PD17	30212+200n	Set with GX Works2
PD18	30213+200n	
PD19	30214+200n	
PD20	30215+200n	
PD21	30216+200n	
PD22	30217+200n	
PD23	30218+200n	
PD24	30219+200n	
PD25	30220+200n	
PD26	30221+200n	
PD27	30222+200n	
PD28	30223+200n	
PD29	30224+200n	
PD30	30225+200n	
PD31	30226+200n	
PD32	30227+200n	

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(e) Extension control parameters

Servo amplifier Parameter No.	Buffer memory address	
	QD77MS2 QD77MS4	QD77MS16
PE01	30228+200n	Set with GX Works2
PE02	30229+200n	
PE03	30230+200n	
PE04	30231+200n	
PE05	30232+200n	
PE06	30233+200n	
PE07	30234+200n	
PE08	30235+200n	
PE09	30236+200n	
PE10	30237+200n	
PE11	30238+200n	
PE12	30239+200n	
PE13	30240+200n	
PE14	30241+200n	
PE15	30242+200n	
PE16	30243+200n	
PE17	30244+200n	
PE18	30245+200n	
PE19	30246+200n	
PE20	30247+200n	

Servo amplifier Parameter No.	Buffer memory address	
	QD77MS2 QD77MS4	QD77MS16
PE21	30248+200n	Set with GX Works2
PE22	30249+200n	
PE23	30250+200n	
PE24	30251+200n	
PE25	30252+200n	
PE26	30253+200n	
PE27	30254+200n	
PE28	30255+200n	
PE29	30256+200n	
PE30	30257+200n	
PE31	30258+200n	
PE32	30259+200n	
PE33	30260+200n	
PE34	30261+200n	
PE35	30262+200n	
PE36	30263+200n	
PE37	30264+200n	
PE38	30265+200n	
PE39	30266+200n	
PE40	30267+200n	

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(f) Special setting parameters

Servo amplifier Parameter No.	Buffer memory address	
	QD77MS2 QD77MS4	QD77MS16
PS01	30268+200n	Set with GX Works2
PS02	30269+200n	
PS03	30270+200n	
PS04	30271+200n	
PS05	30272+200n	
PS06	30273+200n	
PS07	30274+200n	
PS08	30275+200n	
PS09	30276+200n	
PS10	30277+200n	
PS11	30278+200n	
PS12	30279+200n	
PS13	30280+200n	
PS14	30281+200n	
PS15	30282+200n	
PS16	30283+200n	

Servo amplifier Parameter No.	Buffer memory address	
	QD77MS2 QD77MS4	QD77MS16
PS17	30284+200n	Set with GX Works2
PS18	30285+200n	
PS19	30286+200n	
PS20	30287+200n	
PS21	30288+200n	
PS22	30289+200n	
PS23	30290+200n	
PS24	30291+200n	
PS25	30292+200n	
PS26	30293+200n	
PS27	30294+200n	
PS28	30295+200n	
PS29	30296+200n	
PS30	30297+200n	
PS31	30298+200n	
PS32	30299+200n	

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(g) Other setting parameters

Servo amplifier Parameter No.	Buffer memory address	
	QD77MS2 QD77MS4	QD77MS16
PF01	30900+50n	Set with GX Works2
PF02	30901+50n	
PF03	30902+50n	
PF04	30903+50n	
PF05	30904+50n	
PF06	30905+50n	
PF07	30906+50n	
PF08	30907+50n	

Servo amplifier Parameter No.	Buffer memory address	
	QD77MS2 QD77MS4	QD77MS16
PF09	30908+50n	Set with GX Works2
PF10	30909+50n	
PF11	30910+50n	
PF12	30911+50n	
PF13	30912+50n	
PF14	30913+50n	
PF15	30914+50n	
PF16	30915+50n	

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(h) Option unit parameters

Servo amplifier Parameter No.	Buffer memory address	
	QD77MS2 QD77MS4	QD77MS16
Po01	30916+50n	Set with GX Works2
Po02	30917+50n	
Po03	30918+50n	
Po04	30919+50n	
Po05	30920+50n	
Po06	30921+50n	
Po07	30922+50n	
Po08	30923+50n	

Servo amplifier Parameter No.	Buffer memory address	
	QD77MS2 QD77MS4	QD77MS16
Po09	30924+50n	Set with GX Works2
Po10	30925+50n	
Po11	30926+50n	
Po12	30927+50n	
Po13	30928+50n	
Po14	30929+50n	
Po15	30930+50n	
Po16	30931+50n	

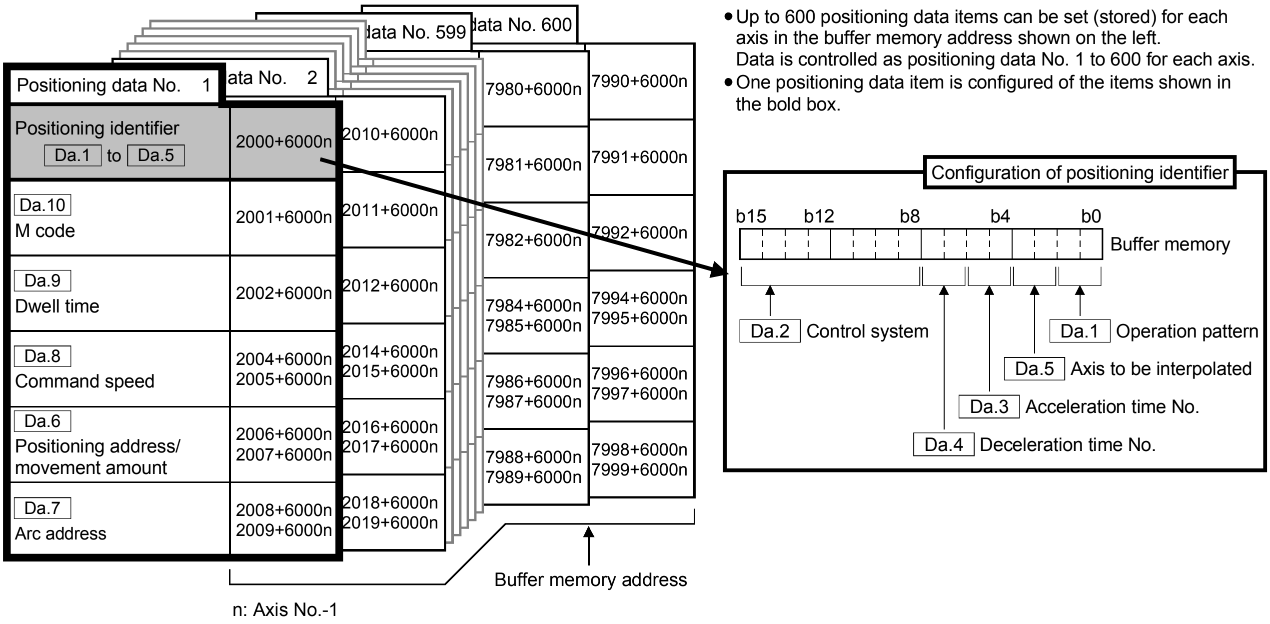
n: Axis No.-1

5.3 List of positioning data

Before explaining the positioning data setting items Da.1 to Da.10, Da.20 to Da.22 the configuration of the positioning data will be shown below.

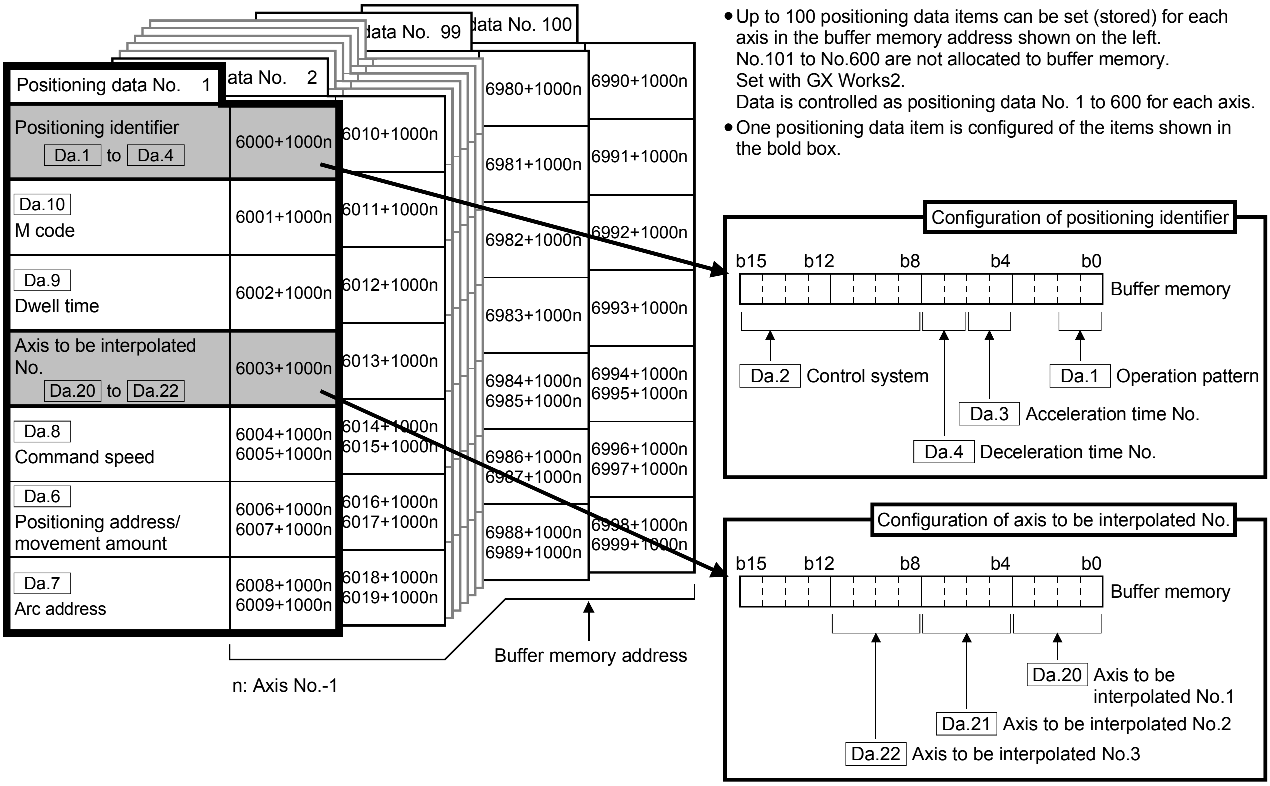
The positioning data stored in the buffer memory of Simple Motion module has the following type of configuration.

- QD77MS2/QD77MS4



- Up to 600 positioning data items can be set (stored) for each axis in the buffer memory address shown on the left.
  Data is controlled as positioning data No. 1 to 600 for each axis.
- One positioning data item is configured of the items shown in the bold box.

- QD77MS16



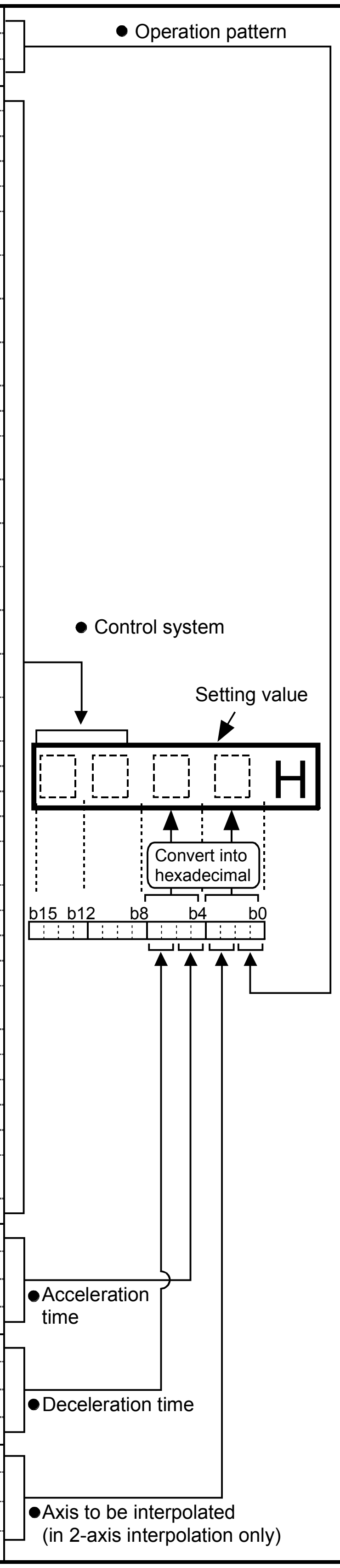
- Up to 100 positioning data items can be set (stored) for each axis in the buffer memory address shown on the left.
  No.101 to No.600 are not allocated to buffer memory.
  Set with GX Works2.
  Data is controlled as positioning data No. 1 to 600 for each axis.
- One positioning data item is configured of the items shown in the bold box.

The descriptions that follow relate to the positioning data set items Da.1 to Da.10, Da.20 to Da.22.
(The buffer memory addresses shown are those of the "positioning data No. 1".)

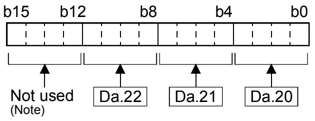
- Guide to buffer memory address
  In the buffer memory address, "n" in "6001+1000n", etc. indicates a value corresponding to axis No. such as the following table.

Axis No.	n	Axis No.	n	Axis No.	n	Axis No.	n
1	0	5	4	9	8	13	12
2	1	6	5	10	9	14	13
3	2	7	6	11	10	15	14
4	3	8	7	12	11	16	15

(Note-1): Calculate as follows for the buffer memory address corresponding to each axis.
(Example) For axis No. 16
6001+1000n (Da.10 M code)=6001+1000×15=21001
(Note-2): The range from axis No.1 to 2 (n=0 to 1) is valid in the QD77MS2.
(Note-3): The range from axis No.1 to 4 (n=0 to 3) is valid in the QD77MS4

Item		Setting value			Default value	Buffer memory address	
		Value set with GX Works2	Value set with sequence program			QD77MS2 QD77MS4	QD77MS16
Positioning identifier	Da.1 Operation pattern	00:Positioning complete	00		0000H	2000+6000n	6000+1000n
		01:Continuous positioning control	01				
		11:Continuous path control	11				
	Da.2 Control system	ABS1 :1-axis linear control (ABS)	01H				
		INC1 :1-axis linear control (INC)	02H				
		FEED1:1-axis fixed-feed control	03H				
		VF1 :1-axis speed control (forward run)	04H				
		VR1 :1-axis speed control (reverse run)	05H				
		VPF :Speed-position switching control (forward run)	06H				
		VPR :Speed-position switching control (reverse run)	07H				
		PVF : Position-speed switching control (forward run)	08H				
		PVR :Position-speed switching control (reverse run)	09H				
		ABS2 :2-axis linear interpolation control (ABS)	0AH				
		INC2 :2-axis linear interpolation control (INC)	0BH				
		FEED2:Fixed-feed control by 2-axis linear interpolation	0CH				
		ABS ⌒:Circular interpolation control with sub point specified (ABS)	0DH				
		INC ⌒:Circular interpolation control with sub point specified (INC)	0EH				
		ABS . :Circular interpolation control with center point specified (ABS, CW)	0FH				
		ABS . :Circular interpolation control with center point specified (ABS, CCW)	10H				
		INC . :Circular interpolation control with center point specified (INC, CW)	11H				
		INC . :Circular interpolation control with center point specified (INC, CCW)	12H				
		VF2 :2-axis speed control (forward run)	13H				
		VR2 :2-axis speed control (reverse run)	14H				
		ABS3 :3-axis linear interpolation control (ABS)	15H				
		INC3 :3-axis linear interpolation control (INC)	16H				
		FEED3:Fixed-feed control by 3-axis linear interpolation control	17H				
		VF3 :3-axis speed control (forward run)	18H				
		VR3 :3-axis speed control (reverse run)	19H				
		ABS4 :4-axis linear interpolation control (ABS)	1AH				
		INC4 :4-axis linear interpolation control (INC)	1BH				
		FEED4:Fixed-feed control by 4-axis linear interpolation control	1CH				
		VF4 :4-axis speed control (forward run)	1DH				
		VR4 :4-axis speed control (reverse run)	1EH				
		NOP :NOP instruction	80H				
		POS :Current value changing	81H				
		JUMP :JUMP instruction	82H				
		LOOP :Declares the beginning of LOOP to LEND section	83H				
		LEND :Declares the end of LOOP to LEND section	84H				
	Da.3 Acceleration time No.	0: Pr.9 Acceleration time 0	00				
		1: Pr.25 Acceleration time 1	01				
		2: Pr.26 Acceleration time 2	10				
		3: Pr.27 Acceleration time 3	11				
	Da.4 Deceleration time No.	0: Pr.10 Deceleration time 0	00				
		1: Pr.28 Deceleration time 1	01				
		2: Pr.29 Deceleration time 2	10				
		3: Pr.30 Deceleration time 3	11				
	Da.5 Axis to be interpolated QD77MS2 QD77MS4	0: Axis1	00				
		1: Axis 2	01				
		2: Axis 3	10				
		3: Axis 4	11				

n: Axis No.-1

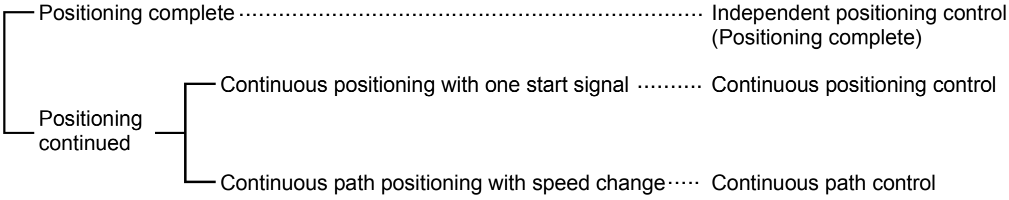
Item		Setting value, setting range			Default value	Buffer memory address	
		Value set with GX Works2		Value set with sequence program		QD77MS2 QD77MS4	QD77MS16
Da.6 Positioning address/ movement amount		The setting value range differs according to the "Da.2 Control system".			0	2006+6000n 2007+6000n	6006+1000n 6007+1000n
Da.7 Arc address					0	2008+6000n 2009+6000n	6008+1000n 6009+1000n
Da.8 Command speed		The setting value range differs depending on the "Pr.1 Unit setting".			0	2004+6000n 2005+6000n	6004+1000n 6005+1000n
		-1: Current speed (Speed set for previous positioning data No.)		-1			
Da.9 Dwell time/ JUMP destination positioning data No.	Dwell time JUMP destination positioning data No.	The setting value range differs according to the "Da.2 Control system".			0	2002+6000n	6002+1000n
Da.10 M code	M code Condition data No. Number of LOOP to LEND repetitions				0	2001+6000n	6001+1000n
Axis to be interpolated	Da.20 Axis to be interpolated No.1 QD77MS16 Da.21 Axis to be interpolated No.2 QD77MS16 Da.22 Axis to be interpolated No.3 QD77MS16	0: Axis 1 selected 1: Axis 2 selected 2: Axis 3 selected 3: Axis 4 selected 4: Axis 5 selected 5: Axis 6 selected 6: Axis 7 selected 7: Axis 8 selected 8: Axis 9 selected 9: Axis 10 selected A: Axis 11 selected B: Axis 12 selected C: Axis 13 selected D: Axis 14 selected E: Axis 15 selected F: Axis 16 selected	0H 1H 2H 3H 4H 5H 6H 7H 8H 9H AH BH CH DH EH FH	 (Note): Always "0" is set to the part not used.	0000H		6003+1000n

n: Axis No.-1

Da.1 Operation pattern

The operation pattern designates whether positioning of a certain data No. is to be ended with just that data, or whether the positioning for the next data No. is to be carried out in succession.

[Operation pattern]



1) Positioning complete .... Set to execute positioning to the designated address, and then complete positioning.

2) Continuous positioning control ..... Positioning is carried out successively in order of data Nos. with one start signal. The operation halts at each position indicated by a positioning data.

3) Continuous path control............... Positioning is carried out successively in order of data Nos. with one start signal. The operation does not stop at each positioning data.

Da.2 Control system

Set the "control system" for carrying out positioning control.

Note)
- When "JUMP instruction" is set for the control system, the "Da.9 Dwell time" and "Da.10 M code" setting details will differ.
- In case you selected "LOOP" as the control system, the "Da.10 M code" should be set differently from other cases.
- Refer to Chapter 9 "Major Positioning Control" for details on the control systems.
- If "degree" is set for "Pr.1 Unit setting", circular interpolation control cannot be carried out. (The "Circular interpolation not possible error" will occur when executed (error code: 535).)

Da.3 Acceleration time No.

Set which of "acceleration time 0 to 3" to use for the acceleration time during positioning.

0: Use the value set in "Pr.9 Acceleration time 0".

1: Use the value set in "Pr.25 Acceleration time 1".

2: Use the value set in "Pr.26 Acceleration time 2".

3: Use the value set in "Pr.27 Acceleration time 3".

Da.4 Deceleration time No.

Set which of "deceleration time 0 to 3" to use for the deceleration time during positioning.

0: Use the value set in "Pr.10 Deceleration time 0".

1: Use the value set in "Pr.28 Deceleration time 1".

2: Use the value set in "Pr.29 Deceleration time 2".

3: Use the value set in "Pr.30 Deceleration time 3".

Da.5 Axis to be interpolated QD77MS2 QD77MS4

Set the target axis (partner axis) for operations under the 2-axis interpolation control.
0: Selects the axis 1 as the target axis (partner axis).
1: Selects the axis 2 as the target axis (partner axis).
2: Selects the axis 3 as the target axis (partner axis).
3: Selects the axis 4 as the target axis (partner axis).

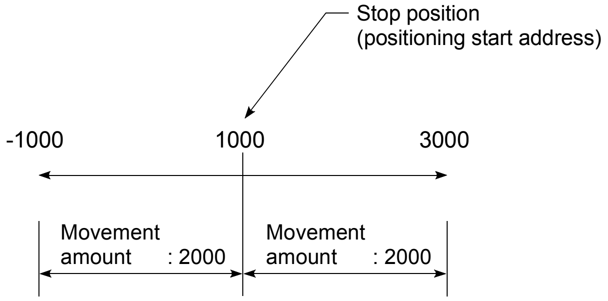
Note)
- Do not specify the own axis number or any number except the above. (If you do, the "Illegal interpolation description command error" will occur during the program execution (error code: 521).)
- This item does not need to be set in case 3 or 4-axis interpolation is selected.

Da.6 Positioning address/movement amount

Set the address to be used as the target value for positioning control.
The setting value range differs according to the "Da.2 Control system".
((1) to (4))

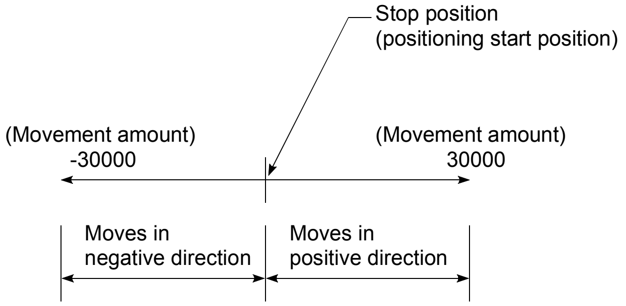
(1) Absolute (ABS) system, current value changing

- The setting value (positioning address) for the ABS system and current value changing is set with an absolute address (address from OP).



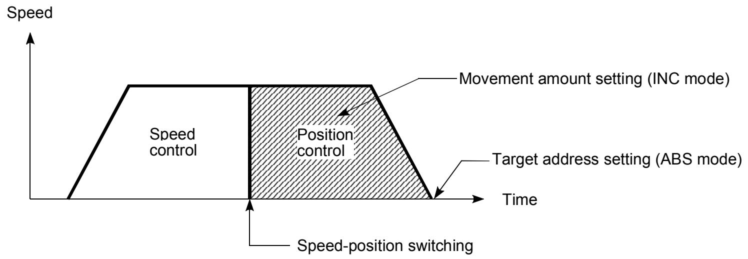
(2) Incremental (INC) system, fixed-feed 1, fixed-feed 2, fixed-feed 3, fixed-feed 4

- The setting value (movement amount) for the INC system is set as a movement amount with sign.
  When movement amount is positive: Moves in the positive direction (address increment direction)
  When movement amount is negative: Moves in the negative direction (address decrement direction)



(3) Speed-position switching control

- INC mode:
  Set the amount of movement after the switching from speed control to position control.
- ABS mode:
  Set the absolute address which will be the target value after speed control is switched to position control. (The unit is "degree" only)



(4) Position-speed switching control

- Set the amount of movement before the switching from position control to speed control.

■ When "Pr.1 Unit setting" is "mm"

The table below lists the control systems that require the setting of the positioning address or movement amount and the associated setting ranges.
(With any control system excluded from the table below, neither the positioning address nor the movement amount needs to be set.)

Da.2 setting value	Value set with GX Works2 (μm)	Value set with sequence program ∗1 (×10^{-1}μm)
ABS Linear 1 : 01H ABS Linear 2 : 0AH ABS Linear 3 : 15H ABS Linear 4 : 1AH Current value changing : 81H	◊ Set the address -214748364.8 to 214748364.7	◊ Set the address -2147483648 to 2147483647
INC Linear 1 : 02H INC Linear 2 : 0BH INC Linear 3 : 16H INC Linear 4 : 1BH Fixed-feed 1 : 03H Fixed-feed 2 : 0CH Fixed-feed 3 : 17H Fixed-feed 4 : 1CH	◊ Set the movement amount -214748364.8 to 214748364.7	◊ Set the movement amount -2147483648 to 2147483647
Forward run speed/position : 06H Reverse run speed/position : 07H Forward run position/speed : 08H Reverse run position/speed : 09H	◊ Set the movement amount 0 to 214748364.7	◊ Set the movement amount 0 to 2147483647
ABS circular sub : 0DH ABS circular right : 0FH ABS circular left : 10H	◊ Set the address -214748364.8 to 214748364.7	◊ Set the address -2147483648 to 2147483647
INC circular sub : 0EH INC circular right : 11H INC circular left : 12H	◊ Set the movement amount -214748364.8 to 214748364.7	◊ Set the movement amount -2147483648 to 2147483647

∗1: Set an integer because the sequence program cannot handle fractions.
(The value will be converted properly within the system.)

■ When "Pr.1 Unit setting" is "degree"

The table below lists the control systems that require the setting of the positioning address or movement amount and the associated setting ranges.
(With any control system excluded from the table below, neither the positioning address nor the movement amount needs to be set.)

Da.2 setting value	Value set with GX Works2 (degree)	Value set with sequence program ∗1 ($\times 10^{-5}$ degree)
ABS Linear 1 : 01H ABS Linear 2 : 0AH ABS Linear 3 : 15H ABS Linear 4 : 1AH Current value changing : 81H	◊ Set the address 0 to 359.99999	◊ Set the address 0 to 35999999
INC Linear 1 : 02H INC Linear 2 : 0BH INC Linear 3 : 16H INC Linear 4 : 1BH Fixed-feed 1 : 03H Fixed-feed 2 : 0CH Fixed-feed 3 : 17H Fixed-feed 4 : 1CH	◊ Set the movement amount -21474.83648 to 21474.83647	◊ Set the movement amount -2147483648 to 2147483647 ∗2
Forward run speed/position : 06H Reverse run speed/position : 07H	In INC mode ◊ Set the movement amount 0 to 21474.83647 In ABS mode ◊ Set the address 0 to 359.99999	In INC mode ◊ Set the movement amount 0 to 2147483647 In ABS mode ◊ Set the address 0 to 35999999
Forward run position/speed : 08H Reverse run position/speed : 09H	◊ Set the movement amount 0 to 21474.83647	◊ Set the movement amount 0 to 2147483647

∗1: Set an integer because the sequence program cannot handle fractions.
(The value will be converted properly within the system.)

∗2: When the software stroke limit is valid, -35999999 to 35999999 is set.

■ When "Pr.1 Unit setting" is "PLS"

The table below lists the control systems that require the setting of the positioning address or movement amount and the associated setting ranges.
(With any control system excluded from the table below, neither the positioning address nor the movement amount needs to be set.)

Da.2 setting value	Value set with GX Works2 (PLS)	Value set with sequence program ＊1 (PLS)
ABS Linear 1 : 01H ABS Linear 2 : 0AH ABS Linear 3 : 15H ABS Linear 4 : 1AH Current value changing : 81H	◊ Set the address -2147483648 to 2147483647	◊ Set the address -2147483648 to 2147483647
INC Linear 1 : 02H INC Linear 2 : 0BH INC Linear 3 : 16H INC Linear 4 : 1BH Fixed-feed 1 : 03H Fixed-feed 2 : 0CH Fixed-feed 3 : 17H Fixed-feed 4 : 1CH	◊ Set the movement amount -2147483648 to 2147483647	◊ Set the movement amount -2147483648 to 2147483647
Forward run speed/position : 06H Reverse run speed/position : 07H Forward run position/speed : 08H Reverse run position/speed : 09H	◊ Set the movement amount 0 to 2147483647	◊ Set the movement amount 0 to 2147483647
ABS circular sub : 0DH ABS circular right : 0FH ABS circular left : 10H	◊ Set the address -2147483648 to 2147483647	◊ Set the address -2147483648 to 2147483647
INC circular sub : 0EH INC circular right : 11H INC circular left : 12H	◊ Set the movement amount -2147483648 to 2147483647	◊ Set the movement amount -2147483648 to 2147483647

■ When "Pr.1 Unit setting" is "inch"

The table below lists the control systems that require the setting of the positioning address or movement amount and the associated setting ranges.
(With any control system excluded from the table below, neither the positioning address nor the movement amount needs to be set.)

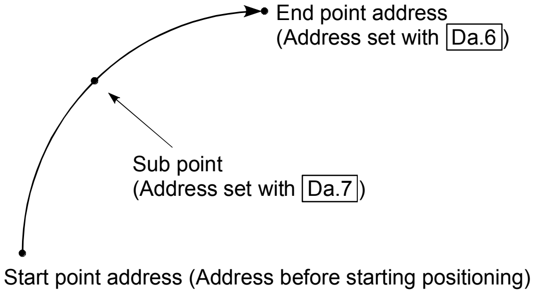
Da.2 setting value	Value set with GX Works2 (inch)	Value set with sequence program ∗1 ($\times 10^{-5}$ inch)
ABS Linear 1 : 01H ABS Linear 2 : 0AH ABS Linear 3 : 15H ABS Linear 4 : 1AH Current value changing : 81H	◊ Set the address -21474.83648 to 21474.83647	◊ Set the address -2147483648 to 2147483647
INC Linear 1 : 02H INC Linear 2 : 0BH INC Linear 3 : 16H INC Linear 4 : 1BH Fixed-feed 1 : 03H Fixed-feed 2 : 0CH Fixed-feed 3 : 17H Fixed-feed 4 : 1CH	◊ Set the movement amount -21474.83648 to 21474.83647	◊ Set the movement amount -2147483648 to 2147483647
Forward run speed/position : 06H Reverse run speed/position : 07H Forward run position/speed : 08H Reverse run position/speed : 09H	◊ Set the movement amount 0 to 21474.83647	◊ Set the movement amount 0 to 2147483647
ABS circular sub : 0DH ABS circular right : 0FH ABS circular left : 10H	◊ Set the address -21474.83648 to 21474.83647	◊ Set the address -2147483648 to 2147483647
INC circular sub : 0EH INC circular right : 11H INC circular left : 12H	◊ Set the movement amount -21474.83648 to 21474.83647	◊ Set the movement amount -2147483648 to 2147483647

∗1: Set an integer because the sequence program cannot handle fractions.
(The value will be converted properly within the system.)

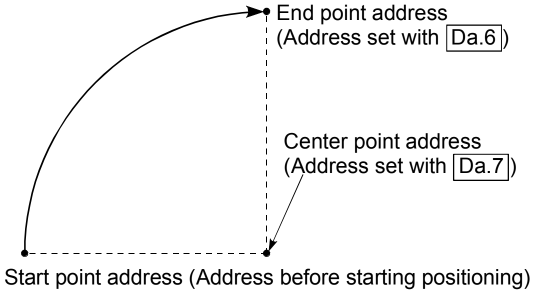
Da.7 Arc address

The arc address is data required only when carrying out circular interpolation control.

(1) When carrying out circular interpolation with sub point designation, set the sub point (passing point) address as the arc address.
(2) When carrying out circular interpolation with center point designation, set the center point address of the arc as the arc address.



<(1) Circular interpolation with sub point designation>



<(2) Circular interpolation with center point designation>

When not carrying out circular interpolation control, the value set in "Da.7 Arc address" will be invalid.

■ When "Pr.1 Unit setting" is "mm"

The table below lists the control systems that require the setting of the arc address and shows the setting range.
(With any control system excluded from the table below, the arc address does not need to be set.)

Da.2 setting value	Value set with GX Works2 (μm)	Value set with sequence program ∗1 (×10^{-1}μm)
ABS circular sub : 0DH ABS circular right : 0FH ABS circular left : 10H	◊ Set the address -214748364.8 to 214748364.7 ∗2	◊ Set the address -2147483648 to 2147483647
INC circular sub : 0EH INC circular right : 11H INC circular left : 12H	◊ Set the movement amount -214748364.8 to 214748364.7 ∗2	◊ Set the movement amount -2147483648 to 2147483647 ∗2

∗1: Set an integer because the sequence program cannot handle fractions.
(The value will be converted properly within the system.)

∗2: Note that the maximum radius that circular interpolation control is possible is 536870912 (×10^{-1}μm), although the setting value can be input within the range shown in the above table, as an arc address.

■ When "Pr.1 Unit setting" is "degree"

No control system requires the setting of the arc address by "degree".

■ When "Pr.1 Unit setting" is "PLS"

The table below lists the control systems that require the setting of the arc address and shows the setting range.
(With any control system excluded from the table below, the arc address does not need to be set.)

Da.2 setting value	Value set with GX Works2 (PLS)	Value set with sequence program ∗1 (PLS)
ABS circular sub : 0DH ABS circular right : 0FH ABS circular left : 10H	◊ Set the address -2147483648 to 2147483647 ∗1	◊ Set the address -2147483648 to 2147483647
INC circular sub : 0EH INC circular right : 11H INC circular left : 12H	◊ Set the movement amount -2147483648 to 2147483647 ∗1	◊ Set the movement amount -2147483648 to 2147483647 ∗1

∗1: Note that the maximum radius that circular interpolation control is possible is 536870912 (PLS), although the setting value can be input within the range shown in the above table, as an arc address.

■ When "Pr.1 Unit setting" is "inch"

The table below lists the control systems that require the setting of the arc address and shows the setting range.
(With any control system excluded from the table below, the arc address does not need to be set.)

Da.2 setting value	Value set with GX Works2 (inch)	Value set with sequence program ∗1 ($\times 10^{-5}$ inch)
ABS circular sub : 0DH ABS circular right : 0FH ABS circular left : 10H	◊ Set the address -21474.83648 to 21474.83647 ∗2	◊ Set the address -2147483648 to 2147483647
INC circular sub : 0EH INC circular right : 11H INC circular left : 12H	◊ Set the movement amount -21474.83648 to 21474.83647 ∗2	◊ Set the movement amount -2147483648 to 2147483647 ∗2

∗1: Set an integer because the sequence program cannot handle fractions.
(The value will be converted properly within the system.)

∗2: Note that the maximum radius that circular interpolation control is possible is 536870912 ($\times 10^{-5}$ inch), although the setting value can be input within the range shown in the above table, as an arc address.

Da.8 Command speed

Set the command speed for positioning.

(1) If the set command speed exceeds "Pr.8 Speed limit value", positioning will be carried out at the speed limit value.

(2) If "-1" is set for the command speed, the current speed (speed set for previous positioning data No.) will be used for positioning control. Use the current speed for uniform speed control, etc. If "-1" is set for continuing positioning data, and the speed is changed, the following speed will also change.

(Note that when starting positioning, if the "-1" speed is set for the positioning data that carries out positioning control first, the error "Command speed is not set"(error code: 503) will occur, and the positioning will not start.
Refer to Section 16.5 "List of errors" for details on the errors.)

Pr.1 setting value	Value set with GX Works2 (unit)	Value set with sequence program (unit)
0 : mm	0.01 to 20000000.00 (mm/min)	1 to 2000000000 ($\times 10^{-2}$mm/min)
1 : inch	0.001 to 2000000.000 (inch/min)	1 to 2000000000 ($\times 10^{-3}$inch/min)
2 : degree	0.001 to 2000000.000 (degree/min) ∗1	1 to 2000000000 ($\times 10^{-3}$degree/min) ∗2
3 : PLS	1 to 1000000000 (PLS/s)	1 to 1000000000 (PLS/s)

∗1: The command speed setting range is 0.001 to 2000000.000[degree/min], but it will be decupled and become 0.01 to 20000000.00[degree/min] by setting "Pr.83 Speed control 10 x multiplier setting for degree axis" to valid.

∗2: The command speed setting range is 1 to 2000000000($\times 10^{-3}$degree/min), but it will be decupled and become 1 to 2000000000 ($\times 10^{-2}$degree/min) by setting "Pr.83 Speed control 10 x multiplier setting for degree axis" to valid.

Da.9 Dwell time/JUMP designation positioning data No.

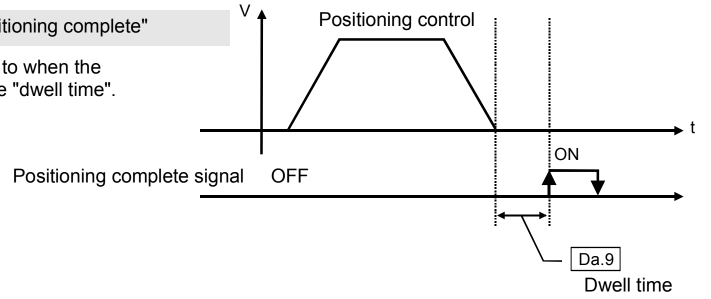
Set the "dwell time" or "positioning data No." corresponding to the "Da.2 Control system".

- When a method other than "JUMP instruction" is set for "Da.2 Control system"
  ..... Set the "dwell time".
- When "JUMP instruction" is set for "Da.2 Control system"
  ..... Set the "positioning data No." for the JUMP destination.

When the "dwell time" is set, the setting details of the "dwell time" will be as follows according to "Da.1 Operation pattern".

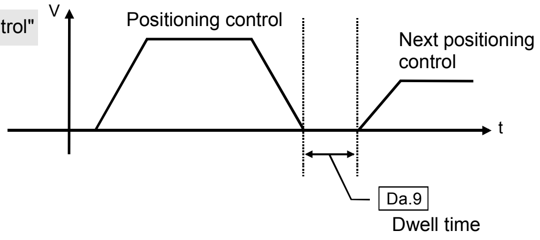
1) When "Da.1 Operation pattern" in "00: Positioning complete"

- Set the time from when the positioning ends to when the "positioning complete signal" turns ON as the "dwell time".



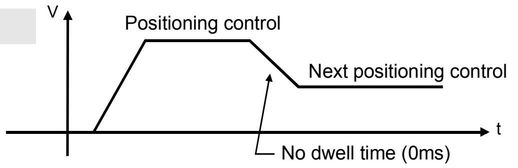
2) When "Da.1 Operation pattern" is "01: Continuous positioning control"

- Set the time from when positioning control ends to when the next positioning control starts as the "dwell time".



3) When "Da.1 Operation pattern" is "11: Continuous path control"

- The setting value is irrelevant to the control. (The "dwell time" is 0ms.)



Da.2 setting value	Setting item	Value set with GX Works2	Value set with sequence program
JUMP instruction: 82H	Positioning data No.	1 to 600	1 to 600
Other than JUMP instruction	Dwell time	0 to 65535 (ms)	0 to 65535 (ms)

Da.10 M code (or condition data No./Number of LOOP to LEND repetitions)

Set an "M code", a "condition data No.", or the "Number of LOOP to LEND repetitions" depending on how the "Da.2 Control system" is set. ＊1

- If a method other than "JUMP instruction" and "LOOP" is selected as the "Da.2 Control system"
  .... Set an "M code".
  If no "M code" needs to be output, set "0" (default value).
- If "JUMP instruction" or "LOOP" is selected as the "Da.2 Control system"
  .... Set the "condition data No." for JUMP.
  0 : Unconditional JUMP to the positioning data specified by Da.9.
  1 to 10 : JUMP performed according to the condition data No. specified (a number between 1 and 10).
  Make sure that you specify the number of LOOP to LEND repetitions by a number other than "0". The "Control system LOOP setting error" will occur if you specify "0". (error code: 545)

＊1: The condition data specifies the condition for the JUMP instruction to be executed.
(A JUMP will take place when the condition is satisfied.)

Da.2 setting value	Setting item	Value set with GX Works2	Value set with sequence program
JUMP instruction: 82H	Condition data No.	0 to 10	0 to 10
Other than JUMP instruction	M code	0 to 65535	0 to 65535
LOOP: 83H	Repetition count	1 to 65535	1 to 65535

Da.20 Axis to be interpolated No.1 to Da.22 Axis to be interpolated No.3

QD77MS16

Set the axis to be interpolated to execute the 2 to 4-axis interpolation operation.

- 2-axis interpolation......... Set the target axis number in "Da.20 Axis to be interpolated No.1".
- 3-axis interpolation......... Set the target axis number in "Da.20 Axis to be interpolated No.1" and "Da.21 Axis to be interpolated No.2".
- 4-axis interpolation......... Set the target axis number in "Da.20 Axis to be interpolated No.1" to "Da.22 Axis to be interpolated No.3".

Set the axis set as axis to be interpolated.

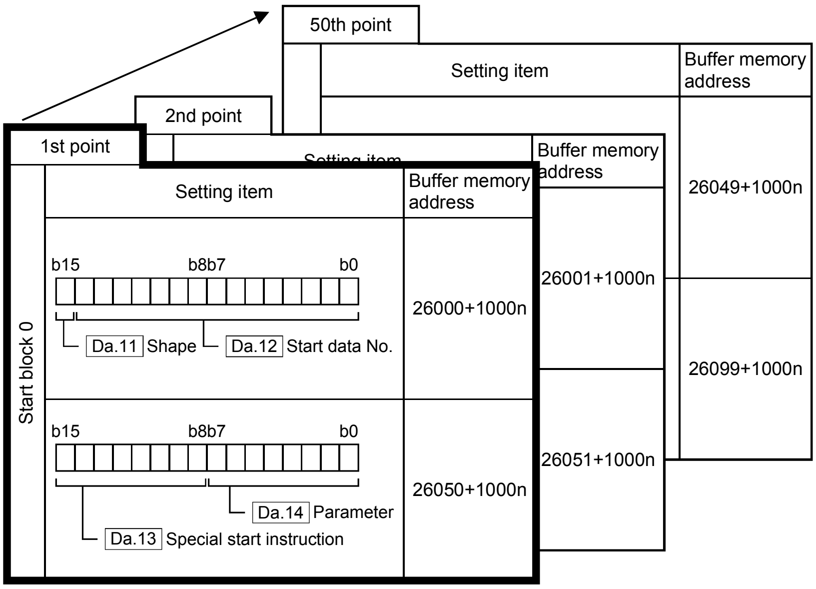
0: Axis 1
1: Axis 2
2: Axis 3
3: Axis 4
4: Axis 5
5: Axis 6
6: Axis 7
7: Axis 8
8: Axis 9
9: Axis 10
A: Axis 11
B: Axis 12
C: Axis 13
D: Axis 14
E: Axis 15
F: Axis 16

Note)
- Do not specify the own axis number. (If you do, the "Illegal interpolation description command error" will occur during the program execution (error code: 521).)
- When the same axis number or axis number of own axis is set to multiple axis to be interpolated number, the "Illegal interpolation description command error" will occur during the program execution (error code: 521).
- Do not specify the axis to be interpolated No.2 and axis to be interpolated No.3 for 2-axis interpolation, and do not specify the axis to be interpolated No.3 for 3-axis interpolation.
  The setting value is ignored.

5.4 List of block start data

The illustrations below show the organization of the block start data stored in the buffer memory of Simple Motion module. The block start data setting items Da.11 to Da.14 are explained in the pages that follow.

- QD77MS2/QD77MS4

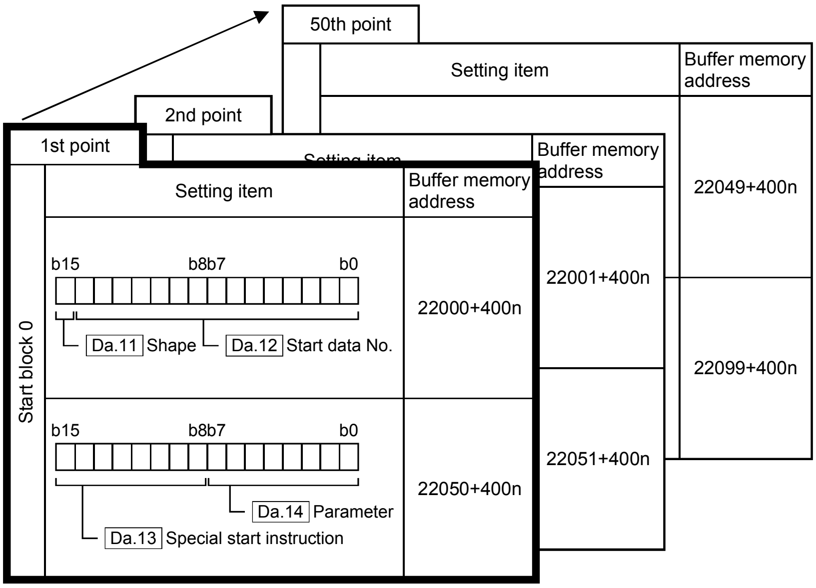


- Up to 50 block start data points can be set (stored) for each axis in the buffer memory addresses shown on the left.
- Items in a single unit of block start data are shown included in a bold frame.
- Each axis has five start blocks (block Nos. 0 to 4).

(Note): For information on the organization of the buffer memory addresses assigned to the start blocks 1 to 4, refer to Appendix 1 "List of buffer memory addresses".

n: Axis No.-1

- QD77MS16



- Up to 50 block start data points can be set (stored) for each axis in the buffer memory addresses shown on the left.
- Items in a single unit of block start data are shown included in a bold frame.
- Each axis has five start blocks (block Nos. 0 to 4).
  Start block 2 to 4 are not allocated to buffer memory.
  Set with GX Works2.

(Note): For information on the organization of the buffer memory addresses assigned to the start block 1, refer to Appendix 1 "List of buffer memory addresses".

n: Axis No.-1

The pages that follow explain the block start data setting items Da.11 to Da.14.
(The buffer memory addresses shown are those of the "1st point block start data (block No. 7000)".)

- Guide to buffer memory address
  In the buffer memory address, "n" in "22000+400n", etc. indicates a value corresponding to axis No. such as the following table.

Axis No.	n	Axis No.	n	Axis No.	n	Axis No.	n
1	0	5	4	9	8	13	12
2	1	6	5	10	9	14	13
3	2	7	6	11	10	15	14
4	3	8	7	12	11	16	15

(Note-1): Calculate as follows for the buffer memory address corresponding to each axis.
(Example) For axis No. 16
22000+400n (Da.11 Shape)=22000+400×15=28000
(Note-2): The range from axis No.1 to 2 (n=0 to 1) is valid in the QD77MS2.
(Note-3): The range from axis No.1 to 4 (n=0 to 3) is valid in the QD77MS4.

REMARK

To perform an high-level positioning control using block start data, set a number between 7000 and 7004 to the "Cd.3 Positioning start No." and use the "Cd.4 Positioning starting point No." to specify a point number between 1 and 50, a position counted from the beginning of the block.
The number between 7000 and 7004 specified here is called the "block No.".
With the Simple Motion module, up to 50 "block start data" points and up to 10 "condition data" items can be assigned to each "block No.".

- QD77MS2

Block No. *1	Axis	Block start data	Condition	Buffer memory	GX Works2
7000	Axis 1	Start block 0	Condition data (1 to 10)	Supports the settings	Supports the settings
	Axis 2		Condition data (1 to 10)		
7001	Axis 1	Start block 1	Condition data (1 to 10)		
	Axis 2		Condition data (1 to 10)		
7002	Axis 1	Start block 2	Condition data (1 to 10)		
	Axis 2		Condition data (1 to 10)		
7003	Axis 1	Start block 3	Condition data (1 to 10)		
	Axis 2		Condition data (1 to 10)		
7004	Axis 1	Start block 4	Condition data (1 to 10)		
	Axis 2		Condition data (1 to 10)		

*1: Setting cannot be made when the "Pre-reading start function" is used. If you set any of Nos. 7000 to 7004 and perform the Pre-reading start function, "Outside start No. range error (error code: 543)" will occur.
(For details, refer to Section 13.7.7 "Pre-reading start function".)

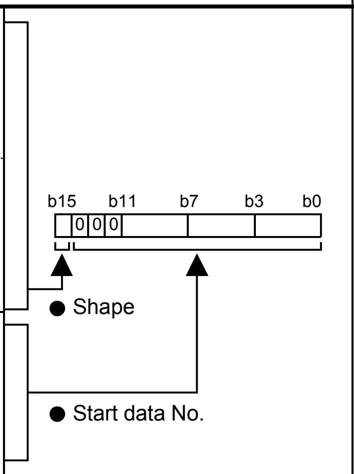
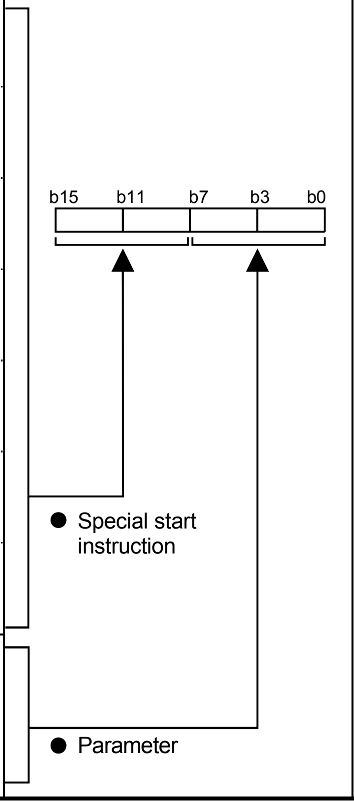
- QD77MS4

Block No. ∗1	Axis	Block start data	Condition	Buffer memory	GX Works2
7000	Axis 1	Start block 0	Condition data (1 to 10)	Supports the settings	Supports the settings
	Axis 2		Condition data (1 to 10)		
	Axis 3		Condition data (1 to 10)		
	Axis 4		Condition data (1 to 10)		
7001	Axis 1	Start block 1	Condition data (1 to 10)		
	Axis 2		Condition data (1 to 10)		
	Axis 3		Condition data (1 to 10)		
	Axis 4		Condition data (1 to 10)		
7002	Axis 1	Start block 2	Condition data (1 to 10)		
	Axis 2		Condition data (1 to 10)		
	Axis 3		Condition data (1 to 10)		
	Axis 4		Condition data (1 to 10)		
7003	Axis 1	Start block 3	Condition data (1 to 10)		
	Axis 2		Condition data (1 to 10)		
	Axis 3		Condition data (1 to 10)		
	Axis 4		Condition data (1 to 10)		
7004	Axis 1	Start block 4	Condition data (1 to 10)		
	Axis 2		Condition data (1 to 10)		
	Axis 3		Condition data (1 to 10)		
	Axis 4		Condition data (1 to 10)		

- QD77MS16

Block No. ∗1	Axis	Block start data	Condition	Buffer memory	GX Works2
7000	Axis 1	Start block 0	Condition data (1 to 10)	Supports the settings	Supports the settings
	to		to		
	Axis 16		Condition data (1 to 10)		
7001	Axis 1	Start block 1	Condition data (1 to 10)		
	to		to		
	Axis 16		Condition data (1 to 10)		
7002	Axis 1	Start block 2	Condition data (1 to 10)		
	to		to		
	Axis 16		Condition data (1 to 10)		
7003	Axis 1	Start block 3	Condition data (1 to 10)		
	to		to		
	Axis 16		Condition data (1 to 10)		
7004	Axis 1	Start block 4	Condition data (1 to 10)		
	to		to		
	Axis 16		Condition data (1 to 10)		

∗1: Setting cannot be made when the "Pre-reading start function" is used. If you set any of Nos. 7000 to 7004 and perform the Pre-reading start function, "Outside start No. range error (error code: 543)" will occur.
(For details, refer to Section 13.7.7 "Pre-reading start function".)

Item	Setting value			Default value	Buffer memory address	
	Value set with GX Works2	Value set with sequence program			QD77MS2 QD77MS4	QD77MS16
Da.11 Shape	0 : End	0		0000H	26000+1000n	22000+400n
	1 : Continue	1				
Da.12 Start data No.	Positioning data No.: 1 to 600 (01H to 258H)	01H to 258H				
Da.13 Special start instruction	0 : Block start (normal start)	00H		0000H	26050+1000n	22050+400n
	1 : Condition start	01H				
	2 : Wait start	02H				
	3 : Simultaneous start	03H				
	4 : FOR loop	04H				
	5 : FOR condition	05H				
	6 : NEXT start	06H				
Da.14 Parameter	Condition data No.: 1 to 10 (01H to 0AH) Number of repetitions: 0 to 255 (00H to FFH)	00H to FFH				

n: Axis No.-1

Da.11 Shape

Set whether to carry out only the local "block start data" and then end control, or to execute the "block start data" set in the next point.

Setting value	Setting details
0 : End	Execute the designated point's "block start data", and then complete the control.
1 : Continue	Execute the designated point's "block start data", and after completing control, execute the next point's "block start data".

Da.12 Start data No.

Set the "positioning data No." designated with the "block start data".

Da.13 Special start instruction

Set the "special start instruction" for using "high-level positioning control". (Set how to start the positioning data set in "Da.12 Start data No.".)

Setting value	Setting details
00H: Block start (Normal start)	Execute the random block positioning data in the set order with one start.
01H: Condition start	Carry out the condition judgment set in "condition data" for the designated positioning data, and when the conditions are established, execute the "block start data". If not established, ignore that "block start data", and then execute the next point's "block start data".
02H: Wait start	Carry out the condition judgment set in "condition data" for the designated positioning data, and when the conditions are established, execute the "block start data". If not established, stop the control (wait) until the conditions are established.
03H: Simultaneous start	Simultaneous execute (output command at same timing) the positioning data with the No. designated for the axis designated in the "condition data". Up to four axes can start simultaneously.
04H: Repeated start (FOR loop)	Repeat the program from the block start data with the "FOR loop" to the block start data with "NEXT" for the designated number of times.
05H: Repeated start (FOR condition)	Repeat the program from the block start data with the "FOR condition" to the block start data with "NEXT" until the conditions set in the "condition data" are established.
06H: NEXT start	Set the end of the repetition when "04H: Repetition start (FOR loop)" or "05H: Repetition start (FOR condition)" is set.

Refer to Chapter 10 "High-Level Positioning Control" for details on the control.

Da.14 Parameter

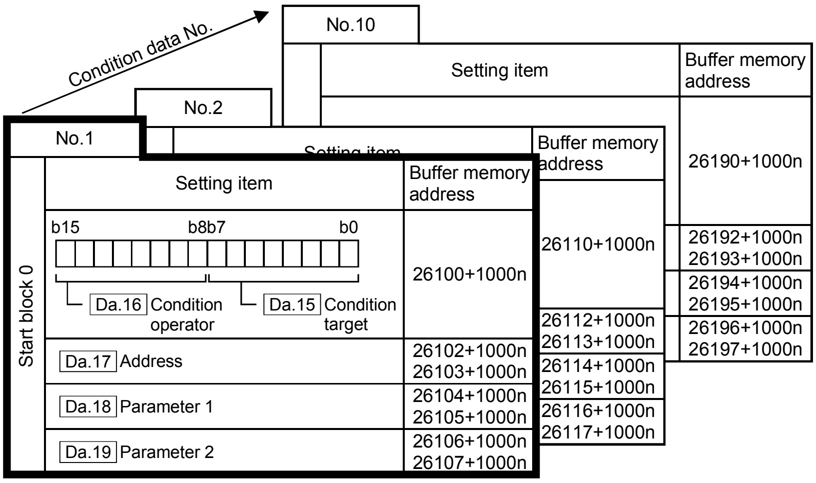
Set the value as required for "Da.13 Special start instruction".

Da.13 Special start instruction	Setting value	Setting details
Block start (Normal start)	–	Not used. (There is no need to set.)
Condition start	1 to 10	Set the condition data No. (Data No. of "condition data" is set up for the condition judgment.)
Wait start		
Simultaneous start		
Repeated start (FOR loop)	0 to 255	Set the number of repetitions.
Repeated start (FOR condition)	1 to 10	Set the condition data No. (Data No. of "condition data" is set up for the condition judgment.)

5.5 List of condition data

The illustrations below show the organization of the condition data stored in the buffer memory of Simple Motion module. The condition data setting items Da.15 to Da.19 and Da.23 to Da.26 are explained in the pages that follow.

- QD77MS2/QD77MS4

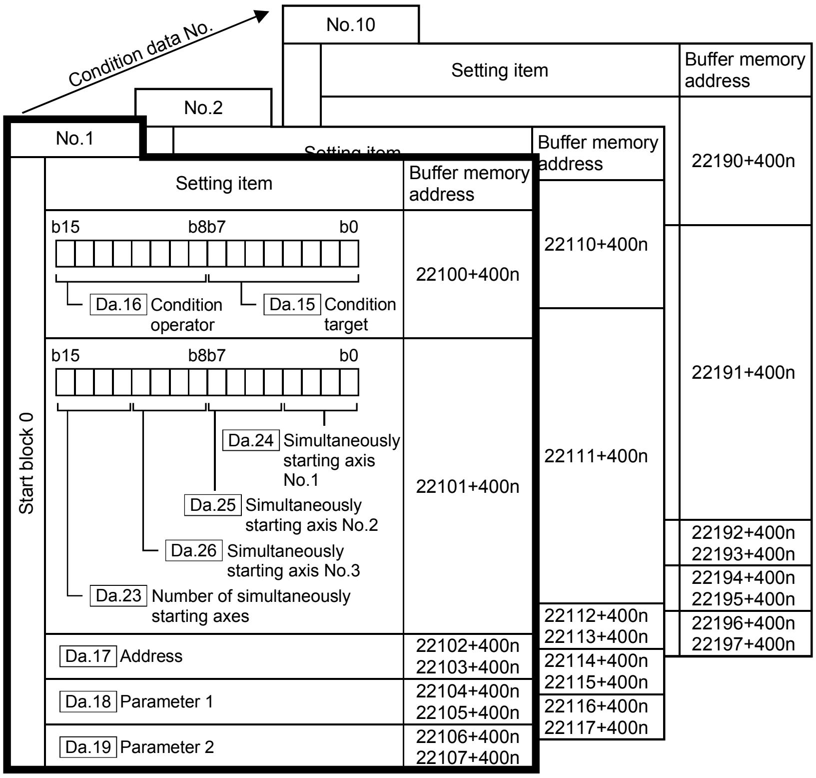


n: Axis No.-1

- Up to 10 condition data points can be set (stored) for each axis in the buffer memory addresses shown on the left.
- Items in a single unit of condition data are shown included in a bold frame.
- Each axis has five start blocks (block Nos. 0 to 4).

(Note): For information on the organization of the buffer memory addresses assigned to the start blocks 1 to 4, refer to Appendix 1 "List of buffer memory addresses".

- QD77MS16



n: Axis No.-1

- Up to 10 condition data points can be set (stored) for each axis in the buffer memory addresses shown on the left.
- Items in a single unit of condition data are shown included in a bold frame.
- Each axis has five start blocks (block Nos. 0 to 4).
  Start block 2 to 4 are not allocated to buffer memory.
  Set with GX Works2.

(Note): For information on the organization of the buffer memory addresses assigned to the start block 1, refer to Appendix 1 "List of buffer memory addresses".

The pages that follow explain the condition data setting items Da.15 to Da.19 and Da.23 to Da.26.
(The buffer memory addresses shown are those of the "condition data No. 1 (block No. 7000)".)

- Guide to buffer memory address
  In the buffer memory address, "n" in "22100+400n", etc. indicates a value corresponding to axis No. such as the following table.

Axis No.	n	Axis No.	n	Axis No.	n	Axis No.	n
1	0	5	4	9	8	13	12
2	1	6	5	10	9	14	13
3	2	7	6	11	10	15	14
4	3	8	7	12	11	16	15

(Note-1): Calculate as follows for the buffer memory address corresponding to each axis.
(Example) For axis No. 16
22100+400n (Da.16 Condition operator)=22100+400×15=28100

(Note-2): The range from axis No.1 to 2 (n=0 to 1) is valid in the QD77MS2.

(Note-3): The range from axis No.1 to 4 (n=0 to 3) is valid in the QD77MS4.

REMARK

To perform an high-level positioning control using block start data, set a number between 7000 and 7004 to the "Cd.3 Positioning start No." and use the "Cd.4 Positioning starting point No." to specify a point number between 1 and 50, a position counted from the beginning of the block.
The number between 7000 and 7004 specified here is called the "block No.".
With the Simple Motion module, up to 50 "block start data" points and up to 10 "condition data" items can be assigned to each "block No.".

- QD77MS2

Block No. ＊1	Axis	Block start data	Condition	Buffer memory	GX Works2
7000	Axis 1	Start block 0	Condition data (1 to 10)	Supports the settings	Supports the settings
	Axis 2		Condition data (1 to 10)		
7001	Axis 1	Start block 1	Condition data (1 to 10)		
	Axis 2		Condition data (1 to 10)		
7002	Axis 1	Start block 2	Condition data (1 to 10)		
	Axis 2		Condition data (1 to 10)		
7003	Axis 1	Start block 3	Condition data (1 to 10)		
	Axis 2		Condition data (1 to 10)		
7004	Axis 1	Start block 4	Condition data (1 to 10)		
	Axis 2		Condition data (1 to 10)		

＊1: Setting cannot be made when the "Pre-reading start function" is used. If you set any of Nos. 7000 to 7004 and perform the Pre-reading start function, "Outside start No. range error (error code: 543)" will occur.
(For details, refer to Section 13.7.7 "Pre-reading start function".)

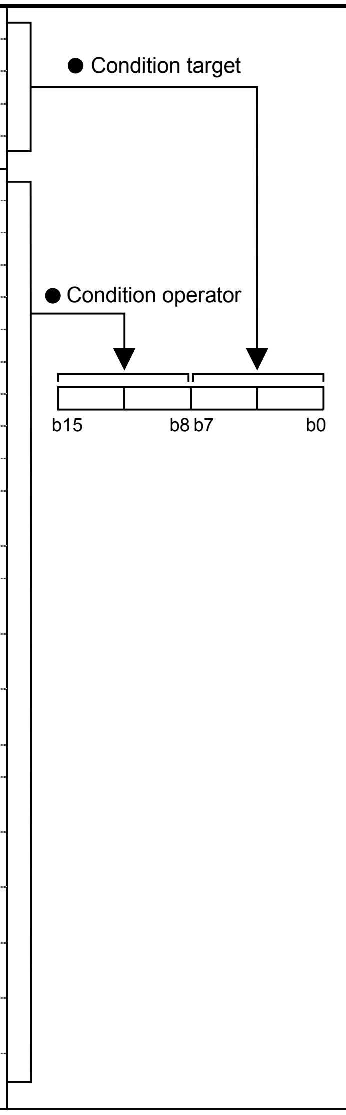
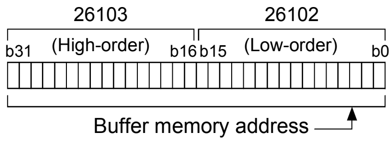
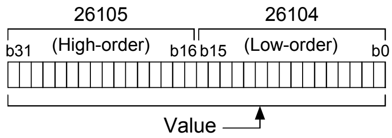
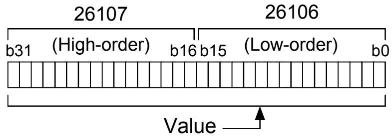
- QD77MS4

Block No. ＊1	Axis	Block start data	Condition	Buffer memory	GX Works2
7000	Axis 1	Start block 0	Condition data (1 to 10)	Supports the settings	Supports the settings
	Axis 2		Condition data (1 to 10)		
	Axis 3		Condition data (1 to 10)		
	Axis 4		Condition data (1 to 10)		
7001	Axis 1	Start block 1	Condition data (1 to 10)		
	Axis 2		Condition data (1 to 10)		
	Axis 3		Condition data (1 to 10)		
	Axis 4		Condition data (1 to 10)		
7002	Axis 1	Start block 2	Condition data (1 to 10)		
	Axis 2		Condition data (1 to 10)		
	Axis 3		Condition data (1 to 10)		
	Axis 4		Condition data (1 to 10)		
7003	Axis 1	Start block 3	Condition data (1 to 10)		
	Axis 2		Condition data (1 to 10)		
	Axis 3		Condition data (1 to 10)		
	Axis 4		Condition data (1 to 10)		
7004	Axis 1	Start block 4	Condition data (1 to 10)		
	Axis 2		Condition data (1 to 10)		
	Axis 3		Condition data (1 to 10)		
	Axis 4		Condition data (1 to 10)		

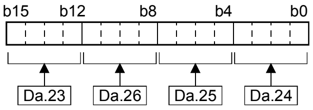
- QD77MS16

Block No. ＊1	Axis	Block start data	Condition	Buffer memory	GX Works2
7000	Axis 1	Start block 0	Condition data (1 to 10)	Supports the settings	Supports the settings
	to		to		
	Axis 16		Condition data (1 to 10)		
7001	Axis 1	Start block 1	Condition data (1 to 10)		
	to		to		
	Axis 16		Condition data (1 to 10)		
7002	Axis 1	Start block 2	Condition data (1 to 10)		
	to		to		
	Axis 16		Condition data (1 to 10)		
7003	Axis 1	Start block 3	Condition data (1 to 10)		
	to		to		
	Axis 16		Condition data (1 to 10)		
7004	Axis 1	Start block 4	Condition data (1 to 10)		
	to		to		
	Axis 16		Condition data (1 to 10)		

＊1: Setting cannot be made when the "Pre-reading start function" is used. If you set any of Nos. 7000 to 7004 and perform the Pre-reading start function, "Outside start No. range error (error code: 543)" will occur.
(For details, refer to Section 13.7.7 "Pre-reading start function".)

Item		Setting value			Default value	Buffer memory address	
		Value set with GX Works2	Value set with sequence program			QD77MS2 QD77MS4	QD77MS16
Condition identifier	Da.15 Condition target	01 : Device X	01H		0000H	26100+1000n	22100+400n
		02 : Device Y	02H				
		03 : Buffer memory (1-word)	03H				
		04 : Buffer memory (2-word)	04H				
		05 : Positioning data No.	05H				
	Da.16 Condition operator	01 : **=P1	01H				
		02 : **≠P1	02H				
		03 : **≤P1	03H				
		04 : **≥P1	04H				
		05 : P1≤**≤ P2	05H				
		06 : **≤P1, P2≤**	06H				
		07 : DEV=ON	07H				
		08 : DEV=OFF	08H				
		10 : Axis 1 selected	10H				
		20 : Axis 2 selected	20H				
		30 : Axis 1 and 2 selected	30H				
		40 : Axis 3 selected	40H				
		50 : Axis 1 and 3 selected	50H				
		60 : Axis 2 and 3 selected	60H				
		70 : Axis 1, 2, and 3 selected	70H				
		80 : Axis 4 selected QD77MS2 QD77MS4	80H				
		90 : Axis 1 and 4 selected	90H				
		A0 : Axis 2 and 4 selected	A0H				
		B0 : Axis 1, 2, and 4 selected	B0H				
		C0 : Axis 3 and 4 selected	C0H				
		D0 : Axis 1, 3, and 4 selected	D0H				
		E0 : Axis 2, 3, and 4 selected	E0H				
Da.17 Address		Buffer memory address	Example) 		0000H	26102+1000n 26103+1000n	22102+400n 22103+400n
Da.18 Parameter 1		Value	Example) 		0000H	26104+1000n 26105+1000n	22104+400n 22105+400n
Da.19 Parameter 2		Value	Example) 		0000H	26106+1000n 26107+1000n	22106+400n 22107+400n

n: Axis No.-1

Item		Setting value			Default value	Buffer memory address	
		Value set with GX Works2	Value set with sequence program			QD77MS2 QD77MS4	QD77MS16
Simultaneously starting axis	Da.23 Number of simultaneously starting axes QD77MS16	2: 2 axes	2H		0000H		22101+400n
		3: 3 axes	3H				
		4: 4 axes	4H				
	Da.24 Simultaneously starting axis No.1 QD77MS16 Da.25 Simultaneously starting axis No.2 QD77MS16 Da.26 Simultaneously starting axis No.3 QD77MS16	0: Axis 1 selected	0H				
		1: Axis 2 selected	1H				
		2: Axis 3 selected	2H				
		3: Axis 4 selected	3H				
		4: Axis 5 selected	4H				
		5: Axis 6 selected	5H				
		6: Axis 7 selected	6H				
		7: Axis 8 selected	7H				
		8: Axis 9 selected	8H				
		9: Axis 10 selected	9H				
		A: Axis 11 selected	AH				
		B: Axis 12 selected	BH				
		C: Axis 13 selected	CH				
		D: Axis 14 selected	DH				
		E: Axis 15 selected	EH				
		F: Axis 16 selected	FH				

n: Axis No.-1

Da.15 Condition target

Set the condition target as required for each control.

Setting value	Setting details
01H : Device X	Set the input/output signal ON/OFF as the conditions.
02H : Device Y	
03H : Buffer memory (1-word)	Set the value stored in the buffer memory as the condition. 03H: The target buffer memory is "1-word (16 bits)" 04H: The target buffer memory is "2-word (32 bits)"
04H : Buffer memory (2-word)	
05H : Positioning data No.	Select only for "simultaneous start".

Da.16 Condition operator

Set the condition operator as required for the "Da.15 Condition target".

Da.15 Condition target	Setting value	Setting details
01H: Device X 02H: Device Y	07H : DEV=ON	The state (ON/OFF) of an I/O signal is defined as the condition. Select ON or OFF as the trigger.
	08H : DEV=OFF	
03H: Buffer memory (1-word) 04H: Buffer memory (2-word)	01H : ∗∗=P1	Select how to use the value (∗∗) in the buffer memory as a part of the condition.
	02H : ∗∗≠P1	
	03H : ∗∗≤P1	
	04H : ∗∗≥P1	
	05H : P1≤∗∗≤P2	
	06H : ∗∗≤P1, P2≤∗∗	
05H: Positioning data No.	10H : Axis 1 selected	If "simultaneous start" is specified, select the axis (or axes) that should start simultaneously. QD77MS2 QD77MS4
	20H : Axis 2 selected	
	30H : Axis 1 and 2 selected	
	40H : Axis 3 selected	
	50H : Axis 1 and 3 selected	
	60H : Axis 2 and 3 selected	
	70H : Axis 1, 2, and 3 selected	
	80H : Axis 4 selected	
	90H : Axis 1 and 4 selected	
	A0H : Axis 2 and 4 selected	
	B0H : Axis 1, 2, and 4 selected	
	C0H : Axis 3 and 4 selected	
	D0H : Axis 1, 3, and 4 selected	
	E0H : Axis 2, 3, and 4 selected	

Da.17 Address

Set the address as required for the "Da.15 Condition target".

Da.15 Condition target	Setting value	Setting details
01H : Device X	–	Not used. (There is no need to set.)
02H : Device Y		
03H : Buffer memory (1-word)	Value (Buffer memory address)	Set the target "buffer memory address". (For 2 word, set the low-order buffer memory address.)
04H : Buffer memory (2-word)		
05H : Positioning data No.	–	Not used. (There is no need to set.)

Da.18 Parameter 1

- QD77MS2/QD77MS4

Set the parameters as required for the "Da.16 Condition operator".

Da.16 Condition operator	Setting value	Setting details
01H : **=P1	Value	The value of P1 should be equal to or smaller than the value of P2. (P1≤P2) If P1 is greater than P2 (P1>P2), the "condition data error" (error code 533) will occur.
02H : **≠P1		
03H : **≤P1		
04H : **≥P1		
05H : P1≤**≤P2		
06H : **≤P1, P2≤**		
07H : DEV=ON	Value (bit No.)	Set the device bit No. X: 0H, 1H, 4H to 17H Y: 0H, 1H, 4H to 17H
08H : DEV=OFF		
10H : Axis 1 selected	Value (positioning data No.)	Set the positioning data No. for starting axis 1 and/or axis 2. Low-order 16-bit : Axis 1 positioning data No. 1 to 600 (01H to 258H) High-order 16-bit : Axis 2 positioning data No. 1 to 600 (01H to 258H)
↓		
E0H : Axis 2, 3, and 4 selected		

- QD77MS16

Set the parameters as required for the "Da.16 Condition operator" and "Da.23 Number of simultaneously starting axes".

Da.16 Condition operator	Da.23 Number of simultaneously starting axes	Setting value	Setting details
01H : **=P1		Value	The value of P1 should be equal to or smaller than the value of P2. (P1≤P2) If P1 is greater than P2 (P1>P2), the "condition data error" (error code 533) will occur.
02H : **≠P1			
03H : **≤P1			
04H : **≥P1			
05H : P1≤**≤P2			
06H : **≤P1, P2≤**			
07H : DEV=ON		Value (bit No.)	Set the device bit No. X: 0H to 1H, 10H to 1FH Y: 0H, 1H, 10H to 1FH
08H : DEV=OFF			
	2 to 4	Value (positioning data No.)	Set the positioning data No. for starting axis set in "Da.24 Simultaneously starting axis No.1" and/or "Da.25 Simultaneously starting axis No.2". Low-order 16-bit : Simultaneously starting axis No.1 positioning data No.1 to 600 (01H to 258H) High-order 16-bit : Simultaneously starting axis No.2 positioning data No.1 to 600 (01H to 258H)

Da.19 Parameter 2

- QD77MS2/QD77MS4

Set the parameters as required for the "Da.16 Condition operator".

Da.16 Condition operator	Setting value	Setting details
01H : **=P1	—	Not used. (No need to be set.)
02H : **≠P1		
03H : **≤P1		
04H : **≥P1		
05H : P1≤**≤P2	Value	The value of P2 should be equal to or greater than the value of P1. (P1≤P2) If P1 is greater than P2 (P1>P2), the "condition data error" (error code 533) will occur.
06H : **≤P1, P2≤**		
07H : DEV=ON	—	Not used. (No need to be set.)
08H : DEV=OFF		
10H : Axis 1 selected		
20H : Axis 2 selected		
30H : Axis 1 and 2 selected		
40H : Axis 3 selected	Value (positioning data No.)	Set the positioning data No. for starting axis 3 and/or axis 4. Low-order 16-bit : Axis 3 positioning data No. 1 to 600 (01H to 258H) High-order 16-bit : Axis 4 positioning data No. 1 to 600 (01H to 258H)
50H : Axis 1 and 3 selected		
60H : Axis 2 and 3 selected		
70H : Axis 1, 2, and 3 selected		
80H : Axis 4 selected		
90H : Axis 1 and 4 selected		
A0H : Axis 2 and 4 selected		
B0H : Axis 1, 2, and 4 selected		
C0H : Axis 3 and 4 selected		
D0H : Axis 1, 3, and 4 selected		
E0H : Axis 2, 3, and 4 selected		

- QD77MS16

Set the parameters as required for the "Da.16 Condition operator" and "Da.23 Number of simultaneously starting axes".

Da.16 Condition operator	Da.23 Number of simultaneously starting axes	Setting value	Setting details
01H : **=P1		—	Not used. (No need to be set.)
02H : **≠P1			
03H : **≤P1			
04H : **≥P1			
05H : P1≤**≤P2		Value	The value of P2 should be equal to or greater than the value of P1. (P1≤P2) If P1 is greater than P2 (P1>P2), the "condition data error" (error code 533) will occur.
06H : **≤P1, P2≤**			
07H : DEV=ON		—	Not used. (No need to be set.)
08H : DEV=OFF			
	2 to 3		
	4	Value (positioning data No.)	Set the positioning data No. for starting axis set in "Da.26 Simultaneously starting axis No.3" Low-order 16-bit : Simultaneously starting axis No.3 positioning data No. 1 to 600 (01H to 258H) High-order 16-bit : Not used (Set "0")

Da.23 Number of simultaneously starting axes QD77MS16

Set the number of simultaneously starting axes to execute the simultaneous start.

2: Simultaneous start by 2 axes of the starting axis and axis set in "Da.24 Simultaneously starting axis No.1".
3: Simultaneous start by 3 axes of the starting axis and axis set in "Da.24 Simultaneously starting axis No.1" and "Da.25 Simultaneously starting axis No.2".
4: Simultaneous start by 4 axes of the starting axis and axis set in "Da.24 Simultaneously starting axis No.1" to "Da.26 Simultaneously starting axis No.3".

Da.24 Simultaneously starting axis No.1 to Da.26 Simultaneously starting axis No.3 QD77MS16

Set the simultaneously starting axis to execute the 2 to 4-axis simultaneous start.

- 2-axis interpolation......... Set the target axis number in "Da.24 Simultaneously starting axis No.1".
- 3-axis interpolation......... Set the target axis number in "Da.24 Simultaneously starting axis No.1" and "Da.25 Simultaneously starting axis No.2".
- 4-axis interpolation......... Set the target axis number in "Da.24 Simultaneously starting axis No.1" to "Da.26 Simultaneously starting axis No.3".

Set the axis set as simultaneously starting axis.

0: Axis 1
1: Axis 2
2: Axis 3
3: Axis 4
4: Axis 5
5: Axis 6
6: Axis 7
7: Axis 8
8: Axis 9
9: Axis 10
A: Axis 11
B: Axis 12
C: Axis 13
D: Axis 14
E: Axis 15
F: Axis 16

Note)
- Do not specify the own axis number. (If you do, the " Condition data error" will occur during the program execution (error code: 533).)
- When the same axis number or axis number of own axis is set to multiple simultaneously starting axis number, the "Condition data error" will occur during the program execution (error code: 533).
- Do not specify the simultaneously starting axis No.2 and simultaneously starting axis No.3 for 2-axis simultaneously start, and not specify the simultaneously starting axis No.3 for 3-axis simultaneously start. The setting value is ignored.

5.6 List of monitor data

The setting items of the monitor data are explained in this section.

- Guide to buffer memory address
  In the buffer memory address, "n" in "2406+100n", etc. indicates a value corresponding to axis No. such as the following table.

Axis No.	n	Axis No.	n	Axis No.	n	Axis No.	n
1	0	5	4	9	8	13	12
2	1	6	5	10	9	14	13
3	2	7	6	11	10	15	14
4	3	8	7	12	11	16	15

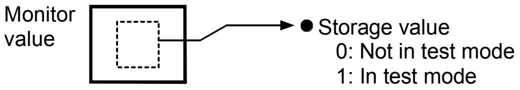
(Note-1): Calculate as follows for the buffer memory address corresponding to each axis.
(Example) For axis No. 16
2406+100n (Md.23 Axis error No.)=2406+100×15=3906

(Note-2): The range from axis No.1 to 2 (n=0 to 1) is valid in the QD77MS2.

(Note-3): The range from axis No.1 to 4 (n=0 to 3) is valid in the QD77MS4.

5.6.1 System monitor data

Storage item	Storage details	
Md.1 In test mode flag	Whether the mode is the test mode from the GX Works2 or not is stored. • When not in test mode : OFF • When in test mode : ON Refresh cycle: Immediate	

	Reading the monitor value	Default value	Buffer memory address (common for all axes)	
			QD77MS2 QD77MS4	QD77MS16
	■ Monitoring is carried out with a decimal.  Monitor value ● Storage value 0: Not in test mode 1: In test mode	0	1200	4000

(Unless noted in particular, the monitor value is saved as binary data.)

Storage item	Storage details	Reading the monitor value

Starting history (Up to 16 records can be stored)

Md.3

Start information

[Storage details]

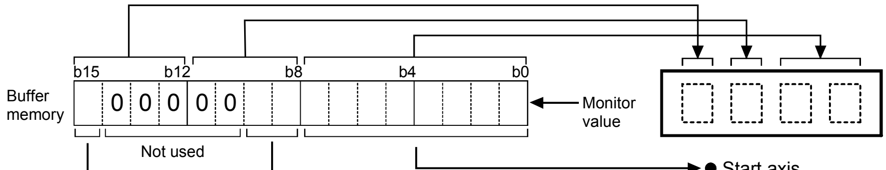
This area stores the start information (restart flag, start origin, and start axis):

- Restart flag: Indicates whether the operation has or has not been halted and restarted.
- Start origin: Indicates the source of the start signal.
- Start axis : Indicates the started axis.

Refresh cycle: At start

[Reading the monitor value]

■ Monitoring is carried out with a hexadecimal display.



- Start origin

Stored contents	Storage value
PLC CPU	00
External signal	01
GX Works2	10

- Restart flag

Stored contents	Storage value
Restart flag OFF	0
Restart flag ON	1

- Start axis

Stored contents	Storage value
Axis 1	1
Axis 2	2
Axis 3	3
Axis 4	4
Axis 5	5
⁞	⁞
Axis 16	F

＊: Valid for the range from axis 1 to axis 2 in the QD77MS2, from axis 1 to axis 4 in the QD77MS4.

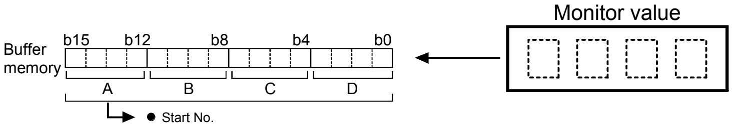
Md.4

Start No.

The starting No. is stored.

Refresh cycle: At start

■ Monitoring is carried out with a hexadecimal display.



- Start No.

Stored contents	Storage value A	B	C	D	Reference (Decimal)
Positioning operation	0	0	0	1	001
	to				
	0	2	5	8	600
	1	B	5	8	7000
	1	B	5	9	7001
	1	B	5	A	7002
	1	B	5	B	7003
	1	B	5	C	7004
JOG operation	2	3	3	2	9010
Manual pulse generator	2	3	3	3	9011
Machine OPR	2	3	2	9	9001
Fast OPR	2	3	2	A	9002
Current value changing	2	3	2	B	9003
Simultaneous start	2	3	2	C	9004
Synchronous control operation	2	3	3	C	9020
Position control mode → speed control mode switching	2	3	4	6	9030
Position control mode → torque control mode switching	2	3	4	7	9031
Speed control mode → torque control mode switching	2	3	4	8	9032
Torque control mode → speed control mode switching	2	3	4	9	9033
Speed control mode → position control mode switching	2	3	4	A	9034
Torque control mode → position control mode switching	2	3	4	B	9035
Outside the range of control mode setting	2	3	4	C	9036
Position control mode → continuous operation to torque control mode switching	2	3	4	D	9037
Continuous operation to torque control mode → position control mode switching	2	3	4	E	9038
Speed control mode → continuous operation to torque control mode switching	2	3	4	F	9039
Continuous operation to torque control mode → speed control mode switching	2	3	5	0	9040
Torque control mode → continuous operation to torque control mode switching	2	3	5	1	9041
Continuous operation to torque control mode → torque control mode switching	2	3	5	2	9042

Note: If a start signal is issued against an operating axis, a record relating to this event may be output before a record relating to an earlier start signal is output.

	Default value	Buffer memory address (common for all axes)	
		QD77MS2/QD77MS4	QD77MS16
	0000H		
	0000H		

● QD77MS2/QD77MS4

Md.8 Start history pointer	1292

Indicates a pointer No. that is next to the pointer No. assigned to the latest of the existing starting history records.

	Pointer No.	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Item	Md.3 Start information	1212	1217	1222	1227	1232	1237	1242	1247	1252	1257	1262	1267	1272	1277	1282	1287
	Md.4 Start No.	1213	1218	1223	1228	1233	1238	1243	1248	1253	1258	1263	1268	1273	1278	1283	1288
	Md.54 Start Year: month	1440	1441	1442	1443	1444	1445	1446	1447	1448	1449	1450	1451	1452	1453	1454	1455
	Md.5 Start Day: hour	1214	1219	1224	1229	1234	1239	1244	1249	1254	1259	1264	1269	1274	1279	1284	1289
	Md.6 Start Minute: second	1215	1220	1225	1230	1235	1240	1245	1250	1255	1260	1265	1270	1275	1280	1285	1290
	Md.7 Error judgment	1216	1221	1226	1231	1236	1241	1246	1251	1256	1261	1266	1271	1276	1281	1286	1291

- Each group of buffer memory addresses storing a complete starting history record is assigned a pointer No.
  Example: Pointer No. 0 = Buffer memory addresses 1212 to 1216, 1440
  Pointer No. 1 = Buffer memory addresses 1217 to 1221, 1441
  Pointer No. 2 = Buffer memory addresses 1222 to 1226, 1442
  ⋮
  Pointer No. 15 = Buffer memory addresses 1287 to 1291, 1455
- Each history record is assigned a pointer No. in the range between 0 and 15.
  If the pointer No. 15 has been assigned to a new record, the next record will be assigned the pointer number 0.
  (A new record replaces an older record when a pointer No. is reassigned.)

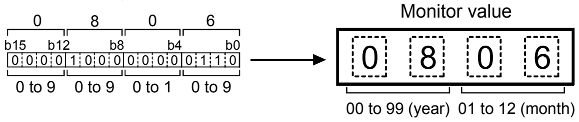
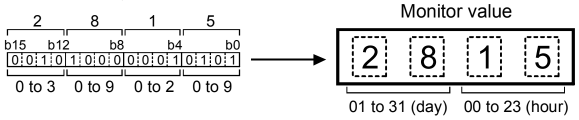
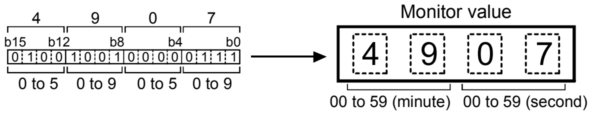
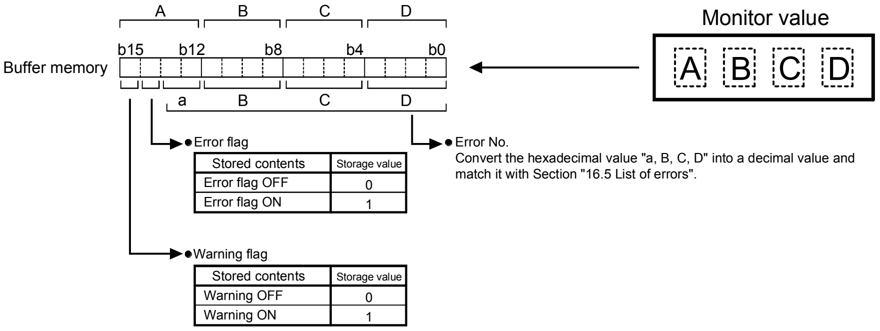
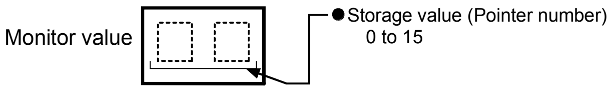
● QD77MS16

Md.8 Start history pointer	4092

Indicates a pointer No. that is next to the pointer No. assigned to the latest of the existing starting history records.

	Pointer No.	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Item	Md.3 Start information	4012	4017	4022	4027	4032	4037	4042	4047	4052	4057	4062	4067	4072	4077	4082	4087
	Md.4 Start No.	4013	4018	4023	4028	4033	4038	4043	4048	4053	4058	4063	4068	4073	4078	4083	4088
	Md.54 Start Year: month	4240	4241	4242	4243	4244	4245	4246	4247	4248	4249	4250	4251	4252	4253	4254	4255
	Md.5 Start Day: hour	4014	4019	4024	4029	4034	4039	4044	4049	4054	4059	4064	4069	4074	4079	4084	4089
	Md.6 Start Minute: second	4015	4020	4025	4030	4035	4040	4045	4050	4055	4060	4065	4070	4075	4080	4085	4090
	Md.7 Error judgment	4016	4021	4026	4031	4036	4041	4046	4051	4056	4061	4066	4071	4076	4081	4086	4091

- Each group of buffer memory addresses storing a complete starting history record is assigned a pointer No.
  Example: Pointer No. 0 = Buffer memory addresses 4012 to 4016, 4240
  Pointer No. 1 = Buffer memory addresses 4017 to 4021, 4241
  Pointer No. 2 = Buffer memory addresses 4022 to 4026, 4242
  ⋮
  Pointer No. 15 = Buffer memory addresses 4087 to 4091, 4255
- Each history record is assigned a pointer No. in the range between 0 and 15.
  If the pointer No. 15 has been assigned to a new record, the next record will be assigned the pointer number 0.
  (A new record replaces an older record when a pointer No. is reassigned.)

	Storage item	Storage details	Reading the monitor value	
Starting history (Up to 16 records can be stored)	Md.54 Start Year: month	The starting time (Year: month) is stored. Refresh cycle: At start	■ Monitoring is carried out with a hexadecimal display. Buffer memory (stored with BCD code) 	
	Md.5 Start Day: hour	The starting time (Day: hour) is stored. Refresh cycle: At start	■ Monitoring is carried out with a hexadecimal display. Buffer memory (stored with BCD code) 	
	Md.6 Start Minute: second	The starting time (Minute: second) is stored. Refresh cycle: At start	■ Monitoring is carried out with a hexadecimal display. Buffer memory (stored with BCD code) 	
	Md.7 Error judgment	[Storage details] [Reading the monitor value]	This area stores the following results of the error judgment performed upon starting: • Warning flag BUSY start Control mode switching during BUSY Control mode switching during zero speed OFF Outside control mode range Control mode switching • Error flag • Error No. Refresh cycle: At start ■ Monitoring is carried out with a hexadecimal display. 	
	Md.8 Start history pointer	Indicates a pointer No. that is next to the Pointer No. assigned to the latest of the existing starting history records. Refresh cycle: At start	■ Monitoring is carried out with a decimal display. 	

Note: If a start signal is issued against an operating axis, a record relating to this event may be output before a record relating to an earlier start signal is output.

	Default value	Buffer memory address (common for all axes)	
		QD77MS2/QD77MS4	QD77MS16
	0000H		
	0000H		
	0000H		
	0000H		
	0		

● QD77MS2/QD77MS4

Md.8 Start history pointer	1292

Indicates a pointer No. that is next to the pointer No. assigned to the latest of the existing starting history records.

	Pointer No.	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Item	Md.3 Start information	1212	1217	1222	1227	1232	1237	1242	1247	1252	1257	1262	1267	1272	1277	1282	1287
	Md.4 Start No.	1213	1218	1223	1228	1233	1238	1243	1248	1253	1258	1263	1268	1273	1278	1283	1288
	Md.54 Start Year: month	1440	1441	1442	1443	1444	1445	1446	1447	1448	1449	1450	1451	1452	1453	1454	1455
	Md.5 Start Day: hour	1214	1219	1224	1229	1234	1239	1244	1249	1254	1259	1264	1269	1274	1279	1284	1289
	Md.6 Start Minute: second	1215	1220	1225	1230	1235	1240	1245	1250	1255	1260	1265	1270	1275	1280	1285	1290
	Md.7 Error judgment	1216	1221	1226	1231	1236	1241	1246	1251	1256	1261	1266	1271	1276	1281	1286	1291

- Each group of buffer memory addresses storing a complete starting history record is assigned a pointer No.
  Example: Pointer No. 0 = Buffer memory addresses 1212 to 1216, 1440
  Pointer No. 1 = Buffer memory addresses 1217 to 1221, 1441
  Pointer No. 2 = Buffer memory addresses 1222 to 1226, 1442
  ⋮
  Pointer No. 15 = Buffer memory addresses 1287 to 1291, 1455
- Each history record is assigned a pointer No. in the range between 0 and 15.
  If the pointer No. 15 has been assigned to a new record, the next record will be assigned the pointer number 0.
  (A new record replaces an older record when a pointer No. is reassigned.)

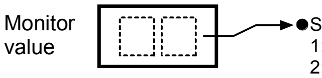
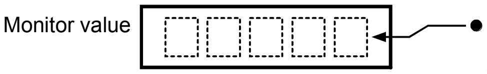
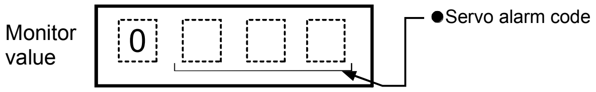
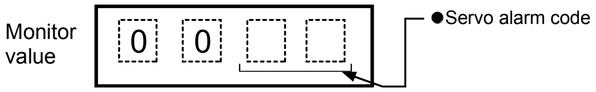
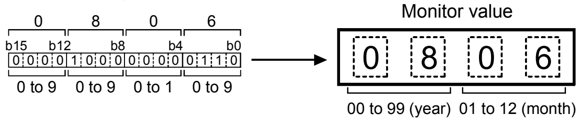
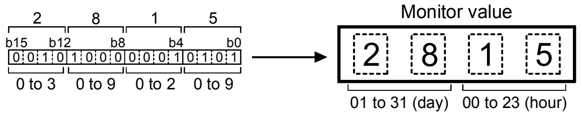
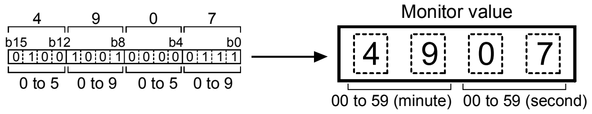
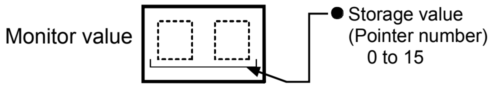
● QD77MS16

Md.8 Start history pointer	4092

Indicates a pointer No. that is next to the pointer No. assigned to the latest of the existing starting history records.

	Pointer No.	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Item	Md.3 Start information	4012	4017	4022	4027	4032	4037	4042	4047	4052	4057	4062	4067	4072	4077	4082	4087
	Md.4 Start No.	4013	4018	4023	4028	4033	4038	4043	4048	4053	4058	4063	4068	4073	4078	4083	4088
	Md.54 Start Year: month	4240	4241	4242	4243	4244	4245	4246	4247	4248	4249	4250	4251	4252	4253	4254	4255
	Md.5 Start Day: hour	4014	4019	4024	4029	4034	4039	4044	4049	4054	4059	4064	4069	4074	4079	4084	4089
	Md.6 Start Minute: second	4015	4020	4025	4030	4035	4040	4045	4050	4055	4060	4065	4070	4075	4080	4085	4090
	Md.7 Error judgment	4016	4021	4026	4031	4036	4041	4046	4051	4056	4061	4066	4071	4076	4081	4086	4091

- Each group of buffer memory addresses storing a complete starting history record is assigned a pointer No.
  Example: Pointer No. 0 = Buffer memory addresses 4012 to 4016, 4240
  Pointer No. 1 = Buffer memory addresses 4017 to 4021, 4241
  Pointer No. 2 = Buffer memory addresses 4022 to 4026, 4242
  ⋮
  Pointer No. 15 = Buffer memory addresses 4087 to 4091, 4255
- Each history record is assigned a pointer No. in the range between 0 and 15.
  If the pointer No. 15 has been assigned to a new record, the next record will be assigned the pointer number 0.
  (A new record replaces an older record when a pointer No. is reassigned.)

	Storage item	Storage details	Reading the monitor value
Error history (Up to 16 records can be stored)	Md.9 Axis in which the error occurred	Stores an axis No. in which an error occurred. Refresh cycle: Immediate	■ Monitoring is carried out with a decimal display.  ●Storage value 1: Axis 1 5: Axis 5 9: Axis 9 13: Axis 13 2: Axis 2 6: Axis 6 10: Axis 10 14: Axis 14 3: Axis 3 7: Axis 7 11: Axis 11 15: Axis 15 4: Axis 4 8: Axis 8 12: Axis 12 16: Axis 16 ✻: Valid for the range from axis 1 to axis 2 in the QD77MS2, from axis 1 to axis 4 in the QD77MS4.
	Md.10 Axis error No.	Stores an axis error No. Refresh cycle: Immediate	■ Monitoring is carried out with a decimal display.  ● Error No. For details of error Nos. (Error codes), refer to Section 16.5 "List of errors".
	Md.57 Servo alarm	Stores the LED display details of servo amplifier detection alarm. ("0" is stored other than when a servo error occurs.) Refresh cycle: Immediate	■ Monitoring is carried out with a hexadecimal display. • When SSCNET setting is SSCNETⅢ/H  • When SSCNET setting is SSCNETⅢ 
	Md.55 Axis error occurrence (Year: month)	Stores the time (Year: month) at which an axis error was detected. Refresh cycle: Immediate	■ Monitoring is carried out with a hexadecimal display. Buffer memory (stored with BCD code) 
	Md.11 Axis error occurrence (Day: hour)	Stores the time (Day: hour) at which an axis error was detected. Refresh cycle: Immediate	■ Monitoring is carried out with a hexadecimal display. Buffer memory (stored with BCD code) 
	Md.12 Axis error occurrence (Minute: second)	Stores the time (Minute: second) at which an axis error was detected. Refresh cycle: Immediate	■ Monitoring is carried out with a hexadecimal display. Buffer memory (stored with BCD code) 
	Md.13 Error history pointer	Indicates a pointer No. that is next to the Pointer No. assigned to the latest of the existing records. Refresh cycle: Immediate	■ Monitoring is carried out with a decimal display.  ● Storage value (Pointer number) 0 to 15

	Default value	Buffer memory address (common for all axes)	
		QD77MS2/QD77MS4	QD77MS16
	0		
	0		
	0000H		
	0000H		
	0000H		
	0000H		
	0		

● QD77MS2/QD77MS4

Md.13 Error history pointer	1357

Indicates a pointer No. that is next to the pointer No. assigned to the latest of the existing error history records.

	Pointer No.	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Item	Md.9 Axis in which the error occurred	1293	1297	1301	1305	1309	1313	1317	1321	1325	1329	1333	1337	1341	1345	1349	1353
	Md.10 Axis error No.	1294	1298	1302	1306	1310	1314	1318	1322	1326	1330	1334	1338	1342	1346	1350	1354
	Md.57 Servo alarm	31300	31301	31302	31303	31304	31305	31306	31307	31308	31309	31310	31311	31312	31313	31314	31315
	Md.55 Axis error occurrence (Year: month)	1456	1457	1458	1459	1460	1461	1462	1463	1464	1465	1466	1467	1468	1469	1470	1471
	Md.11 Axis error occurrence (Day: hour)	1295	1299	1303	1307	1311	1315	1319	1323	1327	1331	1335	1339	1343	1347	1351	1355
	Md.12 Axis error occurrence (Minute: second)	1296	1300	1304	1308	1312	1316	1320	1324	1328	1332	1336	1340	1344	1348	1352	1356

- Each group of buffer memory addresses storing a complete error history record is assigned a pointer No.

  Example: Pointer No. 0 = Buffer memory addresses 1293 to 1296, 1456, 31300
  Pointer No. 1 = Buffer memory addresses 1297 to 1300, 1457, 31301
  Pointer No. 2 = Buffer memory addresses 1301 to 1304, 1458, 31302
  ⋮
  Pointer No. 15 = Buffer memory addresses 1353 to 1356, 1471, 31315
- Each history record is assigned a pointer No. in the range between 0 and 15.
  If the pointer No. 15 has been assigned to a new record, the next record will be assigned the pointer number 0.
  (A new record replaces an older record when a pointer No. is reassigned.)

● QD77MS16

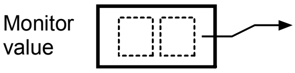
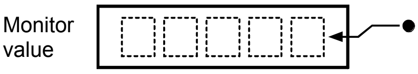
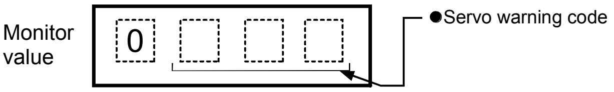
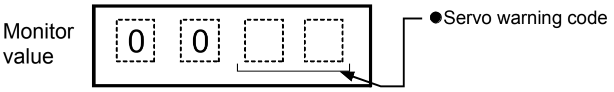
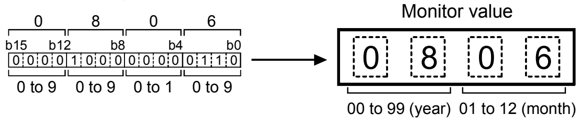
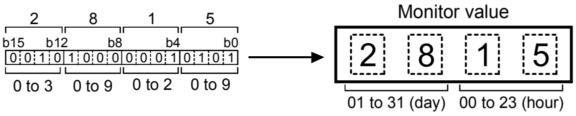
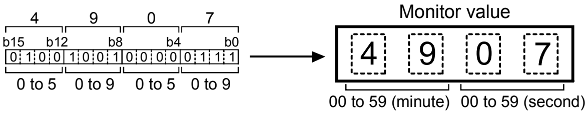
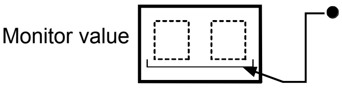
Md.13 Error history pointer	4157

Indicates a pointer No. that is next to the pointer No. assigned to the latest of the existing error history records.

	Pointer No.	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Item	Md.9 Axis in which the error occurred	4093	4097	4101	4105	4109	4113	4117	4121	4125	4129	4133	4137	4141	4145	4149	4153
	Md.10 Axis error No.	4094	4098	4102	4106	4110	4114	4118	4122	4126	4130	4134	4138	4142	4146	4150	4154
	Md.57 Servo alarm	31300	31301	31302	31303	31304	31305	31306	31307	31308	31309	31310	31311	31312	31313	31314	31315
	Md.55 Axis error occurrence (Year: month)	4256	4257	4258	4259	4260	4261	4262	4263	4264	4265	4266	4267	4268	4269	4270	4271
	Md.11 Axis error occurrence (Day: hour)	4095	4099	4103	4107	4111	4115	4119	4123	4127	4131	4135	4139	4143	4147	4151	4155
	Md.12 Axis error occurrence (Minute: second)	4096	4100	4104	4108	4112	4116	4120	4124	4128	4132	4136	4140	4144	4148	4152	4156

- Each group of buffer memory addresses storing a complete error history record is assigned a pointer No.

  Example: Pointer No. 0 = Buffer memory addresses 4093 to 4096, 4256, 31300
  Pointer No. 1 = Buffer memory addresses 4097 to 4100, 4257, 31301
  Pointer No. 2 = Buffer memory addresses 4101 to 4104, 4258, 31302
  ⋮
  Pointer No. 15 = Buffer memory addresses 4153 to 4156, 4271, 31315
- Each history record is assigned a pointer No. in the range between 0 and 15.
  If the pointer No. 15 has been assigned to a new record, the next record will be assigned the pointer number 0.
  (A new record replaces an older record when a pointer No. is reassigned.)

	Storage item	Storage details	Reading the monitor value
Warning history (Up to 16 records can be stored)	Md.14 Axis in which the warning occurred	Stores an axis No. in which a warning occurred. Refresh cycle: Immediate	■ Monitoring is carried out with a decimal display.  ●Storage value 1: Axis 1 5: Axis 5 9: Axis 9 13: Axis 13 2: Axis 2 6: Axis 6 10: Axis 10 14: Axis 14 3: Axis 3 7: Axis 7 11: Axis 11 15: Axis 15 4: Axis 4 8: Axis 8 12: Axis 12 16: Axis 16 ✻: Valid for the range from axis 1 to axis 2 in the QD77MS2, from axis 1 to axis 4 in the QD77MS4.
	Md.15 Axis warning No.	Stores an axis warning No. Refresh cycle: Immediate	■ Monitoring is carried out with a decimal display.  ● Warning No. For details of warning Nos. (warning codes), refer to Section 16.6 "List of warnings".
	Md.58 Servo warning	Stores the LED display details of servo amplifier detection warning. ("0" is stored other than when a servo error occurs.) Refresh cycle: Immediate	■ Monitoring is carried out with a hexadecimal display. • When SSCNET setting is SSCNETⅢ/H  • When SSCNET setting is SSCNETⅢ 
	Md.56 Axis warning occurrence (Year: month)	Stores the time (Year: month) at which an axis warning was detected. Refresh cycle: Immediate	■ Monitoring is carried out with a hexadecimal display. Buffer memory (stored with BCD code) 
	Md.16 Axis warning occurrence (Day: hour)	Stores the time (Day: hour) at which an axis warning was detected. Refresh cycle: Immediate	■ Monitoring is carried out with a hexadecimal display. Buffer memory (stored with BCD code) 
	Md.17 Axis warning occurrence (Minute: second)	Stores the time (Minute: second) at which an axis warning was detected. Refresh cycle: Immediate	■ Monitoring is carried out with a hexadecimal display. Buffer memory (stored with BCD code) 
	Md.18 Warning history pointer	Indicates a pointer No. that is next to the Pointer No. assigned to the latest of the existing records. Refresh cycle: Immediate	■ Monitoring is carried out with a decimal display.  ● Storage value (Pointer number) 0 to 15

	Default value	Buffer memory address (common for all axes)	
		QD77MS2/QD77MS4	QD77MS16
	0		
	0		
	0000H		
	0000H		
	0000H		
	0000H		
	0		

● QD77MS2/QD77MS4

Md.18 Warning history pointer	1422

Indicates a pointer No. that is next to the pointer No. assigned to the latest of the existing warning history records.

	Pointer No.	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Item	Md.14 Axis in which the warning occurred	1358	1362	1366	1370	1374	1378	1382	1386	1390	1394	1398	1402	1406	1410	1414	1418
	Md.15 Axis warning No.	1359	1363	1367	1371	1375	1379	1383	1387	1391	1395	1399	1403	1407	1411	1415	1419
	Md.58 Servo warning	31316	31317	31318	31319	31320	31321	31322	31323	31324	31325	31326	31327	31328	31329	31330	31331
	Md.56 Axis warning occurrence (Year: month)	1472	1473	1474	1475	1476	1477	1478	1479	1480	1481	1482	1483	1484	1485	1486	1487
	Md.16 Axis warning occurrence (Day: hour)	1360	1364	1368	1372	1376	1380	1384	1388	1392	1396	1400	1404	1408	1412	1416	1420
	Md.17 Axis warning occurrence (Minute: second)	1361	1365	1369	1373	1377	1381	1385	1389	1393	1397	1401	1405	1409	1413	1417	1421

- Each group of buffer memory addresses storing a complete warning history record is assigned a pointer No.
  Example: Pointer No. 0 = Buffer memory addresses 1358 to 1361, 1472, 31316
  Pointer No. 1 = Buffer memory addresses 1362 to 1365, 1473, 31317
  Pointer No. 2 = Buffer memory addresses 1366 to 1369, 1474, 31318
  ⋮
  Pointer No. 15 = Buffer memory addresses 1418 to 1421, 1487, 31331
- Each history record is assigned a pointer No. in the range between 0 and 15.
  If the pointer No. 15 has been assigned to a new record, the next record will be assigned the pointer number 0.
  (A new record replaces an older record when a pointer No. is reassigned.)

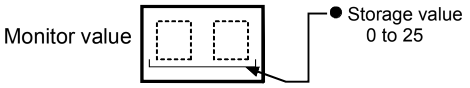
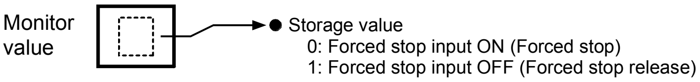
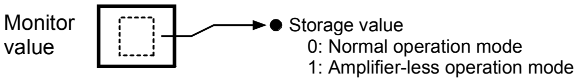
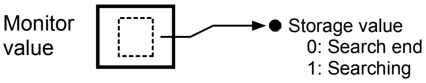
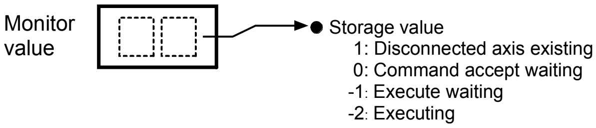
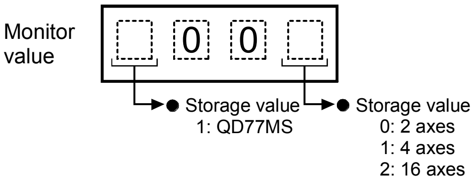
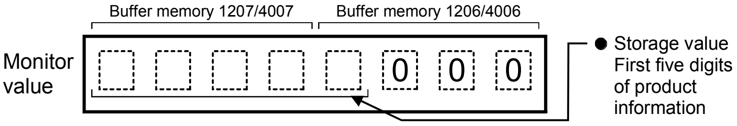
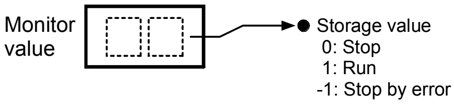
● QD77MS16

Md.18 Warning history pointer	4222

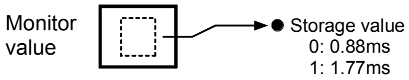
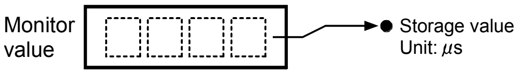
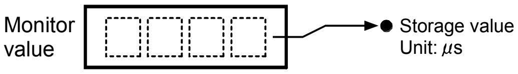
Indicates a pointer No. that is next to the pointer No. assigned to the latest of the existing warning history records.

	Pointer No.	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Item	Md.14 Axis in which the warning occurred	4158	4162	4166	4170	4174	4178	4182	4186	4190	4194	4198	4202	4206	4210	4214	4218
	Md.15 Axis warning No.	4159	4163	4167	4171	4175	4179	4183	4187	4191	4195	4199	4203	4207	4211	4215	4219
	Md.58 Servo warning	31316	31317	31318	31319	31320	31321	31322	31323	31324	31325	31326	31327	31328	31329	31330	31331
	Md.56 Axis warning occurrence (Year: month)	4272	4273	4274	4275	4276	4277	4278	4279	4280	4281	4282	4283	4284	4285	4286	4287
	Md.16 Axis warning occurrence (Day: hour)	4160	4164	4168	4172	4176	4180	4184	4188	4192	4196	4200	4204	4208	4212	4216	4220
	Md.17 Axis warning occurrence (Minute: second)	4161	4165	4169	4173	4177	4181	4185	4189	4193	4197	4201	4205	4209	4213	4217	4221

- Each group of buffer memory addresses storing a complete warning history record is assigned a pointer No.
  Example: Pointer No. 0 = Buffer memory addresses 4158 to 4161, 4272, 31316
  Pointer No. 1 = Buffer memory addresses 4162 to 4165, 4273, 31317
  Pointer No. 2 = Buffer memory addresses 4166 to 4169, 4274, 31318
  ⋮
  Pointer No. 15 = Buffer memory addresses 4218 to 4221, 4287, 31331
- Each history record is assigned a pointer No. in the range between 0 and 15.
  If the pointer No. 15 has been assigned to a new record, the next record will be assigned the pointer number 0.
  (A new record replaces an older record when a pointer No. is reassigned.)

Storage item	Storage details	Reading the monitor value	
Md.19 Number of write accesses to flash ROM	Stores the number of write accesses to the flash ROM after the power is switched ON. The count is cleared to "0" when the number of write accesses reaches 26 and an error reset operation is performed. Refresh cycle: Immediate	■ Monitoring is carried out with a decimal display. 	
Md.50 Forced stop input	This area stores the states (ON/OFF) of forced stop input. Refresh cycle: Operation cycle	■ Monitoring is carried out with a decimal display. 	
Md.51 Amplifier-less operation mode status	Indicates a current operation mode. Refresh cycle: Immediate	■ Monitoring is carried out with a decimal display. 	
Md.52 Communication between amplifiers axes searching flag	Stores the detection status of axis that set communication between amplifiers. Refresh cycle: Immediate	■ Monitoring is carried out with a decimal display. 	
Md.53 SSCNET control status	Stores the connect/disconnect status of SSCNET communication. Refresh cycle: Immediate	■ Monitoring is carried out with a decimal display. 	
Md.59 Module information	Stores the module information. Refresh cycle: At power supply ON	■ Monitoring is carried out with a hexadecimal display. 	
Md.130 OS version	Stores the first five digits of the module product information. Refresh cycle: At power supply ON	■ Monitoring is carried out with a hexadecimal display. Buffer memory (stored with BCD code) 	
Md.131 Digital oscilloscope executing	Stores the RUN status of digital oscilloscope. Refresh cycle: Main cycle	■ Monitoring is carried out with a decimal display. 	

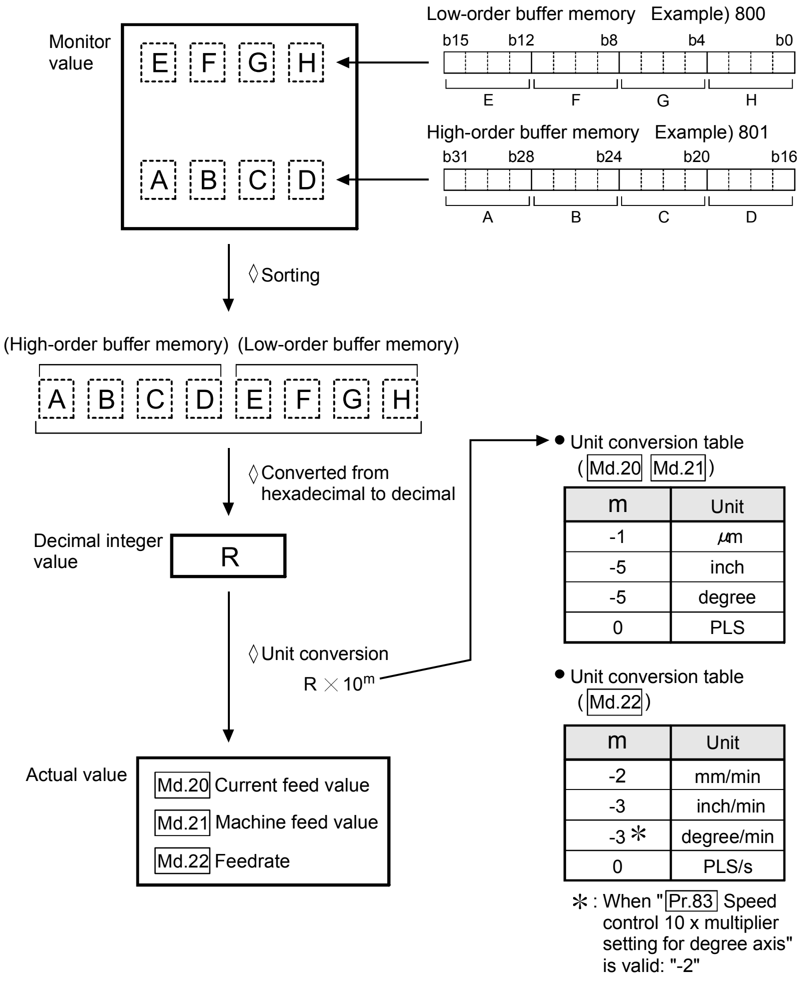
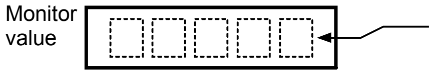
Default value	Buffer memory address (common for all axes)	
	QD77MS2/QD77MS4	QD77MS16
0	1424 1425	4224 4225
0	1431	4231
0	1432	4232
0	1434	4234
0	1433	4233
QD77MS2: 1000H QD77MS4: 1001H QD77MS16: 1002H	31332 (Monitors this buffer memory address too. QD77MS2/QD77MS4: 1435, QD77MS16: 4235)	
Factory-set product information	1206 1207	4006 4007
0	1211	4011

Storage item	Storage details	Reading the monitor value	
Md.132 Operation cycle setting	Stores the current operation cycle. Refresh cycle: At power supply ON	■ Monitoring is carried out with a decimal display. 	
Md.133 Operation cycle over flag	This flag turns ON when the operation cycle time exceeds operation cycle. Refresh cycle: Immediate	■ Monitoring is carried out with a decimal display.  POINT Latch status of operation cycle over is indicated. When this flag turns ON, correct the positioning detail or change the operation cycle longer than current setting.	
Md.134 Operation time	Stores the time that took for operation every operation cycle. Refresh cycle: Operation cycle	■ Monitoring is carried out with a decimal display. 	
Md.135 Maximum operation time	Stores the maximum value of operation time after each module's power supply ON. Refresh cycle: Immediate	■ Monitoring is carried out with a decimal display. 	

Default value	Buffer memory address (common for all axes)	
	QD77MS2/QD77MS4	QD77MS16
0	1438	4238
0	1439	4239
0	1208	4008
0	1209	4009

5.6.2 Axis monitor data

Storage item	Storage details
Md.20 Current feed value	The currently commanded address is stored. (Different from the actual motor position during operation) The current position address is stored. If "degree" is selected as the unit, the addresses will have a ring structure for values between 0 and 359.99999 degrees. • The OP address is stored when the machine OPR is completed. • When the current value is changed with the current value changing function, the changed value is stored. Refresh cycle: Operation cycle
Md.21 Machine feed value	The address of the current position according to the machine coordinates will be stored. (Different from the actual motor position during operation) Note that the current value changing function will not change the machine feed value. Under the speed control mode, the machine feed value is constantly updated always, irrespective of the parameter setting. The value will not be cleared to "0" at the beginning of fixed-feed control. Even if "degree" is selected as the unit, the addresses will become a cumulative value. (They will not have a ring structure for values between 0 and 359.99999 degrees). However, the machine feed value is restored within the range of 0 to 359.99999 degrees at the communication start with servo amplifier after the power supply ON or PLC CPU reset. • Machine coordinates: Characteristic coordinates determined with machine Refresh cycle: Operation cycle
Md.22 Feedrate	The speed of the operating workpiece is stored. (May be different from the actual motor speed during operation) • During interpolation operation, the speed is stored in the following manner. Reference axis : Composite speed or reference axis speed (Set with Pr.20) Interpolation axis : 0 Refresh cycle: Operation cycle POINT In case of the single axis operation, "Md.22 Feedrate" and "Md.28 Axis feedrate" are identical. In the composite mode of the interpolation operation, "Md.22 Feedrate" is a speed in a composite direction and "Md.28 Axis feedrate" is that in each axial direction.
Md.23 Axis error No.	When an axis error is detected, the error code corresponding to the error details is stored. • The latest error code is always stored. (When a new axis error occurs, the error code is overwritten.) • When "Cd.5 Axis error reset" (axis control data) turns ON, the axis error No. is cleared (set to 0). Refresh cycle: Immediate

	Reading the monitor value	Default value	Buffer memory address	
			QD77MS2 QD77MS4	QD77MS16
	■ Monitoring is carried out with a hexadecimal. 	0000H	800+100n 801+100n	2400+100n 2401+100n
		0000H	802+100n 803+100n	2402+100n 2403+100n
		0000H	804+100n 805+100n	2404+100n 2405+100n
	■ Monitoring is carried out with a decimal.  ● Error code For details of error Nos. (error codes), refer to Section 16.5 "List of errors".	0	806+100n	2406+100n

● Unit conversion table (Md.20 Md.21)

m	Unit
-1	μm
-5	inch
-5	degree
0	PLS

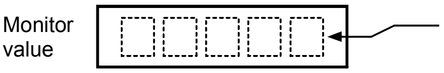
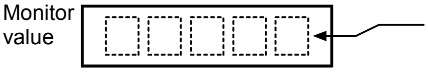
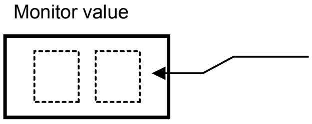
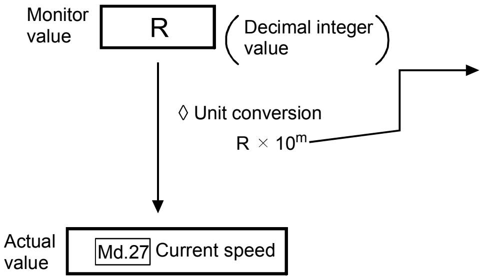
● Unit conversion table (Md.22)

m	Unit
-2	mm/min
-3	inch/min
-3 *	degree/min
0	PLS/s

*: When "Pr.83 Speed control 10 x multiplier setting for degree axis" is valid: "-2"

n: Axis No.-1

Storage item	Storage details
Md.24 Axis warning No.	Whenever an axis warning is reported, a related warning code is stored. • This area stores the latest warning code always. (Whenever an axis warning is reported, a new warning code replaces the stored warning code.) • When the "Cd.5 Axis error reset" (axis control data) is set to ON, the axis warning No. is cleared to "0". Refresh cycle: Immediate
Md.25 Valid M code	This area stores an M code that is currently active (i.e. set to the positioning data relating to the current operation). When the PLC READY signal [Y0] goes OFF, the value is set to "0". Refresh cycle: Immediate
Md.26 Axis operation status	This area stores the axis operation status. Refresh cycle: Immediate
Md.27 Current speed	The "Da.8 Command speed" used by the positioning data currently being executed is stored. • If "Da.8 Command speed" is set to "-1", this area stores the command speed set by the positioning data used one step earlier. • If "Da.8 Command speed" is set to a value other than "-1", this area stores the command speed set by the current positioning data. • When speed change function is executed, this area stores "Cd.14 New speed value". (For details of change speed function, refer to Section 13.5.1.) Refresh cycle: Immediate

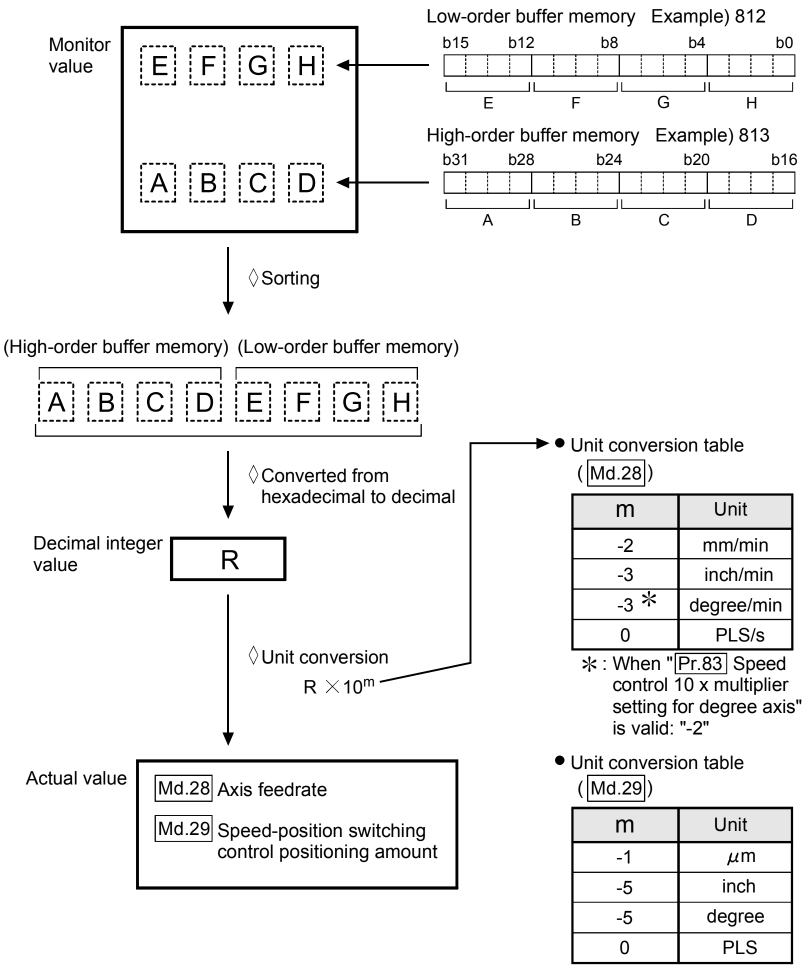
	Reading the monitor value	Default value	Buffer memory address QD77MS2 QD77MS4	Buffer memory address QD77MS16
	■ Monitoring is carried out with a decimal display.  ● Warning No. For details of warning Nos. (warning codes), refer to Section 16.6 "List of warnings".	0	807+100n	2407+100n
	■ Monitoring is carried out with a decimal display.  ● M code No. (0 to 65535)	0	808+100n	2408+100n
	■ Monitoring is carried out with a decimal display.  ● Axis operation status -2: Step standby -1: Error 0: Standby 1: Stopped 2: Interpolation 3: JOG operation 4: Manual pulse generator operation 5: Analyzing 6: Special start standby 7: OPR 8: Position control 9: Speed control 10: Speed control in speed-position switching control 11: Position control in speed-position switching control 12: Position control in position-speed switching control 13: Speed control in position-speed switching control 15: Synchronous control 20: Servo amplifier has not been connected/ servo amplifier power OFF 21: Servo OFF 30: Control mode switch 31: Speed control 32: Torque control 33: Continuous operation to torque control mode	0	809+100n	2409+100n
	■ Monitoring is carried out with a decimal display.  ● Unit conversion table (Md.27) m: -2 — Unit: mm/min m: -3 — Unit: inch/min m: -3* — Unit: degree/min m: 0 — Unit: PLS/s *: When "Pr.83 Speed control 10 x multiplier setting for degree axis" is valid: "-2"	0	810+100n 811+100n	2410+100n 2411+100n

n: Axis No.-1

Storage item	Storage details	
Md.28 Axis feedrate	• The speed which is actually output as a command at that time in each axis is stored. (May be different from the actual motor speed) "0" is stored when the axis is at a stop. Refresh cycle: Operation cycle POINT Refer to "Md.22 Feedrate"	
Md.29 Speed-position switching control positioning amount	• The movement amount for the position control to end after changing to position control with the speed-position switching control is stored. When the control method is "Reverse run: position/speed", the negative value is stored. Refresh cycle: Immediate	
Md.30 External input signal	The ON/OFF state of the external input signal is stored. The following items are stored. • Lower limit signal ＊ • Upper limit signal ＊ • Stop signal ＊ • External command signal/switching signal • Near-point dog signal ＊ ＊: This area stores the states of the external input signal (QD77MS), external input signal (servo amplifier) or buffer memory of QD77MS set by "Pr.80 External input signal selection". Refresh cycle: Operation cycle	

<table>
<tr><th rowspan="2"></th><th rowspan="2">Reading the monitor value</th><th rowspan="2">Default value</th><th colspan="2">Buffer memory address</th></tr>
<tr><th>QD77MS2
QD77MS4</th><th>QD77MS16</th></tr>
<tr><td></td><td rowspan="2">

■ Monitoring is carried out with a hexadecimal.



● Unit conversion table (Md.28)

<table>
<tr><th>m</th><th>Unit</th></tr>
<tr><td>-2</td><td>mm/min</td></tr>
<tr><td>-3</td><td>inch/min</td></tr>
<tr><td>-3 *</td><td>degree/min</td></tr>
<tr><td>0</td><td>PLS/s</td></tr>
</table>

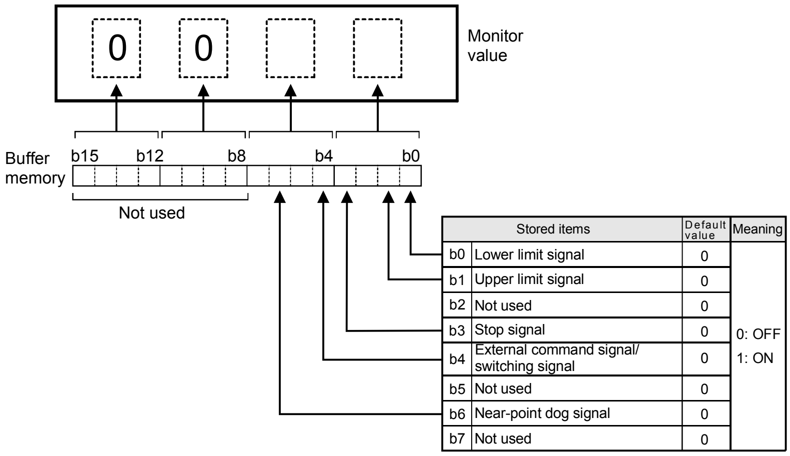
*: When "Pr.83 Speed control 10 x multiplier setting for degree axis" is valid: "-2"

● Unit conversion table (Md.29)

<table>
<tr><th>m</th><th>Unit</th></tr>
<tr><td>-1</td><td>μm</td></tr>
<tr><td>-5</td><td>inch</td></tr>
<tr><td>-5</td><td>degree</td></tr>
<tr><td>0</td><td>PLS</td></tr>
</table>

</td><td>0000H</td><td>812+100n
813+100n</td><td>2412+100n
2413+100n</td></tr>
<tr><td></td><td>0000H</td><td>814+100n
815+100n</td><td>2414+100n
2415+100n</td></tr>
<tr><td></td><td>

■ Monitoring is carried out with a hexadecimal.

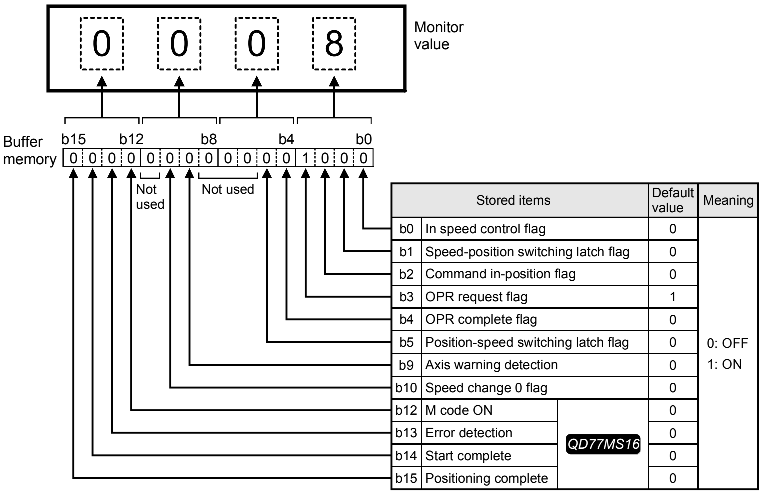


<table>
<tr><th></th><th>Stored items</th><th>Default value</th><th>Meaning</th></tr>
<tr><td>b0</td><td>Lower limit signal</td><td>0</td><td rowspan="8">0: OFF
1: ON</td></tr>
<tr><td>b1</td><td>Upper limit signal</td><td>0</td></tr>
<tr><td>b2</td><td>Not used</td><td>0</td></tr>
<tr><td>b3</td><td>Stop signal</td><td>0</td></tr>
<tr><td>b4</td><td>External command signal/ switching signal</td><td>0</td></tr>
<tr><td>b5</td><td>Not used</td><td>0</td></tr>
<tr><td>b6</td><td>Near-point dog signal</td><td>0</td></tr>
<tr><td>b7</td><td>Not used</td><td>0</td></tr>
</table>

</td><td>0000H</td><td>816+100n</td><td>2416+100n</td></tr>
</table>

n: Axis No.-1

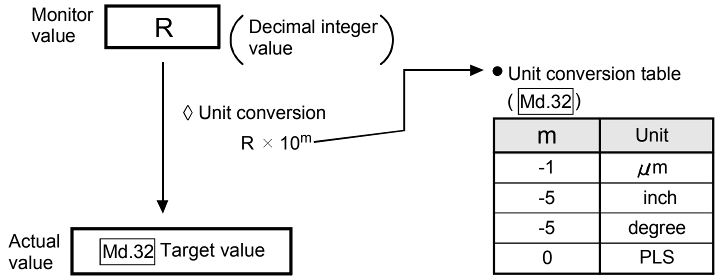
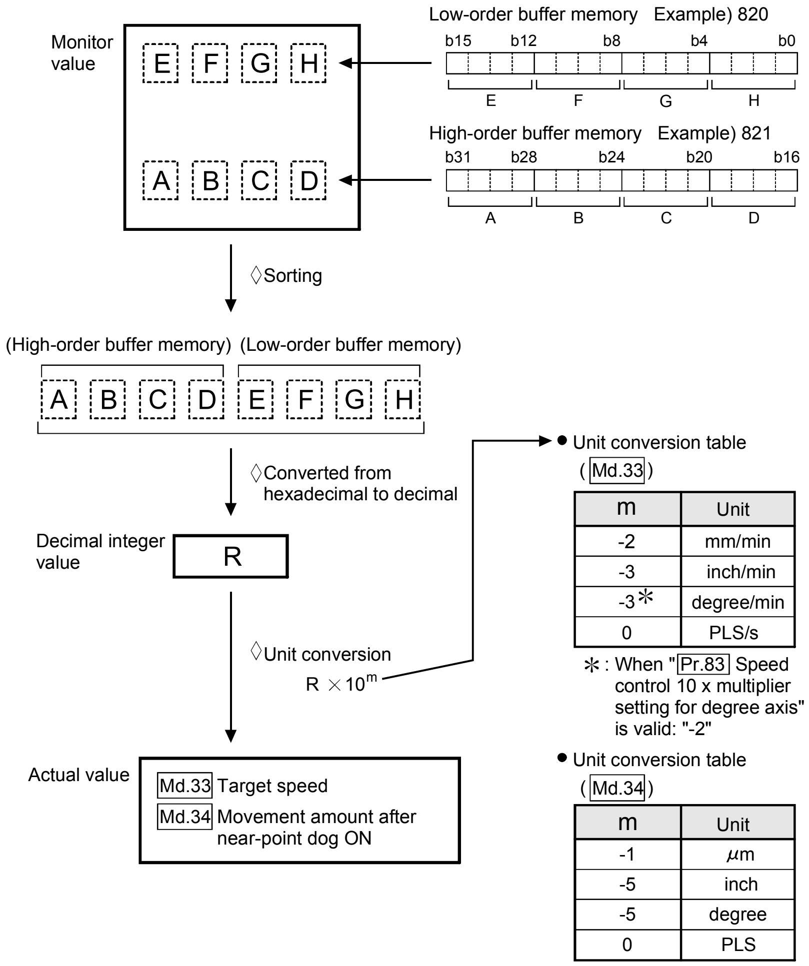
Storage item	Storage details	
Md.31 Status	This area stores the states (ON/OFF) of various flags. Information on the following flags is stored. ● In speed control flag This signal that comes ON under the speed control can be used to judge whether the operation is performed under the speed control or position control. The signal goes OFF when the power is switched ON, under the position control, and during JOG operation or manual pulse generator operation. During the speed-position or position-speed switching control, this signal comes ON only when the speed control is in effect. During the speed-position switching control, this signal goes OFF when the speed-position switching signal executes a switching over from speed control to position control. During the position-speed switching control, this signal comes ON when the position-speed switching signal executes a switching over from position control to speed control. ● Speed-position switching latch flag This signal is used during the speed-position switching control for interlocking the movement amount change function. During the speed-position switching control, this signal comes ON when position control takes over. This signal goes OFF when the next positioning data is processed, and during JOG operation or manual pulse generator operation. ● Command in-position flag This signal is ON when the remaining distance is equal to or less than the command in-position range (set by a detailed parameter). This signal remains OFF with data that specify the continuous path control (P11) as the operation pattern. The state of this signal is monitored every operation cycle except when the monitoring is canceled under the speed control or while the speed control is in effect during the speed-position or position-speed switching control. While operations are performed with interpolation, this signal comes ON only in respect of the starting axis. (This signal goes OFF in respect of all axes upon starting.) ● OPR request flag This signal comes ON when the power is switched ON, when the absolute system has not been set, when the machine OPR has not been executed at the absolute position system, when a machine OPR operation starts. This signal goes OFF when a machine OPR operation completes. (For details of OPR request flag, refer to the remark of Section 8.1.1.) ● OPR complete flag This signal comes ON when a machine OPR operation completes normally. This signal goes OFF when the operation start. ● Position-speed switching latch flag This signal is used during the position-speed switching control for interlocking the command speed change function. During the position-speed switching control, this signal comes ON when speed control takes over. This signal goes OFF when the next positioning data is processed, and during JOG operation or manual pulse generator operation. ● Axis warning detection flag This signal comes On when an axis warning is reported and goes OFF when the axis error reset signal comes ON. ● Speed change 0 flag This signal comes ON when a speed change request that specifies 0 as the new speed value is issued. This signal comes ON when a speed change request that specifies a new speed value other than 0 is issued. ● M code ON QD77MS16 In the WITH mode, this signal turns ON when the positioning data operation is started. In the AFTER mode, this signal turns ON when the positioning data operation is completed. This signal turns OFF with the "Cd.7 M code OFF request". When M code is not designated (when "Da.10 M code" is "0"), this signal will remain OFF. With using continuous path control for the positioning operation, the positioning will continue even when this signal does not turn OFF. However, a warning will occur. (Warning code: 503) When the PLC READY signal [Y0] turns OFF, the M code ON signal will also turn OFF. If operation is started while the M code is ON, an error will occur. (Error code: 536) ● Error detection QD77MS16 This signal turns ON when an error listed in Section 16.4 occurs, and turns OFF when the error is reset on "Cd.5 Axis error reset". ● Start complete QD77MS16 This signal turns ON when the positioning start signal turns ON and the Simple Motion module starts the positioning process. (The start complete signal also turns ON during OPR control.) ● Positioning complete QD77MS16 This signal turns ON for the time set in "Pr.40 Positioning complete signal output time" from the instant when the positioning control for each positioning data No. is completed. For the interpolation control, the positioning complete signal of interpolation axis turns ON during the time set to the reference axis. (It does not turn ON when "Pr.40 Positioning complete signal output time" is "0".) If positioning (including OPR), JOG/Inching operation, or manual pulse generator operation is started while this signal is ON, the signal will turn OFF. This signal will not turn ON when speed control or positioning is canceled midway. Refresh cycle: Immediate	

Reading the monitor value	Default value	Buffer memory address	
		QD77MS2 QD77MS4	QD77MS16
■ Monitoring is carried out with a hexadecimal display. 	0008H	817+100n	2417+100n

	Stored items		Default value	Meaning
b0	In speed control flag		0	0: OFF 1: ON
b1	Speed-position switching latch flag		0	
b2	Command in-position flag		0	
b3	OPR request flag		1	
b4	OPR complete flag		0	
b5	Position-speed switching latch flag		0	
b9	Axis warning detection		0	
b10	Speed change 0 flag		0	
b12	M code ON	QD77MS16	0	
b13	Error detection		0	
b14	Start complete		0	
b15	Positioning complete		0	

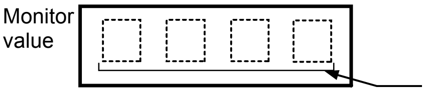
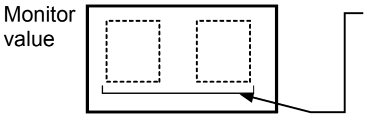
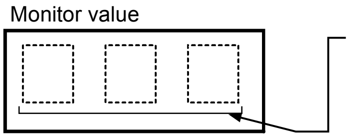
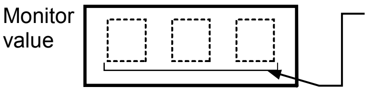
n: Axis No.-1

Storage item	Storage details
Md.32 Target value	This area stores the target value (Da.6 Positioning address/movement amount) for a positioning operation. • At the beginning of positioning control and current value changing: Stores the value of "Da.6 Positioning address/movement amount". • At the OP shift operation of OPR control : Stores the value of OP shift amount. • At other times : Stores "0". Refresh cycle: Immediate
Md.33 Target speed	• During operation with positioning data : The actual target speed, considering the override and speed limit value, etc., is stored. "0" is stored when positioning is completed. • During interpolation of position control : The composite speed or reference axis speed is stored in the reference axis address, and "0" is stored in the interpolation axis address. • During interpolation of speed control : The target speeds of each axis are stored in the monitor of the reference axis and interpolation axis. • During JOG operation : The actual target speed, considering the JOG speed limit value for the JOG speed, is stored. • During manual pulse generator operation : "0" is stored. Refresh cycle: Immediate POINT The target speed is when an override is made to the command speed. When the speed limit value is overridden, the target speed is restricted to the speed limit value. The target speed changes every time data is switched, but does not change in an acceleration/deceleration state inside each piece of data (changes with the speed change because the target speed changes.)
Md.34 Movement amount after near-point dog ON	• "0" is stored when machine OPR starts. • After machine OPR starts, the movement amount from the near-point dog ON to the machine OPR completion is stored. (Movement amount: Movement amount to machine OPR completion using near-point dog ON as "0".) Refresh cycle: Immediate

<table>
<tr><th rowspan="2"></th><th rowspan="2">Reading the monitor value</th><th rowspan="2">Default value</th><th colspan="2">Buffer memory address</th></tr>
<tr><th>QD77MS2
QD77MS4</th><th>QD77MS16</th></tr>
<tr><td></td><td>■ Monitoring is carried out with a decimal display.
 </td><td>0</td><td>818+100n
819+100n</td><td>2418+100n
2419+100n</td></tr>
<tr><td></td><td rowspan="2">■ Monitoring is carried out with a hexadecimal display.
 </td><td>0000H</td><td>820+100n
821+100n</td><td>2420+100n
2421+100n</td></tr>
<tr><td></td><td>0000H</td><td>824+100n
825+100n</td><td>2424+100n
2425+100n</td></tr>
</table>

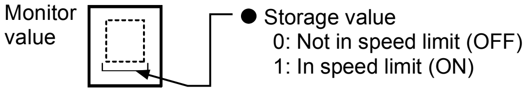
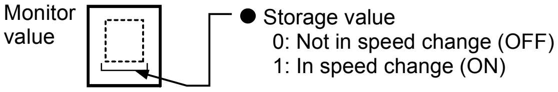
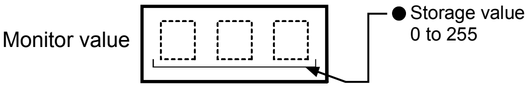
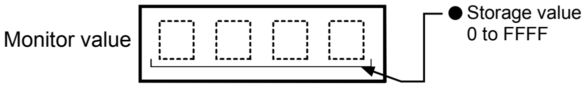
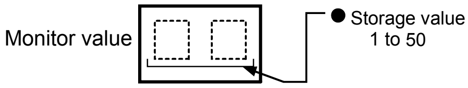
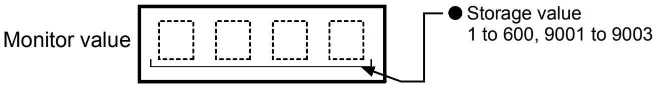
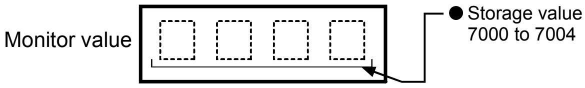
n: Axis No.-1

Storage item	Storage details	
Md.35 Torque limit stored value/ forward torque limit stored value	The "Pr.17 Torque limit setting value", "Cd.101 Torque output setting value" or "Cd.22 New torque value/forward new torque value", "Pr.54 OPR torque limit value" is stored. • During positioning start, JOG operation start, manual pulse generator operation : The "Pr.17 Torque limit setting value" or "Cd.101 Torque output setting value" is stored. • When value is changed to "Cd.22 New torque value/forward new torque value" during operation : The "Cd.22 New torque value/forward new torque value" is stored. • When OPR : The "Pr.17 Torque limit setting value" or "Cd.101 Torque output setting value" is stored. But "Pr.54 OPR torque limit value" is stored after the "Pr.47 Creep speed" completion. Refresh cycle: Immediate	
Md.36 Special start data instruction code setting value	• The "instruction code" used with special start and indicated by the start data pointer currently being executed is stored. Refresh cycle: Immediate	
Md.37 Special start data instruction parameter setting value	The "instruction parameter" used with special start and indicated by the start data pointer currently being executed is stored. The stored value differs according to the value set for Md.36 . Refresh cycle: Immediate	
Md.38 Start positioning data No. setting value	• The "positioning data No." indicated by the start data pointer currently being executed is stored. Refresh cycle: Immediate	

<table>
<tr><th rowspan="2">Reading the monitor value</th><th rowspan="2">Default value</th><th colspan="2">Buffer memory address</th></tr>
<tr><th>QD77MS2
QD77MS4</th><th>QD77MS16</th></tr>
<tr><td>■ Monitoring is carried out with a decimal display.

● Storage value
1 to 1000 (%)</td><td>0</td><td>826+100n</td><td>2426+100n</td></tr>
<tr><td>■ Monitoring is carried out with a decimal display.

● Storage value
00: Block start (Normal start)
01: Condition start
02: Wait start
03: Simultaneous start
04: FOR loop
05: FOR condition
06: NEXT</td><td>0</td><td>827+100n</td><td>2427+100n</td></tr>
<tr><td>■ Monitoring is carried out with a decimal display.

● Storage value<table><tr><th>Md.36 setting value</th><th>Stored contents</th><th>Storage value</th></tr><tr><td>00
06</td><td>None</td><td>None</td></tr><tr><td>01
02
03
05</td><td>Condition data No.</td><td>1 to 10</td></tr><tr><td>04</td><td>Number of repetitions</td><td>0 to 255</td></tr></table></td><td>0</td><td>828+100n</td><td>2428+100n</td></tr>
<tr><td>■ Monitoring is carried out with a decimal display.

● Storage value
1 to 600</td><td>0</td><td>829+100n</td><td>2429+100n</td></tr>
</table>

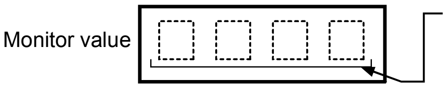
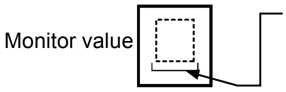
n: Axis No.-1

Storage item	Storage details	
Md.39 In speed limit flag	• If the speed exceeds the "Pr.8 Speed limit value" ("Pr.31 JOG speed limit value" at JOG operation control) due to a speed change or override, the speed limit functions, and the in speed limit flag turns ON. • When the speed drops to less than "Pr.8 Speed limit value" ("Pr.31 JOG speed limit value" at JOG operation control), or when the axis stops, the in speed limit flag turns OFF. Refresh cycle: Immediate	
Md.40 In speed change processing flag	• The speed change process flag turns ON when the speed is changed during positioning control. • After the speed change process is completed or when deceleration starts with the stop signal during the speed change process, the in speed change process flag turns OFF. Refresh cycle: Immediate	
Md.41 Special start repetition counter	• This area stores the remaining number of repetitions during "repetitions" specific to special starting. • The count is decremented by one (-1) at the loop end. • The control comes out of the loop when the count reaches "0". • This area stores "0" within an infinite loop. Refresh cycle: Immediate	
Md.42 Control system repetition counter	• This area stores the remaining number of repetitions during "repetitions" specific to control system. • The count is decremented by one (-1) at the loop start. • The loop is terminated with the positioning data of the control method "LEND", after the counter be comes "0". Refresh cycle: Immediate	
Md.43 Start data pointer being executed	• This area stores a point No. (1 to 50) attached to the start data currently being executed. • This area stores "0" after completion of a positioning operation. Refresh cycle: Immediate	
Md.44 Positioning data No. being executed	• This area stores a positioning data No. attached to the positioning data currently being executed. • This area stores "0" when the JOG/inching operation is executed. Refresh cycle: Immediate	
Md.45 Block No. being executed	• When the operation is controlled by "block start data", this area stores a block number (7000 to 7004) attached to the block currently being executed. • At other times, this area stores "0". Refresh cycle: At start	

	Reading the monitor value	Default value	Buffer memory address	
			QD77MS2 QD77MS4	QD77MS16
	■ Monitoring is carried out with a decimal display.  	0	830+100n	2430+100n
	■ Monitoring is carried out with a decimal display.  	0	831+100n	2431+100n
	■ Monitoring is carried out with a decimal display.  	0	832+100n	2432+100n
	■ Monitoring is carried out with a hexadecimal display.  	0000H	833+100n	2433+100n
	■ Monitoring is carried out with a decimal display.  	0	834+100n	2434+100n
	■ Monitoring is carried out with a decimal display.  	0	835+100n	2435+100n
	■ Monitoring is carried out with a decimal display.  	0	836+100n	2436+100n

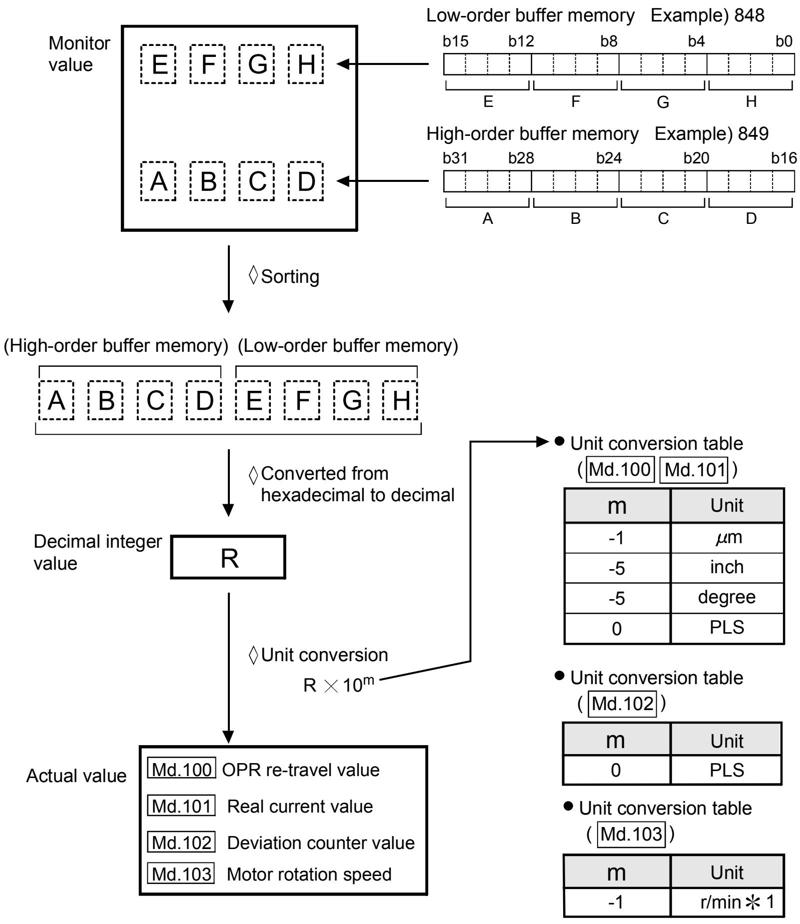
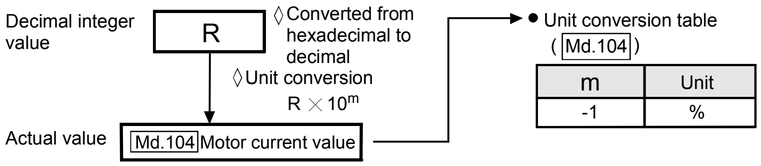
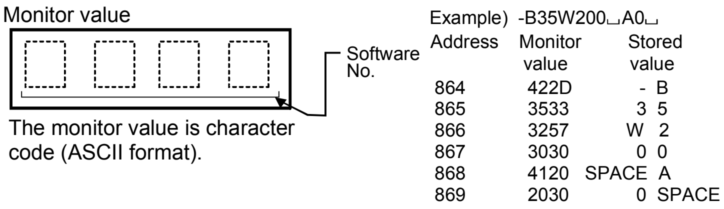
n: Axis No.-1

Storage item	Storage details	
Md.46 Last executed positioning data No.	• This area stores the positioning data No. attached to the positioning data that was executed last time. • The value is retained until a new positioning operation is executed. • This area stores "0" when the JOG/inching operation is executed. Refresh cycle: Immediate	
Md.47 Positioning data being executed	• The addresses shown to the right store details of the positioning data currently being executed (positioning data No. given by Md.44). Refresh cycle: Immediate	
Md.48 Deceleration start flag	• "1" is stored when the constant speed status or acceleration status switches to the deceleration status during position control whose operation pattern is "Positioning complete". • "0" is stored at the next operation start or manual pulse generator operation enable. Refresh cycle: Immediate POINT This parameter is possible to monitor when " Cd.41 Deceleration start flag valid" is valid.	

<table>
<tr><th rowspan="2"></th><th rowspan="2">Reading the monitor value</th><th rowspan="2">Default value</th><th colspan="2">Buffer memory address</th></tr>
<tr><th>QD77MS2
QD77MS4</th><th>QD77MS16</th></tr>
<tr><td></td><td>■ Monitoring is carried out with a decimal display.

● Storage value
1 to 600, 9001 to 9003</td><td>0</td><td>837+100n</td><td>2437+100n</td></tr>
<tr><td></td><td>Information is stored in the following addresses:
<table>
<tr><th colspan="2">Stored address (Monitor value)</th><th rowspan="2">Stored item</th><th colspan="2">Reference</th></tr>
<tr><th>QD77MS2
QD77MS4</th><th>QD77MS16</th><th>QD77MS2
QD77MS4</th><th>QD77MS16</th></tr>
<tr><td>838+100n</td><td>2438+100n</td><td>Positioning identifier</td><td>Da.1 to Da.5</td><td>Da.1 to Da.4</td></tr>
<tr><td>839+100n</td><td>2439+100n</td><td>M code</td><td>Da.10</td><td>Da.10</td></tr>
<tr><td>840+100n</td><td>2440+100n</td><td>Dwell time</td><td>Da.9</td><td>Da.9</td></tr>
<tr><td>—</td><td>2441+100n</td><td>Axis to be interpolated</td><td>—</td><td>Da.20 to Da.22</td></tr>
<tr><td>842+100n</td><td>2442+100n</td><td rowspan="2">Command speed</td><td rowspan="2">Da.8</td><td rowspan="2">Da.8</td></tr>
<tr><td>843+100n</td><td>2443+100n</td></tr>
<tr><td>844+100n</td><td>2444+100n</td><td rowspan="2">Positioning address</td><td rowspan="2">Da.6</td><td rowspan="2">Da.6</td></tr>
<tr><td>845+100n</td><td>2445+100n</td></tr>
<tr><td>846+100n</td><td>2446+100n</td><td rowspan="2">Arc address</td><td rowspan="2">Da.7</td><td rowspan="2">Da.7</td></tr>
<tr><td>847+100n</td><td>2447+100n</td></tr>
</table></td><td>0</td><td>838+100n
to
847+100n</td><td>2438+100n
to
2447+100n</td></tr>
<tr><td></td><td>■ Monitoring is carried out with a decimal display.

● Storage value
0: Status other than below
1: Status from deceleration start to next operation start or manual pulse generator operation enable</td><td>0</td><td>899+100n</td><td>2499+100n</td></tr>
</table>

n: Axis No.-1

Storage item	Storage details	
Md.100 OPR re-travel value	• This area stores the travel distance during the OPR travel to the zero point that was executed last time. "0" is stored at machine OPR start. For setting units Example) mm (Buffer memory × 0.1) µm Refresh cycle: Immediate	
Md.101 Real current value	• This area stores the current value (feed current value – deviation counter droop pulses). Example) mm (Buffer memory × 0.1) µm Refresh cycle: Operation cycle	
Md.102 Deviation counter value	• This area stores the difference between the feed current and the real current value. (Buffer memory details) PLS Refresh cycle: Operation cycle	
Md.103 Motor rotation speed	• This area stores the motor speed updated in real time. (Buffer memory × 0.1) r/min ＊1 ＊1: The unit is mm/s at linear servo use. Refresh cycle: Operation cycle	
Md.104 Motor current value	• This area stores the present motor current value of the motor. (Buffer memory × 0.1) % Refresh cycle: Operation cycle	
Md.106 Servo amplifier software No.	• This area stores the software No. of the servo amplifier used. • This area is update when the control power of the servo amplifier is turned ON. Refresh cycle: Servo amplifier's power supply ON	

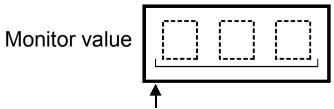
	Reading the monitor value	Default value	Buffer memory address	
			QD77MS2 QD77MS4	QD77MS16
	■ Monitoring is carried out with a hexadecimal display. 	0000H	848+100n 849+100n	2448+100n 2449+100n
		0000H	850+100n 851+100n	2450+100n 2451+100n
		0000H	852+100n 853+100n	2452+100n 2453+100n
		0000H	854+100n 855+100n	2454+100n 2455+100n
	■ Monitoring is carried out with a decimal display. 	0	856+100n	2456+100n
	■ Monitoring is carried out with a decimal display. 	0	864+100n to 869+100n	2464+100n to 2469+100n

n: Axis No.-1

Storage item	Storage details
Md.107 Parameter error No.	• When a servo parameter error occurs, the area that corresponds to the parameter number affected by the error comes ON. • When the "Cd.5 Axis error reset" (axis control data) is set to ON after remove the error factor of servo amplifier side, the servo alarm is cleared (set to 0). Refresh cycle: Immediate
Md.108 Servo status	This area stores the servo status. • Zero point pass Turns ON if the zero point of the encoder has been passed even once. • Zero speed Turns ON when the motor speed is lower than the servo parameter "zero speed." • Speed limit Turn ON during the speed limit in torque control mode. • PID control Turn ON when the servo amplifier is PID control. • READY ON Indicates the ready ON/OFF. • Servo ON Indicates the servo ON/OFF. • Control mode Indicates the control mode of servo amplifier. • Servo alarm Turn ON during the servo alarm. • In-position The dwell pulse turns ON within the servo parameter "in-position". • Torque limit Turns ON when the servo amplifier is having the torque restricted. • Absolute position lost Turns ON when the servo amplifier is lost the absolute position. • Servo warning Turn ON during the servo warning. Refresh cycle: Operation cycle

<table>
<tr><th rowspan="2"></th><th rowspan="2">Reading the monitor value</th><th rowspan="2">Default value</th><th colspan="2">Buffer memory address</th></tr>
<tr><th>QD77MS2
QD77MS4</th><th>QD77MS16</th></tr>
<tr><td></td><td>

■ Monitoring is carried out with a decimal display.



● Storage value

• When SSCNET setting is SSCNETⅢ/H

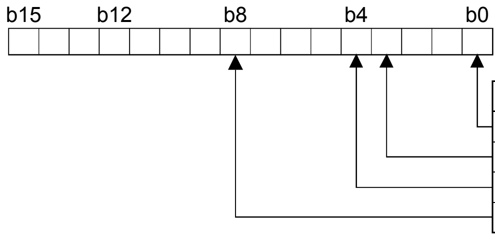
<table>
<tr><th>Storage value</th><th>Parameter No.</th></tr>
<tr><td>1 to 64</td><td>PA01 to PA64</td></tr>
<tr><td>64 to 128</td><td>PB01 to PB64</td></tr>
<tr><td>129 to 192</td><td>PC01 to PC64</td></tr>
<tr><td>193 to 256</td><td>PD01 to PD64</td></tr>
<tr><td>257 to 320</td><td>PE01 to PE64</td></tr>
<tr><td>321 to 384</td><td>PF01 to PF64</td></tr>
<tr><td>385 to 448</td><td>Po01 to Po64</td></tr>
<tr><td>449 to 512</td><td>PS01 to PS64</td></tr>
<tr><td>513 to 576</td><td>PL01 to PL64</td></tr>
</table>

• When SSCNET setting is SSCNETⅢ

<table>
<tr><th>Storage value</th><th>Parameter No.</th></tr>
<tr><td>1 to 18</td><td>PA01 to PA18</td></tr>
<tr><td>19 to 63</td><td>PB01 to PB45</td></tr>
<tr><td>64 to 95</td><td>PC01 to PC32</td></tr>
<tr><td>96 to 127</td><td>PD01 to PD32</td></tr>
<tr><td>128 to 167</td><td>PE01 to PE40</td></tr>
<tr><td>168 to 183</td><td>PF01 to PF16</td></tr>
<tr><td>184 to 199</td><td>Po01 to Po16</td></tr>
<tr><td>200 to 231</td><td>PS01 to PS32</td></tr>
<tr><td>232</td><td>PA19</td></tr>
</table>

</td><td>0</td><td>870+100n</td><td>2470+100n</td></tr>
<tr><td></td><td>

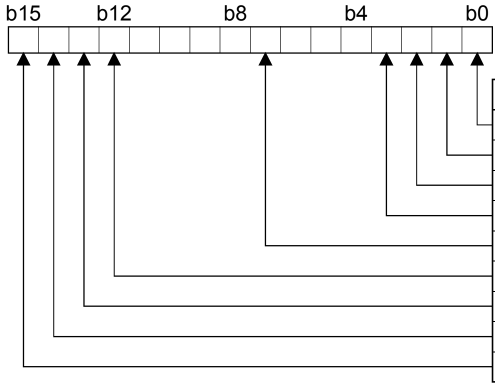
■ Monitoring is carried out with a hexadecimal display.



<table>
<tr><th colspan="2">Stored items</th><th>Meaning</th></tr>
<tr><td>b0</td><td>Zero point pass</td><td rowspan="4">0: OFF
1: ON</td></tr>
<tr><td>b3</td><td>Zero speed</td></tr>
<tr><td>b4</td><td>Speed limit</td></tr>
<tr><td>b8</td><td>PID control</td></tr>
</table>

</td><td>0000H</td><td>876+100n</td><td>2476+100n</td></tr>
<tr><td></td><td>

■ Monitoring is carried out with a hexadecimal display.



<table>
<tr><th colspan="2">Stored items</th><th>Meaning</th></tr>
<tr><td>b0</td><td>READY ON</td><td rowspan="10">0: OFF
1: ON</td></tr>
<tr><td>b1</td><td>Servo ON</td></tr>
<tr><td>b2
b3</td><td>Control mode*</td></tr>
<tr><td>b7</td><td>Servo alarm</td></tr>
<tr><td>b12</td><td>In-position</td></tr>
<tr><td>b13</td><td>Torque limit</td></tr>
<tr><td>b14</td><td>Absolute position lost</td></tr>
<tr><td>b15</td><td>Servo warning</td></tr>
</table>

*: Control mode

<table>
<tr><th>b2</th><th>b3</th><th>Control mode</th></tr>
<tr><td>0</td><td>0</td><td>Position control mode</td></tr>
<tr><td>1</td><td>0</td><td>Speed control mode</td></tr>
<tr><td>0</td><td>1</td><td>Torque control mode</td></tr>
</table>

POINT

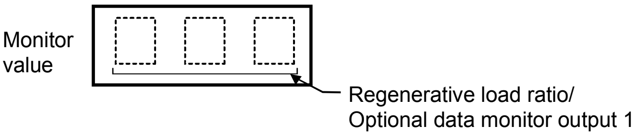
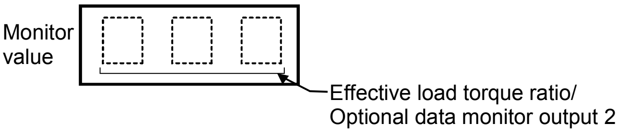
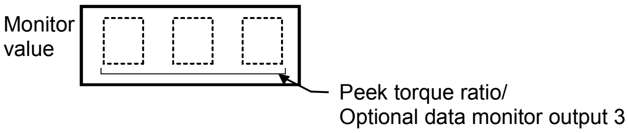
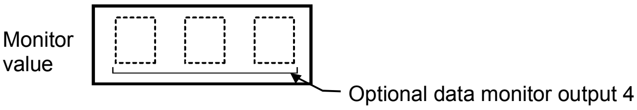
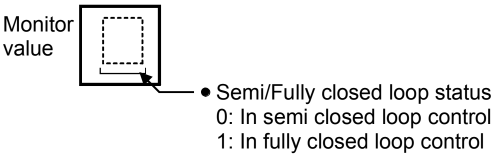
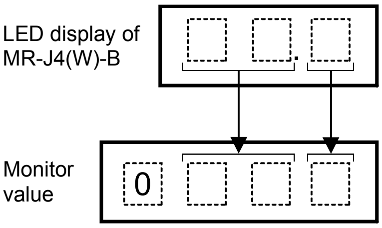
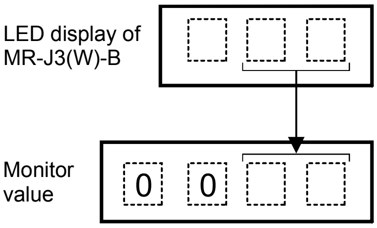
(1) When the forced stop of controller and servo amplifier occurs, the servo warning is turned ON. When the forced stop is reset, the servo warning is turned OFF.

(2) Confirm the status during continuous operation to torque control mode with "Md.125 Servo status3".

</td><td>0000H</td><td>877+100n</td><td>2477+100n</td></tr>
</table>

n: Axis No.-1

Storage item	Storage details
Md.109 Regenerative load ratio/ Optional data monitor output 1	• The rate of regenerative power to the allowable regenerative power is indicated as a percentage. • When the regenerative option is used, the rate to the allowable regenerative power of the option is indicated. (Buffer memory) % • This area stores the content set in "Pr.91 Optional data monitor: Data type setting 1" at optional data monitor data type setting. Refresh cycle: Operation cycle
Md.110 Effective load torque/ Optional data monitor output 2	• The continuous effective load torque is indicated. • The average value of the load rates for the past 15 seconds to the rated torque is stored as a percentage, rated torque being 100%. (Buffer memory) % • This area stores the content set in "Pr.92 Optional data monitor: Data type setting 2" at optional data monitor data type setting. Refresh cycle: Operation cycle
Md.111 Peak torque ratio/ Optional data monitor output 3	• The maximum torque is indicated. (Holding value) • The peak values for the past 15 seconds are indicated, rated torque being 100%. (Buffer memory) % • This area stores the content set in "Pr.93 Optional data monitor: Data type setting 3" at optional data monitor data type setting. Refresh cycle: Operation cycle
Md.112 Optional data monitor output 4	• This area stores the content set in "Pr.94 Optional data monitor: Data type setting 4" at optional data monitor data type setting. ("0" is stored when the optional data monitor data type is not set.) Refresh cycle: Operation cycle
Md.113 Semi/Fully closed loop status	• The switching status of semi closed loop control/fully closed loop control is indicated. Refresh cycle: Operation cycle
Md.114 Servo alarm	• This area stores the servo alarm code and servo warning code displayed in LED of servo amplifier. • When the "Cd.5 Axis error reset" (axis control data) is set to ON after remove the error factor of servo amplifier side, the servo alarm is cleared (set to 0). Refresh cycle: Immediate

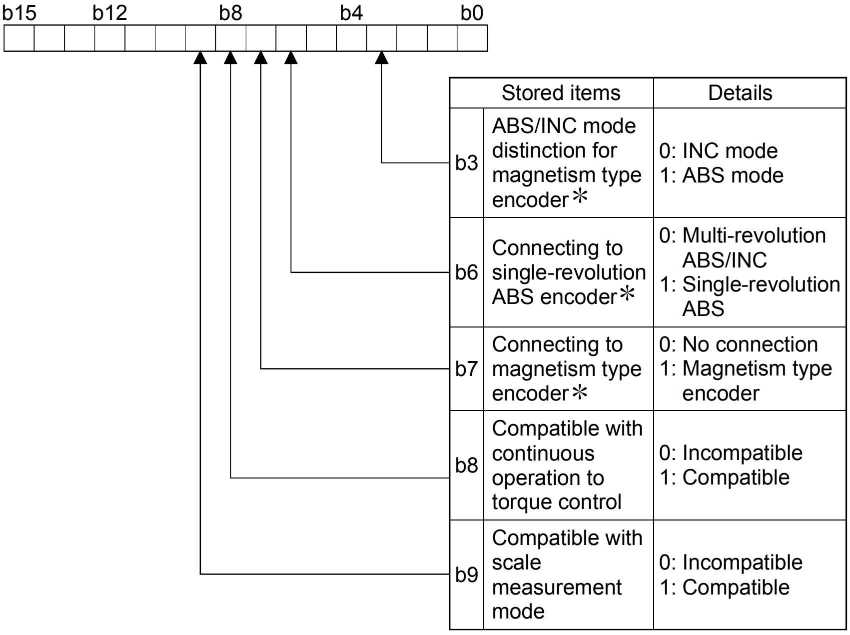
	Reading the monitor value	Default value	Buffer memory address	
			QD77MS2 QD77MS4	QD77MS16
	■ Monitoring is carried out with a decimal display.  	0	878+100n	2478+100n
	■ Monitoring is carried out with a decimal display.  	0	879+100n	2479+100n
	■ Monitoring is carried out with a decimal display.  	0	880+100n	2480+100n
	■ Monitoring is carried out with a decimal display.  	0	881+100n	2481+100n
	■ Monitoring is carried out with a decimal display.  	0	887+100n	2487+100n
	■ Monitoring is carried out with a hexadecimal display. • When SSCNET setting is SSCNETⅢ/H  • When SSCNET setting is SSCNETⅢ  	0000H	888+100n	2488+100n

n: Axis No.-1

Storage item	Storage details	
Md.116 Encoder option information	• The option information of encoder is indicated. Refresh cycle: Servo amplifier's power supply ON	
Md.120 Reverse torque limit stored value	"Pr.17 Torque limit setting value", "Cd.101 Torque output setting value" or "Cd.113 Reverse new torque value", "Pr.54 OPR torque limit value" is stored. • At the positioning start/JOG operation start/ manual pulse generator operation : The "Pr.17 Torque limit setting value" or "Cd.101 Torque output setting value" is stored. • When a value is set in "Cd.22 New torque value/forward new torque value" or "Cd.113 Reverse new torque value" during operation. : "Cd.22 New torque value/forward new torque value" is stored when "0" is set in "Cd.112 Torque change function switching request". "Cd.113 Reverse new torque value" is stored when "1" is set in "Cd.112 Torque change function switching request". • At the OPR : "Pr.17 Torque limit setting value" or "Cd.101 Torque output setting value" is stored. However, "Pr.54 OPR torque limit value" is stored after it reach to "Pr.47 Creep speed" completion. Refresh cycle: Immediate	

<table>
<tr><th rowspan="2"></th><th rowspan="2">Reading the monitor value</th><th rowspan="2">Default value</th><th colspan="2">Buffer memory address</th></tr>
<tr><th>QD77MS2
QD77MS4</th><th>QD77MS16</th></tr>
<tr><td></td><td>

■ Monitoring is carried out with a hexadecimal display.

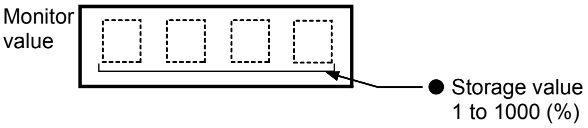


<table>
<tr><th colspan="2">Stored items</th><th>Details</th></tr>
<tr><td>b3</td><td>ABS/INC mode distinction for magnetism type encoder*</td><td>0: INC mode
1: ABS mode</td></tr>
<tr><td>b6</td><td>Connecting to single-revolution ABS encoder*</td><td>0: Multi-revolution ABS/INC
1: Single-revolution ABS</td></tr>
<tr><td>b7</td><td>Connecting to magnetism type encoder*</td><td>0: No connection
1: Magnetism type encoder</td></tr>
<tr><td>b8</td><td>Compatible with continuous operation to torque control</td><td>0: Incompatible
1: Compatible</td></tr>
<tr><td>b9</td><td>Compatible with scale measurement mode</td><td>0: Incompatible
1: Compatible</td></tr>
</table>

*: Servo amplifier compatible with direct drive motor use (Refer to the "Servo Amplifier Instruction Manual" for details.)

</td><td>0000H</td><td>890+100n</td><td>2490+100n</td></tr>
<tr><td></td><td>

■ Monitoring is carried out with a decimal display.



● Storage value
1 to 1000 (%)

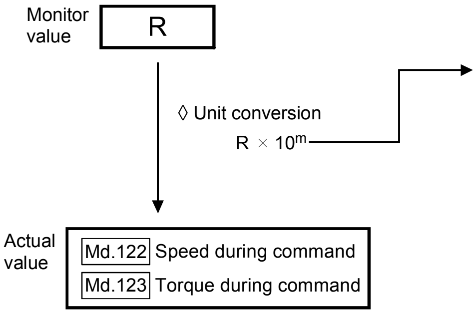
</td><td>0</td><td>891+100n</td><td>2491+100n</td></tr>
</table>

n: Axis No.-1

Storage item	Storage details
Md.122 Speed during command	• This area stores the command speed during speed control mode. • This area stores the command speed during continuous operation to torque control mode. • "0" is stored other than during speed control mode or continuous operation to torque control mode. Refresh cycle: Operation cycle (Speed control mode and continuous operation to torque control mode only)
Md.123 Torque during command	• This area stores the command torque during torque control mode. (Buffer memory × 0.1)% • This area stores the command torque during continuous operation to torque control mode. • "0" is stored other than during torque control mode or continuous operation to torque control mode. Refresh cycle: Operation cycle (Torque control mode and continuous operation to torque control mode only)
Md.124 Control mode switching status	• This area stores the switching status of control mode. Refresh cycle: Operation cycle
Md.125 Servo status3	• This area stores the servo status. • Continuous operation to torque control mode Turn ON when the continuous operation to torque control mode. Refresh cycle: Operation cycle

<table>
<tr><th rowspan="2"></th><th rowspan="2">Reading the monitor value</th><th rowspan="2">Default value</th><th colspan="2">Buffer memory address</th></tr>
<tr><th>QD77MS2
QD77MS4</th><th>QD77MS16</th></tr>
<tr><td></td><td rowspan="2">

■ Monitoring is carried out with a decimal display.



● Unit conversion table (Md.122)

<table>
<tr><th>m</th><th>Unit</th></tr>
<tr><td>-2</td><td>mm/min</td></tr>
<tr><td>-3</td><td>inch/min</td></tr>
<tr><td>-3 ∗</td><td>degree/min</td></tr>
<tr><td>0</td><td>PLS/s</td></tr>
</table>

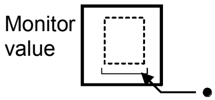
∗ : When "Pr.83 Speed control 10 x multiplier setting for degree axis" is valid: "-2"

● Unit conversion table (Md.123)

<table>
<tr><th>m</th><th>Unit</th></tr>
<tr><td>-1</td><td>%</td></tr>
</table>

</td><td>0</td><td>892+100n
893+100n</td><td>2492+100n
2493+100n</td></tr>
<tr><td></td><td>0</td><td>894+100n</td><td>2494+100n</td></tr>
<tr><td></td><td>

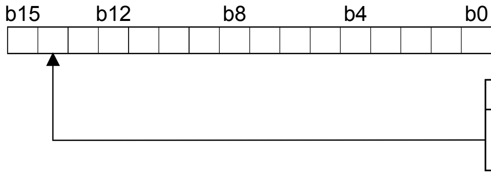
■ Monitoring is carried out with a decimal display.



● Control mode switching status
0: Not during control mode switching
1: Position control mode - continuous operation to torque control mode, speed control mode - continuous operation to torque control mode switching
2: Waiting for the completion of control mode switching condition

</td><td>0</td><td>895+100n</td><td>2495+100n</td></tr>
<tr><td></td><td>

■ Monitoring is carried out with a hexadecimal display.



<table>
<tr><th colspan="2">Stored items</th><th>Meaning</th></tr>
<tr><td>b14</td><td>Continuous operation to torque control mode</td><td>0: OFF
1: ON</td></tr>
</table>

</td><td>0000H</td><td>858+100n</td><td>2458+100n</td></tr>
</table>

n: Axis No.-1

5.7 List of control data

The setting items of the control data are explained in this section.

- Guide to buffer memory address
  In the buffer memory address, "n" in "4303+100n", etc. indicates a value corresponding to axis No. such as the following table.

Axis No.	n	Axis No.	n	Axis No.	n	Axis No.	n
1	0	5	4	9	8	13	12
2	1	6	5	10	9	14	13
3	2	7	6	11	10	15	14
4	3	8	7	12	11	16	15

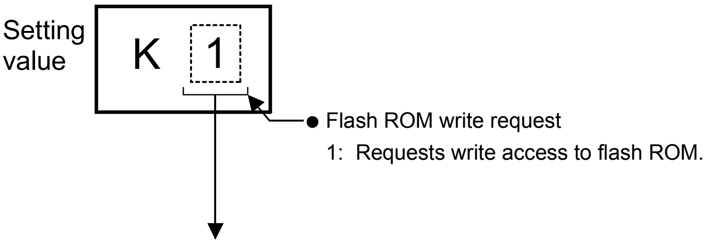
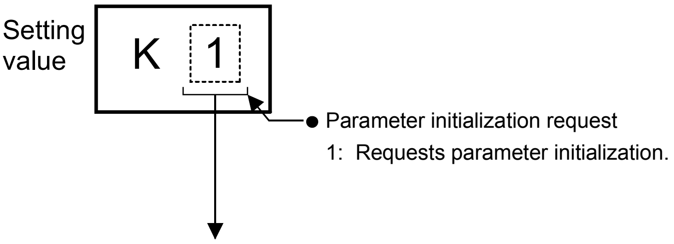
(Note-1): Calculate as follows for the buffer memory address corresponding to each axis.
(Example) For axis No. 16
4303+100n (Cd.6 Restart command)=4303+100×15=5803

(Note-2): The range from axis No.1 to 2 (n=0 to 1) is valid in the QD77MS2.

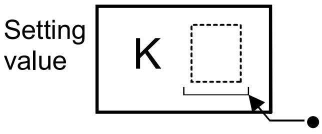
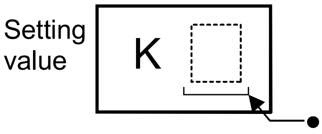
(Note-3): The range from axis No.1 to 4 (n=0 to 3) is valid in the QD77MS4.

5.7.1 System control data

Setting item	Setting details
Cd.1 Flash ROM write request	• Requests writing of data (parameters, positioning data, and block start data) from the buffer memory to the flash ROM. Fetch cycle: 103[ms] POINT (1) Do not turn the power OFF or reset the PLC CPU while writing to the flash ROM. If the power is turned OFF or the PLC CPU is reset to forcibly end the process, the data backed up in the flash ROM will be lost. (2) Do not write the data to the buffer memory before writing to the flash ROM is completed. (3) The number of writes to the flash ROM with the sequence program is 25 max. while the power is turned ON. Writing to the flash ROM beyond 25 times will cause an error (error code: 805). Refer to Section 16.5 "List of errors" for details. (4) Monitoring is the number of writes to the flash ROM after the power is switched ON by the "Md.19 Number of write accesses to flash ROM".
Cd.2 Parameter initialization request	• Requests initialization of setting data. Refer to Section 14.2 for initialized setting data. Initialization: Resetting of setting data to default values Fetch cycle: 103[ms] Note: After completing the initialization of setting data, switch the power ON or reset the PLC CPU.

	Setting value	Default value	Buffer memory address (common for all axes)	
			QD77MS2 QD77MS4	QD77MS16
	■ Set with a decimal.  ● Flash ROM write request 1: Requests write access to flash ROM. The Simple Motion module resets the value to "0" automatically when the write access completes. (This indicates the completion of write operation.)	0	1900	5900
	■ Set with a decimal.  ● Parameter initialization request 1: Requests parameter initialization. The Simple Motion module resets the value to "0" automatically when the initialization completes. (This indicates the completion of parameter initialization.)	0	1901	5901

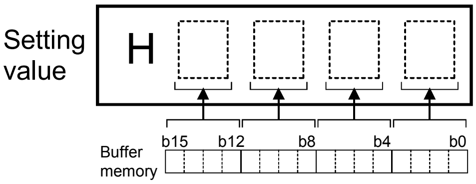
Setting item	Setting details	
Cd.41 Deceleration start flag valid	• Set whether " Md.48 Deceleration start flag" is made valid or invalid. Fetch cycle: At PLC READY ON POINT The " Cd.41 Deceleration start flag valid" become valid when the PLC READY signal [Y0] turns from OFF to ON.	
Cd.42 Stop command processing for deceleration stop selection	• Set the stop command processing for deceleration stop function (deceleration curve re-processing/deceleration curve continuation). Fetch cycle: At deceleration stop causes occurrence	

	Setting value	Default value	Buffer memory address (common for all axes)	
			QD77MS2 QD77MS4	QD77MS16
	■ Set with a decimal.  ● Deceleration start flag valid 0: Deceleration start flag invalid 1: Deceleration start flag valid	0	1905	5905
	■ Set with a decimal.  ● Stop command processing for deceleration stop selection 0: Deceleration curve re-processing 1: Deceleration curve continuation	0	1907	5907

Setting item	Setting details	
Cd.44 External input signal operation device	• Operate the external input signal status (Upper/lower limit signal, near-point dog signal, stop signal) of QD77MS when "2" is set in "Pr.80 External input signal selection". Fetch cycle: Operation cycle	

Setting value	Default value	Buffer memory address (common for all axes) QD77MS2 QD77MS4	Buffer memory address (common for all axes) QD77MS16
(see below)	0000H	1928	5928 to 5931

■ Set with a hexadecimal.



● QD77MS2/QD77MS4

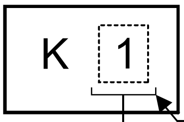
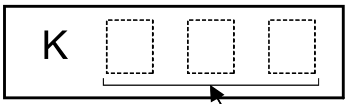
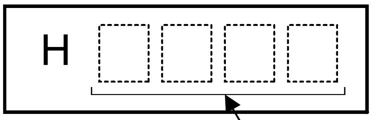
Buffer memory		Setting items	Default value	Meaning
1928	b0	Axis 1 Upper limit signal (FLS)	0	" Pr.22 Input signal logic selection" is negative logic 0: OFF 1: ON
	b1	Axis 1 Lower limit signal (RLS)	0	
	b2	Axis 1 Near-point dog signal (DOG)	0	
	b3	Axis 1 STOP signal (STOP)	0	
	b4	Axis 2 Upper limit signal (FLS)	0	
	b5	Axis 2 Lower limit signal (RLS)	0	
	b6	Axis 2 Near-point dog signal (DOG)	0	
	b7	Axis 2 STOP signal (STOP)	0	
	b8	Axis 3 Upper limit signal (FLS)	0	" Pr.22 Input signal logic selection" is positive logic 0: ON 1: OFF
	b9	Axis 3 Lower limit signal (RLS)	0	
	b10	Axis 3 Near-point dog signal (DOG)	0	
	b11	Axis 3 STOP signal (STOP)	0	
	b12	Axis 4 Upper limit signal (FLS)	0	
	b13	Axis 4 Lower limit signal (RLS)	0	
	b14	Axis 4 Near-point dog signal (DOG)	0	
	b15	Axis 4 STOP signal (STOP)	0	

● QD77MS16

Buffer memory		Setting items	Default value	Meaning
5928	b0	Axis 1 Upper limit signal (FLS)	0	" Pr.22 Input signal logic selection" is negative logic 0: OFF 1: ON
	b1	Axis 1 Lower limit signal (RLS)	0	
	b2	Axis 1 Near-point dog signal (DOG)	0	
	b3	Axis 1 STOP signal (STOP)	0	
	b4	Axis 2 Upper limit signal (FLS)	0	
	b5	Axis 2 Lower limit signal (RLS)	0	
	b6	Axis 2 Near-point dog signal (DOG)	0	
	b7	Axis 2 STOP signal (STOP)	0	
	b8	Axis 3 Upper limit signal (FLS)	0	
	b9	Axis 3 Lower limit signal (RLS)	0	
	b10	Axis 3 Near-point dog signal (DOG)	0	
	b11	Axis 3 STOP signal (STOP)	0	
	b12	Axis 4 Upper limit signal (FLS)	0	
	b13	Axis 4 Lower limit signal (RLS)	0	
	b14	Axis 4 Near-point dog signal (DOG)	0	
	b15	Axis 4 STOP signal (STOP)	0	
5929	b0	Axis 5 Upper limit signal (FLS)	0	" Pr.22 Input signal logic selection" is positive logic 0: ON 1: OFF
	b1	Axis 5 Lower limit signal (RLS)	0	
	b2	Axis 5 Near-point dog signal (DOG)	0	
	b3	Axis 5 STOP signal (STOP)	0	
	b4	Axis 6 Upper limit signal (FLS)	0	
	b5	Axis 6 Lower limit signal (RLS)	0	
	b6	Axis 6 Near-point dog signal (DOG)	0	
	b7	Axis 6 STOP signal (STOP)	0	
	b8	Axis 7 Upper limit signal (FLS)	0	
	b9	Axis 7 Lower limit signal (RLS)	0	
	b10	Axis 7 Near-point dog signal (DOG)	0	
	b11	Axis 7 STOP signal (STOP)	0	
	b12	Axis 8 Upper limit signal (FLS)	0	
	b13	Axis 8 Lower limit signal (RLS)	0	
	b14	Axis 8 Near-point dog signal (DOG)	0	
	b15	Axis 8 STOP signal (STOP)	0	

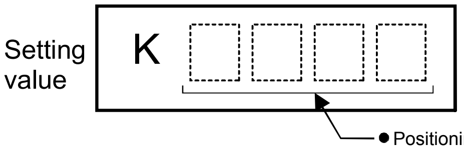
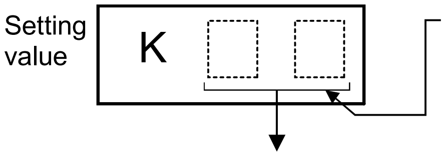
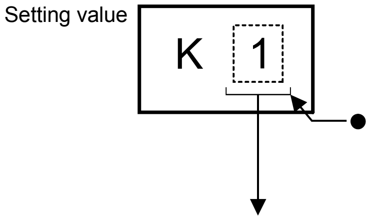
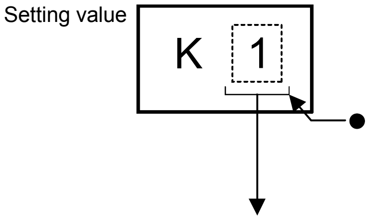
Buffer memory		Setting items	Default value	Meaning
5930	b0	Axis 9 Upper limit signal (FLS)	0	" Pr.22 Input signal logic selection" is negative logic 0: OFF 1: ON
	b1	Axis 9 Lower limit signal (RLS)	0	
	b2	Axis 9 Near-point dog signal (DOG)	0	
	b3	Axis 9 STOP signal (STOP)	0	
	b4	Axis 10 Upper limit signal (FLS)	0	
	b5	Axis 10 Lower limit signal (RLS)	0	
	b6	Axis 10 Near-point dog signal (DOG)	0	
	b7	Axis 10 STOP signal (STOP)	0	
	b8	Axis 11 Upper limit signal (FLS)	0	
	b9	Axis 11 Lower limit signal (RLS)	0	
	b10	Axis 11 Near-point dog signal (DOG)	0	
	b11	Axis 11 STOP signal (STOP)	0	
	b12	Axis 12 Upper limit signal (FLS)	0	
	b13	Axis 12 Lower limit signal (RLS)	0	
	b14	Axis 12 Near-point dog signal (DOG)	0	
	b15	Axis 12 STOP signal (STOP)	0	
5931	b0	Axis 13 Upper limit signal (FLS)	0	" Pr.22 Input signal logic selection" is positive logic 0: ON 1: OFF
	b1	Axis 13 Lower limit signal (RLS)	0	
	b2	Axis 13 Near-point dog signal (DOG)	0	
	b3	Axis 13 STOP signal (STOP)	0	
	b4	Axis 14 Upper limit signal (FLS)	0	
	b5	Axis 14 Lower limit signal (RLS)	0	
	b6	Axis 14 Near-point dog signal (DOG)	0	
	b7	Axis 14 STOP signal (STOP)	0	
	b8	Axis 15 Upper limit signal (FLS)	0	
	b9	Axis 15 Lower limit signal (RLS)	0	
	b10	Axis 15 Near-point dog signal (DOG)	0	
	b11	Axis 15 STOP signal (STOP)	0	
	b12	Axis 16 Upper limit signal (FLS)	0	
	b13	Axis 16 Lower limit signal (RLS)	0	
	b14	Axis 16 Near-point dog signal (DOG)	0	
	b15	Axis 16 STOP signal (STOP)	0	

Setting item	Setting details	
Cd.47 QD75MH initial value setting request	• Request to set the initial value of QD75MH in setting data. Refer to Section 14.14 for initialized setting data. Fetch cycle: 103[ms] Note: After completing the initialization of setting data, switch the power ON or reset the PLC CPU.	
Cd.102 SSCNET control command	• Set the connect/disconnect command of SSCNET communication. Fetch cycle: 3.5[ms]	
Cd.137 Amplifier-less operation mode switching request	• Set the switching request of the normal operation mode and amplifier-less operation mode. Fetch cycle: 3.5[ms]	

	Setting value	Default value	Buffer memory address (common for all axes)	
			QD77MS2 QD77MS4	QD77MS16
	■ Set with a decimal. Setting value  ● QD75MH initial value setting request 1: Requests QD75MH initial value setting. The Simple Motion module resets the value to "0" automatically after the initial value setting is completed. (Indicates that the initial value setting is completed.)	0	1909	5909
	■ Set with a decimal. Setting value  ● SSCNET control command 0 : No command Axis No.(Note-1) : Disconnect command of SSCNET communication (Axis No. to be disconnected) -2 : Execute command -10 : Connect command of SSCNET communication Except above setting : Invalid (Note-1): QD77MS2 : 1 to 2 QD77MS4 : 1 to 4 QD77MS16: 1 to 16	0	1932	5932
	■ Set with a hexadecimal. Setting value  ● Amplifier-less operation mode switching request ABCDh: Change from normal operation mode to amplifier-less operation mode 0000h : Change from amplifier-less operation mode to normal operation mode	0000H	1926	5926

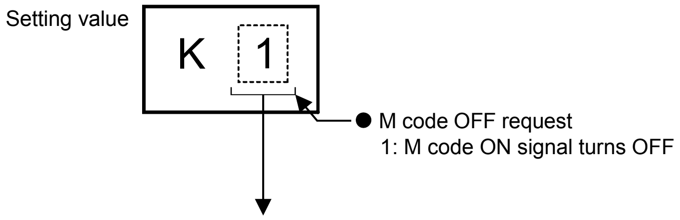
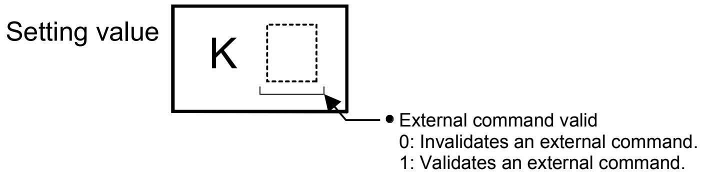
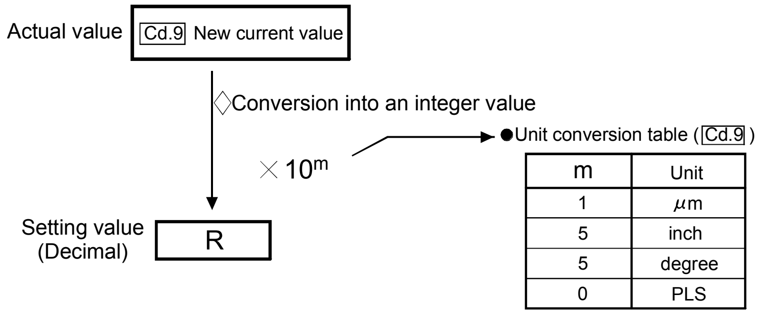
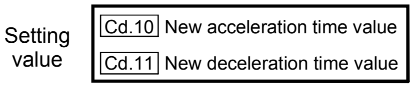
5.7.2 Axis control data

Setting item	Setting details	
Cd.3 Positioning start No.	• Set the positioning start No. (Only 1 to 600 for the Pre-reading start function. For details, refer to Section 13.7.7 "Pre-reading start function".) Fetch cycle: At start	
Cd.4 Positioning starting point No.	• Set a "starting point No." (1 to 50) if block start data is used for positioning. (Handled as "1" if the value of other than 1 to 50 is set.) Fetch cycle: At start	
Cd.5 Axis error reset	• Clears the axis error detection, axis error No., axis warning detection and axis warning No. • When the axis operation state of Simple Motion module is "in error occurrence", the error is cleared and the Simple Motion module is returned to the "waiting" state. • Clears the both of Simple Motion module errors and servo amplifier errors by axis error reset. (Some servo amplifier errors cannot be reset even if error reset is requested. At the time, "0" is not stored in Cd.5 by the Simple Motion module. It remains "1". Set "0" in Cd.5 and then set "1" to execute the error reset again by user side. Refer to the "Servo Amplifier Instruction Manual" for details.) Fetch cycle: 14.2[ms]	
Cd.6 Restart command	• When positioning is stopped for any reason (when axis operation state is "stopped"), set "1" in Cd.6. Positioning will be carried out again from the stopped position to the end point of the stopped positioning data. Fetch cycle: 14.2[ms]	

Setting value	Default value	Buffer memory address QD77MS2 QD77MS4	Buffer memory address QD77MS16
■ Set with a decimal.  ● Positioning data No. • 1 to 600 : Positioning data No. • 7000 to7004 : Block start designation • 9001 : Machine OPR • 9002 : Fast-OPR • 9003 : Current value changing • 9004 : Simultaneous starting of multiple axes	0	1500+100n	4300+100n
■ Set with a decimal.  ● Positioning starting point No. 1 to 50 The Simple Motion module resets the value to "0" automatically when the continuous operation is interrupted.	0	1501+100n	4301+100n
■ Set with a decimal.  ● Error reset request 1: Axis error is reset. The Simple Motion module resets the value to "0" automatically after the axis error reset is completed. (Indicates that the axis error reset is completed.)	0	1502+100n	4302+100n
■ Set with a decimal.  ● Restart command 1: Restarts The Simple Motion module resets the value to "0" automatically after restart acceptance is completed. (Indicates that the restart acceptance is completed.)	0	1503+100n	4303+100n

n: Axis No.-1

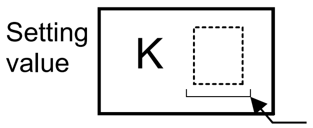
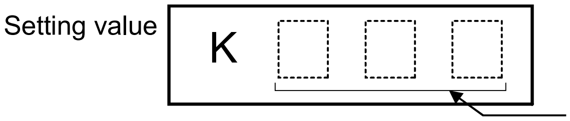
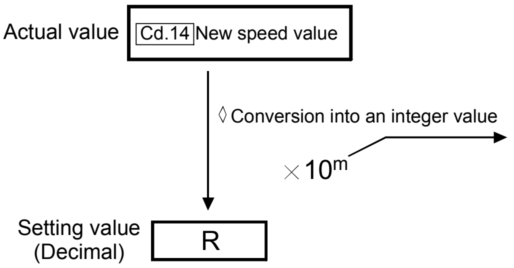
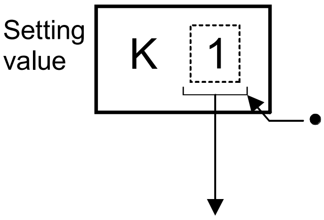
<table>
<tr><th>Setting item</th><th>Setting details</th><th></th></tr>
<tr><td>Cd.7 M code OFF request</td><td>• The M code ON signal turns OFF.
Fetch cycle: Operation cycle</td><td></td></tr>
<tr><td>Cd.8 External command valid</td><td>• Validates or invalidates external command signals.
Fetch cycle: At request by external command signal</td><td></td></tr>
<tr><td>Cd.9 New current value</td><td>• When changing the "current feed value" using the start No. "9003", use this data item to specify a new feed value.
• Set a value within the following range:
<table>
<tr><th>Pr.1 Unit setting</th><th>mm ($\times 10^{-1}$ μm)</th><th>inch ($\times 10^{-5}$ inch)</th><th>degree ($\times 10^{-5}$ degree)</th><th>PLS (PLS)</th></tr>
<tr><td>Setting range</td><td>-2147483648 to +2147483647</td><td>-2147483648 to +2147483647</td><td>0 to 35999999</td><td>-2147483648 to +2147483647</td></tr>
</table>
Fetch cycle: At change request</td><td></td></tr>
<tr><td>Cd.10 New acceleration time value</td><td>• When changing the acceleration time during a speed change, use this data item to specify a new acceleration time.
<table>
<tr><th>Cd.10 setting range (unit)</th></tr>
<tr><td>0 to 8388608 (ms)</td></tr>
</table>
Fetch cycle: At change request</td><td></td></tr>
<tr><td>Cd.11 New deceleration time value</td><td>• When changing the deceleration time during a speed change, use this data item to specify a new deceleration time.
<table>
<tr><th>Cd.11 setting range (unit)</th></tr>
<tr><td>0 to 8388608 (ms)</td></tr>
</table>
Fetch cycle: At change request</td><td></td></tr>
</table>

	Setting value	Default value	Buffer memory address	
			QD77MS2 QD77MS4	QD77MS16
	■ Set with a decimal.  After the M code ON signal turns OFF, "0" is stored by the Simple Motion module automatically. (Indicates that the OFF request is completed.)	0	1504+100n	4304+100n
	■ Set with a decimal.  	0	1505+100n	4305+100n
	■ Set with a decimal.  	0	1506+100n 1507+100n	4306+100n 4307+100n
	■ Set with a decimal.  Example: When the "Cd. 10 New acceleration time value" is set as "60000 ms", the buffer memory stores "60000".	0	1508+100n 1509+100n	4308+100n 4309+100n
		0	1510+100n 1511+100n	4310+100n 4311+100n

n: Axis No.-1

<table>
<tr><th>Setting item</th><th>Setting details</th></tr>
<tr><td>Cd.12 Acceleration/deceleration time change during speed change, enable/disable selection</td><td>
Enables or disables modifications to the acceleration/deceleration time during a speed change.
<p><u>Fetch cycle: At change request</u></p></td></tr>
<tr><td>Cd.13 Positioning operation speed override</td><td>
To use the positioning operation speed override function, use this data item to specify an "override" value.
∗: For details of the override function, refer to Section 13.5.2 "Override function".

If the speed resulting from a small override value (e.g. 1%) includes fractions below the minimum unit, the speed is raised to make a complete unit and the warning No. 110 is output.
<p><u>Fetch cycle: Operation cycle</u></p></td></tr>
<tr><td>Cd.14 New speed value</td><td>
When changing the speed, use this data item to specify a new speed.
The operation halts if you specify "0".
Set a value within the following range:
<table>
<tr><th>Pr.1 Unit setting</th><th>mm
($\times 10^{-2}$ mm/min)</th><th>inch
($\times 10^{-3}$ inch/min)</th><th>degree∗
($\times 10^{-3}$ degree/min)</th><th>PLS
(PLS/s)</th></tr>
<tr><td>Setting range</td><td>0 to 2000000000</td><td>0 to 2000000000</td><td>0 to 2000000000</td><td>0 to 1000000000</td></tr>
</table>
<p>∗: When "Pr.83 Speed control 10 x multiplier setting for degree axis" is valid, this will be the setting range 0 to 2000000000 ($\times 10^{-2}$degree/min).</p>
<p><u>Fetch cycle: At change request</u></p></td></tr>
<tr><td>Cd.15 Speed change request</td><td>
After setting the "Cd.14 New speed value", set this data item to "1" to execute the speed change (through validating the new speed value).
<p><u>Fetch cycle: Operation cycle</u></p></td></tr>
</table>

<table>
<tr><th rowspan="2"></th><th rowspan="2">Setting value</th><th rowspan="2">Default value</th><th colspan="2">Buffer memory address</th></tr>
<tr><th>QD77MS2
QD77MS4</th><th>QD77MS16</th></tr>
<tr><td></td><td>■ Set with a decimal.

● Acceleration/deceleration time change during speed change, enable/disable selection
1 : Enables modifications to acceleration/deceleration time
Other than 1: Disables modifications to acceleration/deceleration time</td><td>0</td><td>1512+100n</td><td>4312+100n</td></tr>
<tr><td></td><td>■ Set with a decimal.

● Override value (%)
1 to 300</td><td>100</td><td>1513+100n</td><td>4313+100n</td></tr>
<tr><td></td><td>■ Set with a decimal.

● Unit conversion table (Cd.14)
<table>
<tr><th>m</th><th>Unit</th></tr>
<tr><td>2</td><td>mm/min</td></tr>
<tr><td>3</td><td>inch/min</td></tr>
<tr><td>3*</td><td>degree/min</td></tr>
<tr><td>0</td><td>PLS/s</td></tr>
</table>
* When "Pr.83 Speed control 10 x multiplier setting for degree axis" is valid: "2"
Example: When the " Cd. 14 New speed value" is set as "20000.00mm /min", the buffer memory stores "2000000".</td><td>0</td><td>1514+100n
1515+100n</td><td>4314+100n
4315+100n</td></tr>
<tr><td></td><td>■ Set with a decimal.

● Speed change request
1: Executes speed change.
The Simple Motion module resets the value to "0" automatically when the speed change request has been processed.
(This indicates the completion of speed change request.)</td><td>0</td><td>1516+100n</td><td>4316+100n</td></tr>
</table>

n: Axis No.-1

<table>
<tr><th>Setting item</th><th>Setting details</th><th></th></tr>
<tr><td>Cd.16 Inching movement amount</td><td>

- Use this data item to set the amount of movement by inching.
- The machine performs a JOG operation if "0" is set.
- Set a value within the following range:

<table>
<tr><th>Pr.1 Unit setting</th><th>mm
($\times 10^{-1}$ μm)</th><th>inch
($\times 10^{-5}$ inch)</th><th>degree
($\times 10^{-5}$ degree)</th><th>PLS
(PLS)</th></tr>
<tr><td>Setting range</td><td>0 to 65535</td><td>0 to 65535</td><td>0 to 65535</td><td>0 to 65535</td></tr>
</table>

Fetch cycle: At start
</td><td></td></tr>
<tr><td>Cd.17 JOG speed</td><td>

- Use this data item to set the JOG speed.
- Set a value within the following range:

<table>
<tr><th>Pr.1 Unit setting</th><th>mm
($\times 10^{-2}$ mm/min)</th><th>inch
($\times 10^{-3}$ inch/min)</th><th>degree *
($\times 10^{-3}$ degree/min)</th><th>PLS
(PLS/s)</th></tr>
<tr><td>Setting range</td><td>1 to 2000000000</td><td>1 to 2000000000</td><td>1 to 2000000000</td><td>1 to 1000000000</td></tr>
</table>

*: When "Pr.83 Speed control 10 x multiplier setting for degree axis" is valid, this will be the setting range 1 to 2000000000 ($\times 10^{-2}$degree/min).

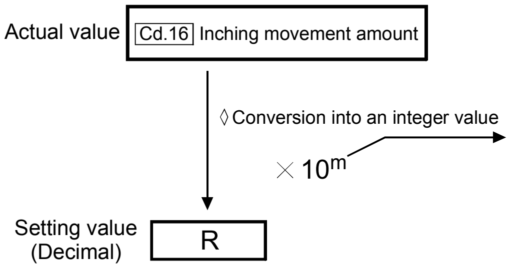
Fetch cycle: At start
</td><td></td></tr>
<tr><td>Cd.18 Interrupt request during continuous operation</td><td>

- To interrupt a continuous operation, set "1" to this data item.
- After processing the interruption request ("1"), the Simple Motion module automatically resets the value to "0".

Fetch cycle: Operation cycle
</td><td></td></tr>
</table>

<table>
<tr><th rowspan="2"></th><th rowspan="2">Setting value</th><th rowspan="2">Default value</th><th colspan="2">Buffer memory address</th></tr>
<tr><th>QD77MS2
QD77MS4</th><th>QD77MS16</th></tr>
<tr><td></td><td>

■ Set with a decimal.



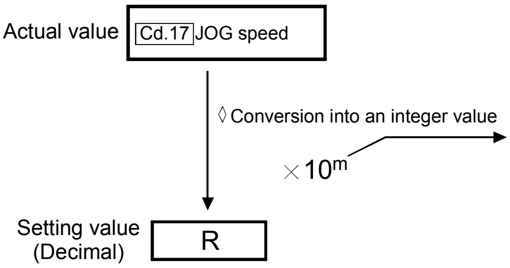
● Unit conversion table (Cd.16)

<table>
<tr><th>m</th><th>Unit</th></tr>
<tr><td>1</td><td>µm</td></tr>
<tr><td>5</td><td>inch</td></tr>
<tr><td>5</td><td>degree</td></tr>
<tr><td>0</td><td>PLS</td></tr>
</table>

Example: When the "Cd. 16 Inching movement amount" is set as "1.0 µm", the buffer memory stores "10".

</td><td>0</td><td>1517+100n</td><td>4317+100n</td></tr>
<tr><td></td><td>

■ Set with a decimal.



● Unit conversion table (Cd.17)

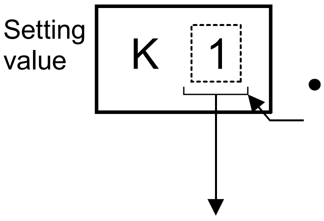
<table>
<tr><th>m</th><th>Unit</th></tr>
<tr><td>2</td><td>mm/min</td></tr>
<tr><td>3</td><td>inch/min</td></tr>
<tr><td>3 ✻</td><td>degree/min</td></tr>
<tr><td>0</td><td>PLS/s</td></tr>
</table>

✻: When "Pr.83 Speed control 10 x multiplier setting for degree axis" is valid: "2"

Example: When the "Cd. 17 JOG speed" is set as "20000.00mm/min", the buffer memory stores "2000000".

</td><td>0</td><td>1518+100n
1519+100n</td><td>4318+100n
4319+100n</td></tr>
<tr><td></td><td>

■ Set with a decimal.



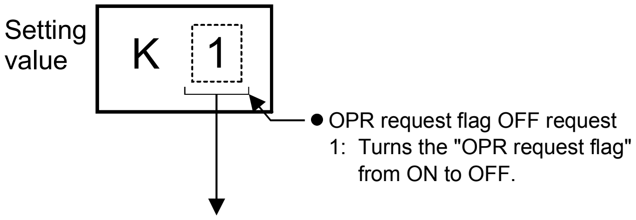
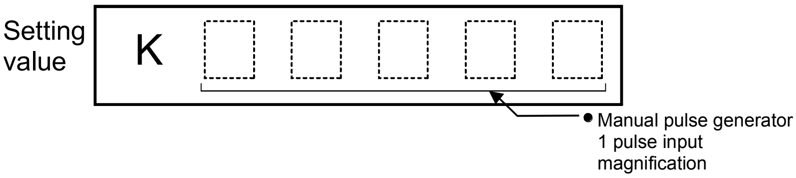
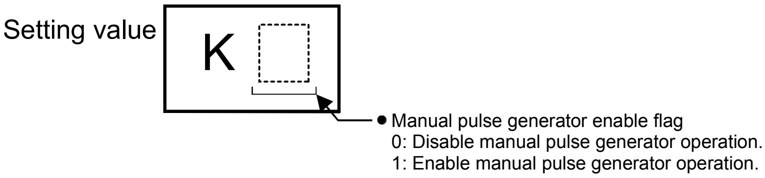
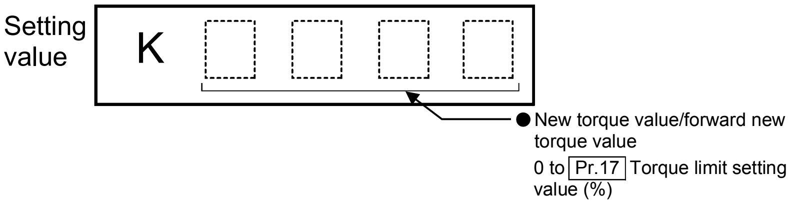
● Interruption request continuous operation
1: Interrupts continuous operation control or continuous path control.

The Simple Motion module resets the value to "0" automatically when the continuous control interruption request is processed.
(This indicates the completion of continuous operation interruption request.)

</td><td>0</td><td>1520+100n</td><td>4320+100n</td></tr>
</table>

n: Axis No.-1

Setting item	Setting details
Cd.19 OPR request flag OFF request	• The sequence program can use this data item to forcibly turn the OPR request flag from ON to OFF. Fetch cycle: 14.2[ms] POINT This parameter is made valid when the increment system is valid.
Cd.20 Manual pulse generator 1 pulse input magnification	• This data item determines the factor by which the number of pulses from the manual pulse generator is magnified. • Value "0" : read as "1". • Value "10001 or more" or negative value : read as "10000". Fetch cycle: Operation cycle (At manual pulse generator enabled)
Cd.21 Manual pulse generator enable flag	• This data item enables or disables operations using a manual pulse generator. Fetch cycle: Operation cycle
Cd.22 New torque value/ forward new torque value	• When "0" is set to "Cd.112 Torque change function switching request", a new torque limit value is set. (This value is set to the forward torque limit value and reverse torque limit value.) When "1" is set to "Cd.112 Torque change function switching request", a new forward torque limit value is set. • Set a value within "0" to "Pr.17 Torque limit setting value". Set a ratio against the rated torque in percentage unit. (The new torque value is invalid when "0" is set, and "Pr.17 Torque limit setting value" or "Cd.101 Torque output setting value" becomes valid. The range of torque change is 1 to "Pr.17 Torque limit setting value".) Fetch cycle: Operation cycle

	Setting value	Default value	Buffer memory address	
			QD77MS2 QD77MS4	QD77MS16
	■ Set with a decimal.  ● OPR request flag OFF request 1: Turns the "OPR request flag" from ON to OFF. The Simple Motion module resets the value to "0" automatically when the OPR request flag is turned OFF. (This indicates the completion of OPR request flag OFF request.)	0	1521+100n	4321+100n
	■ Set with a decimal.  ● Manual pulse generator 1 pulse input magnification 1 to 10000	1	1522+100n 1523+100n	4322+100n 4323+100n
	■ Set with a decimal.  ● Manual pulse generator enable flag 0: Disable manual pulse generator operation. 1: Enable manual pulse generator operation.	0	1524+100n	4324+100n
	■ Set with a decimal.  ● New torque value/forward new torque value 0 to Pr.17 Torque limit setting value (%)	0	1525+100n	4325+100n

n: Axis No.-1

<table>
<tr><th>Setting item</th><th>Setting details</th></tr>
<tr>
<td>Cd.23 Speed-position switching control movement amount change register</td>
<td>

During the speed control stage of the speed-position switching control (INC mode), it is possible to change the specification of the movement amount during the position control stage. For that, use this data item to specify a new movement amount.
The new movement amount has to be set during the speed control stage of the speed-position switching control (INC mode).
The value is reset to "0" when the next operation starts.
Set a value within the following range:

<table>
<tr><th>Pr.1 Unit setting</th><th>mm
($\times 10^{-1}$ μm)</th><th>inch
($\times 10^{-5}$ inch)</th><th>degree
($\times 10^{-5}$ degree)</th><th>PLS
(PLS)</th></tr>
<tr><td>Setting range</td><td>0 to 2147483647</td><td>0 to 2147483647</td><td>0 to 2147483647</td><td>0 to 2147483647</td></tr>
</table>
<u>Fetch cycle: At switching request</u>
</td>
</tr>
<tr>
<td>Cd.24 Speed-position switching enable flag</td>
<td>

Set whether the switching signal set in "Cd.45 Speed-position switching device selection" is enabled or not.

<u>Fetch cycle: At switching request</u>
</td>
</tr>
<tr>
<td>Cd.25 Position-speed switching control speed change register</td>
<td>

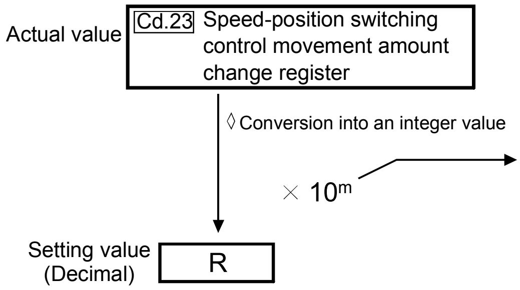
During the position control stage of the position-speed switching control, it is possible to change the specification of the speed during the speed control stage. For that, use this data item to specify a new speed.
The new speed has to be set during the position control stage of the position-speed switching control.
The value is reset to "0" when the next operation starts.
Set a value within the following range:

<table>
<tr><th>Pr.1 Unit setting</th><th>mm
($\times 10^{-2}$ mm/min)</th><th>inch
($\times 10^{-3}$ inch/min)</th><th>degree*
($\times 10^{-3}$ degree/min)</th><th>PLS
(PLS/s)</th></tr>
<tr><td>Setting range</td><td>0 to 2000000000</td><td>0 to 2000000000</td><td>0 to 2000000000</td><td>0 to 1000000000</td></tr>
</table>
*: When "Pr.83 Speed control 10 x multiplier setting for degree axis" is valid, this will be the setting range 0 to 2000000000 ($\times 10^{-2}$degree/min).

<u>Fetch cycle: At switching request</u>
</td>
</tr>
</table>

<table>
<tr><th rowspan="2"></th><th rowspan="2">Setting value</th><th rowspan="2">Default value</th><th colspan="2">Buffer memory address</th></tr>
<tr><th>QD77MS2
QD77MS4</th><th>QD77MS16</th></tr>
<tr><td></td><td>

■ Set with a decimal.



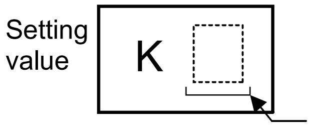
● Unit conversion table (Cd.23)

<table>
<tr><th>m</th><th>Unit</th></tr>
<tr><td>1</td><td>μm</td></tr>
<tr><td>5</td><td>inch</td></tr>
<tr><td>5</td><td>degree</td></tr>
<tr><td>0</td><td>PLS</td></tr>
</table>

Example: If "Cd. 23 Speed-position switching control movement amount change register" is set as "20000.0 μm", the buffer memory stores "200000".

</td><td>0</td><td>1526+100n
1527+100n</td><td>4326+100n
4327+100n</td></tr>
<tr><td></td><td>

■ Set with a decimal.



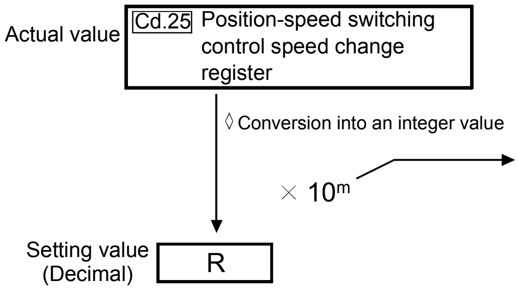
●Speed-position switching enable flag

0: Speed control will not be taken over by position control even when the signal set in "Cd.45 Speed-position switching device selection" comes ON.

1: Speed control will be taken over by position control even when the signal set in "Cd.45 Speed-position switching device selection" comes ON.

</td><td>0</td><td>1528+100n</td><td>4328+100n</td></tr>
<tr><td></td><td>

■ Set with a decimal.



● Unit conversion table (Cd.25)

<table>
<tr><th>m</th><th>Unit</th></tr>
<tr><td>2</td><td>mm/min</td></tr>
<tr><td>3</td><td>inch/min</td></tr>
<tr><td>3*</td><td>degree/min</td></tr>
<tr><td>0</td><td>PLS/s</td></tr>
</table>

*: When "Pr.83 Speed control 10 x multiplier setting for degree axis" is valid: "2"

Example: If "Cd. 25 Position-speed switching control speed change register" is set as "2000.00 mm/min", the buffer memory stores "200000".

</td><td>0</td><td>1530+100n
1531+100n</td><td>4330+100n
4331+100n</td></tr>
</table>

n: Axis No.-1

<table>
<tr><th>Setting item</th><th>Setting details</th></tr>
<tr><td>Cd.26 Position-speed switching enable flag</td><td>

- Set whether the switching signal set in "Cd.45 Speed-position switching device selection" is enabled or not.

Fetch cycle: At switching request
</td></tr>
<tr><td>Cd.27 Target position change value (New address)</td><td>

- When changing the target position during a positioning operation, use this data item to specify a new positioning address.
- Set a value within the following range:

<table>
<tr><th>Pr.1 Unit setting</th><th>mm
($\times 10^{-1}$ μm)</th><th>inch
($\times 10^{-5}$ inch)</th><th>degree
($\times 10^{-5}$ degree)</th><th>PLS
(PLS)</th></tr>
<tr><td>ABS</td><td>-2147483648 to +2147483647</td><td>-2147483648 to +2147483647</td><td>0 to 35999999</td><td>-2147483648 to +2147483647</td></tr>
<tr><td>INC</td><td>-2147483648 to +2147483647</td><td>-2147483648 to +2147483647</td><td>-2147483648 to +2147483647</td><td>-2147483648 to +2147483647</td></tr>
</table>

Fetch cycle: At change request
</td></tr>
<tr><td>Cd.28 Target position change value (New speed)</td><td>

- When changing the target position during a positioning operation, use this data item to specify a new speed.
- The speed will not change if "0" is set.
- Set a value within the following range:

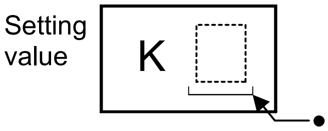
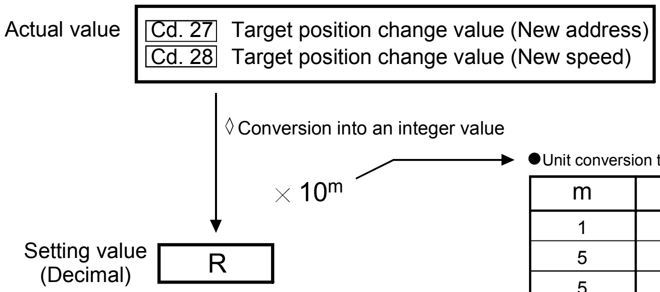
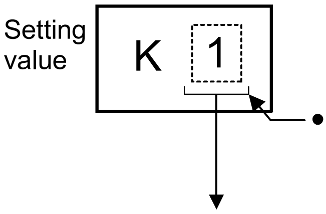
<table>
<tr><th>Pr.1 Unit setting</th><th>mm
($\times 10^{-2}$ mm/min)</th><th>inch
($\times 10^{-3}$ inch/min)</th><th>degree *
($\times 10^{-3}$ degree/min)</th><th>PLS
(PLS/s)</th></tr>
<tr><td>Setting range</td><td>0 to 2000000000</td><td>0 to 2000000000</td><td>0 to 2000000000</td><td>0 to 1000000000</td></tr>
</table>

*: When "Pr.83 Speed control 10 x multiplier setting for degree axis" is valid, this will be the setting range 0 to 2000000000 ($\times 10^{-2}$degree/min).

Fetch cycle: At change request
</td></tr>
<tr><td>Cd.29 Target position change request flag</td><td>

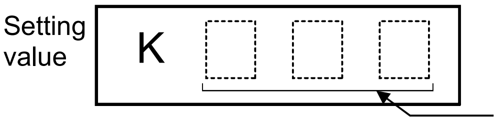
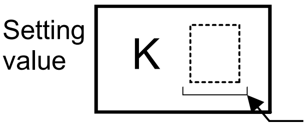
- Requests a change in the target position during a positioning operation.

Fetch cycle: Operation cycle
</td></tr>
</table>

<table>
<tr><th rowspan="2"></th><th rowspan="2">Setting value</th><th rowspan="2">Default value</th><th colspan="2">Buffer memory address</th></tr>
<tr><th>QD77MS2
QD77MS4</th><th>QD77MS16</th></tr>
<tr><td></td><td>■ Set with a decimal.

●Position-speed switching enable flag
0: Position control will not be taken over by speed control even when the signal set in "Cd.45 Speed-position switching device selection" comes ON.
1: Position control will be taken over by speed control when the signal set in "Cd.45 Speed-position switching device selection" comes ON.</td><td>0</td><td>1532+100n</td><td>4332+100n</td></tr>
<tr><td></td><td rowspan="2">■ Set with a decimal.

●Unit conversion table (Cd.27)
<table><tr><th>m</th><th>Unit</th></tr><tr><td>1</td><td>µm</td></tr><tr><td>5</td><td>inch</td></tr><tr><td>5</td><td>degree</td></tr><tr><td>0</td><td>PLS</td></tr></table>
Example: If "Cd. 28 Target position change value (New speed)" is set as "10000.00 mm/min", the buffer memory stores "1000000".
●Unit conversion table (Cd.28)
<table><tr><th>m</th><th>Unit</th></tr><tr><td>2</td><td>mm/min</td></tr><tr><td>3</td><td>inch/min</td></tr><tr><td>3✻</td><td>degree/min</td></tr><tr><td>0</td><td>PLS/s</td></tr></table>
✻: When "Pr.83 Speed control 10 x multiplier setting for degree axis" is valid: "2"</td><td>0</td><td>1534+100n
1535+100n</td><td>4334+100n
4335+100n</td></tr>
<tr><td></td><td>0</td><td>1536+100n
1537+100n</td><td>4336+100n
4337+100n</td></tr>
<tr><td></td><td>■ Set with a decimal.

●Target position change request flag
1: Requests a change in the target position
The Simple Motion module resets the value to "0" automatically when the new target position value has been written.
(This indicates the completion of target position change request.)</td><td>0</td><td>1538+100n</td><td>4338+100n</td></tr>
</table>

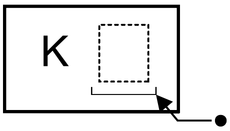
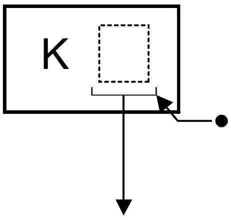
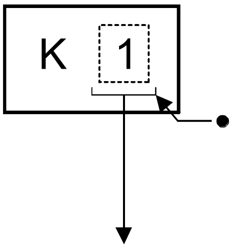
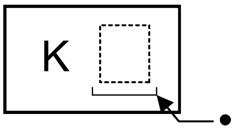
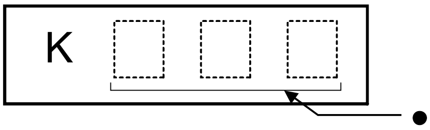
n: Axis No.-1

Setting item		Setting details	
Cd.30	Simultaneous starting axis start data No. (axis 1 start data No.) QD77MS2 QD77MS4	• Use these data items to specify an axis 1 start data No. for each axis that has to start simultaneously. • Set "0" to any axis that should not start simultaneously.	Fetch: At start
	Simultaneous starting own axis start data No. QD77MS16	• Use these data items to specify a start data No. of own axis at multiple axes simultaneous starting.	
Cd.31	Simultaneous starting axis start data No. (axis 2 start data No.) QD77MS2 QD77MS4	• Use these data items to specify an axis 2 start data No. for each axis that has to start simultaneously. • Set "0" to any axis that should not start simultaneously.	Fetch: At start
	Simultaneous starting axis start data No.1 QD77MS16	• Use these data items to specify a start data No.1 for each axis that has to start simultaneously.	
Cd.32	Simultaneous starting axis start data No. (axis 3 start data No.) QD77MS4	• Use these data items to specify an axis 3 start data No. for each axis that has to start simultaneously. • Set "0" to any axis that should not start simultaneously.	Fetch: At start
	Simultaneous starting axis start data No.2 QD77MS16	• Use these data items to specify a start data No.2 for each axis that has to start simultaneously. Note) For 2 axis simultaneous starting, the axis setting is not required. (Setting value is ignored.)	
Cd.33	Simultaneous starting axis start data No. (axis 4 start data No.) QD77MS4	• Use these data items to specify an axis 4 start data No. for each axis that has to start simultaneously. • Set "0" to any axis that should not start simultaneously.	Fetch: At start
	Simultaneous starting axis start data No.3 QD77MS16	• Use these data items to specify a start data No.3 for each axis that has to start simultaneously. Note) For 2 axis simultaneous starting and 3 axis simultaneous starting, the axis setting is not required. (Setting value is ignored.)	
Cd.34	Step mode	• To perform a step operation, use this data item to specify the units by which the stepping should be performed. Fetch cycle: At start	

	Setting value	Default value	Buffer memory address	
			QD77MS2 QD77MS4	QD77MS16
	■ Set with a decimal.  ● QD77MS2 use Cd.30 , Cd.31 Simultaneous starting axis start data No. 1 to 600 ● QD77MS4 use Cd.30 to Cd.33 Simultaneous starting axis start data No. 1 to 600 ● QD77MS16 use Cd.30 Simultaneous starting own axis start data No. Cd.31 to Cd.33 Simultaneous starting axis start data No. 1 to 600	0	1540+100n	4340+100n
		0	1541+100n	4341+100n
		0	1542+100n	4342+100n
		0	1543+100n	4343+100n
	■ Set with a decimal.  ● Step mode 0: Stepping by deceleration units 1: Stepping by data No. units	0	1544+100n	4344+100n

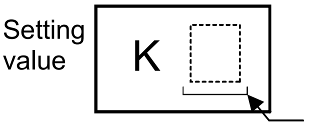
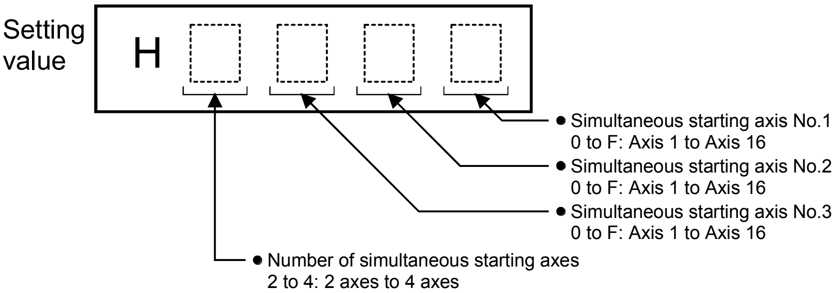
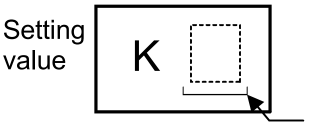
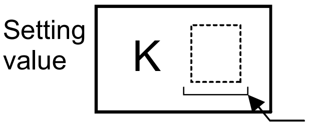
n: Axis No.-1

Setting item	Setting details	
Cd.35 Step valid flag	• This data item validates or invalidates step operations. Fetch cycle: At start	
Cd.36 Step start information	• To continue the step operation when the step function is used, set "1" in the data item. Fetch cycle: 14.2[ms]	
Cd.37 Skip command	• To skip the current positioning operation, set "1" in this data item. Fetch cycle: Operation cycle (During positioning operation)	
Cd.38 Teaching data selection	• This data item specifies the teaching result write destination. • Data are cleared to zero when the teaching ends. Fetch cycle: At operation request	
Cd.39 Teaching positioning data No.	• This data item specifies data to be produced by teaching. • If a value between 1 and 600 is set, a teaching operation is done. • The value is cleared to "0" when the Simple Motion module is initialized, when a teaching operation completes, and when an illegal value (601 or higher) is entered. Fetch cycle: 103[ms]	

	Setting value	Default value	Buffer memory address	
			QD77MS2 QD77MS4	QD77MS16
	■ Set with a decimal. Setting value  ● Step valid flag 0: Invalidates step operations 1: Validates step operations	0	1545+100n	4345+100n
	■ Set with a decimal. Setting value  ● Step start information 1: Continues step operation 2: Restarts operation The Simple Motion module resets the value to "0" automatically when processing of the step start request completes.	0	1546+100n	4346+100n
	■ Set with a decimal. Setting value  ● Skip request 1: Issues a skip request to have the machine decelerate, stop, and then start the next positioning operation. The Simple Motion module resets the value to "0" automatically when processing of the skip request completes.	0	1547+100n	4347+100n
	■ Set with a decimal. Setting value  ● Teaching data selection 0: Takes the current feed value as a positioning address. 1: Takes the current feed value as an arc data.	0	1548+100n	4348+100n
	■ Set with a decimal. Setting value  ● Teaching positioning data No. 1 to 600	0	1549+100n	4349+100n

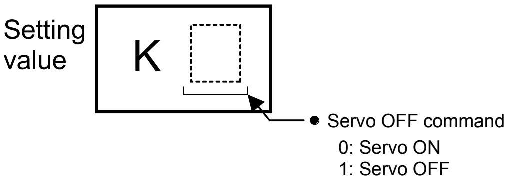
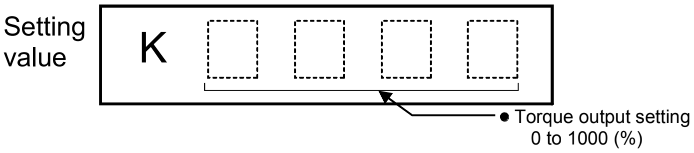
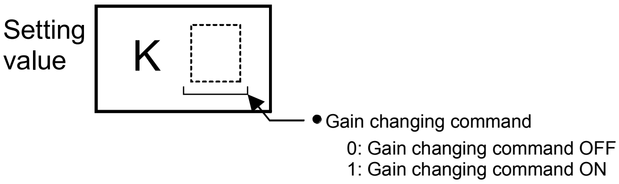
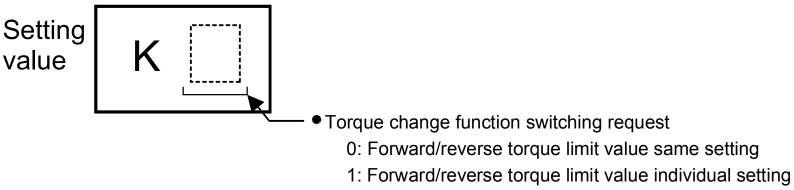
n: Axis No.-1

Setting item	Setting details	
Cd.40 ABS direction in degrees	• This data item specifies the ABS moving direction carrying out the position control when "degree" is selected as the unit. Fetch cycle: At start	
Cd.43 Simultaneous starting axis QD77MS16	• Set the number of simultaneous starting axes and target axis. When "2" is set to the number of simultaneous starting axes, set the target axis No. to the simultaneous starting axis No. 1. When "3" is set to the number of simultaneous starting axes, set the target axis No. to the simultaneous starting axis No.1 and 2. When "4" is set to the number of simultaneous starting axes, set the target axis No. to the simultaneous starting axis No.1 to 3. • When the same axis No. or axis No. of own axis is set to the multiple simultaneous starting axis No, or the value outside the range is set to the number of simultaneous starting axes, "Error before simultaneous start" (error code: 501) will occur, and the operation is not executed. Note) Do not set the simultaneous starting axis No.2 and 3 for 2-axis interpolation, and do not set the simultaneous starting axis No.3 for 3-axis interpolation. The setting value is ignored. Fetch cycle: At start	
Cd.45 Speed-position switching device selection	• Select the device used for speed-position switching. Note) If the setting is outside the range at start, operation is performed with the setting regarded as "0". Fetch cycle: At positioning start for speed-position switching control/position-speed switching control	
Cd.46 Speed-position switching command	• Speed-position control switching is performed when "2" is set in "Cd.45 Speed-position switching device selection". Other than setting value is ignored. Note) This parameter is made valid only when "2" is set in "Cd.45 Speed-position switching device selection" at start. Fetch cycle: 0.88[ms]	

	Setting value	Default value	Buffer memory address	
			QD77MS2 QD77MS4	QD77MS16
	■ Set with a decimal.  ● ABS direction in degrees 0: Takes a shortcut. (Specified direction ignored.) 1: ABS circular right 2: ABS circular left	0	1550+100n	4350+100n
	■ Set with a hexadecimal.  ● Simultaneous starting axis No.1 0 to F: Axis 1 to Axis 16 ● Simultaneous starting axis No.2 0 to F: Axis 1 to Axis 16 ● Simultaneous starting axis No.3 0 to F: Axis 1 to Axis 16 ● Number of simultaneous starting axes 2 to 4: 2 axes to 4 axes	0000H		4339+100n
	■ Set with a decimal.  ● Speed-position switching device selection <Speed-position switching control> 0: Use the external command signal for switching from speed control to position control 1: Use the near-point dog signal for switching from speed control to position control 2: Use "Cd.46 Speed-position switching command" for switching from speed control to position control <Position-speed switching control> 0: Use the external command signal for switching from position control to speed control 1: Use the near-point dog signal for switching from position control to speed control 2: Use "Cd.46 Speed-position switching command" for switching from position control to speed control	0	1566+100n	4366+100n
	■ Set with a decimal.  ● Speed-position switching command <Speed-position switching control> 0: Not switch from speed control to position control 1: Switch from speed control to position control <Position-speed switching control> 0: Not switch from position control to speed control 1: Switch from position control to speed control	0	1567+100n	4367+100n

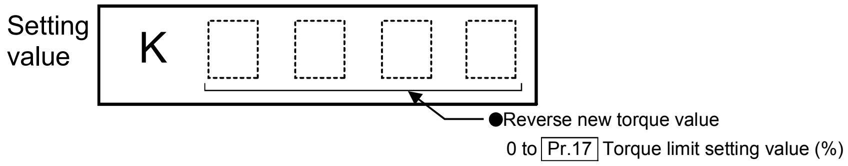
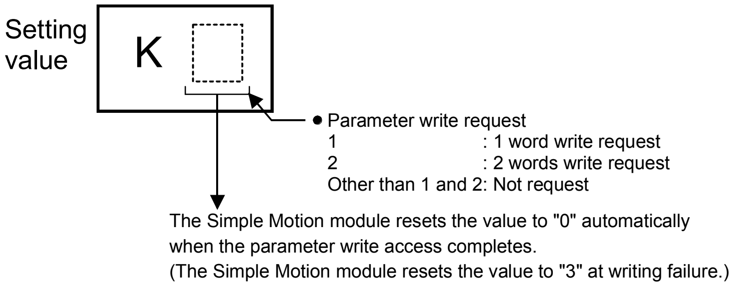
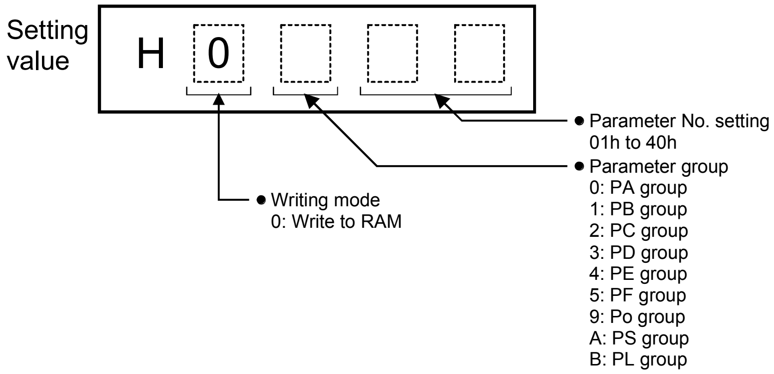
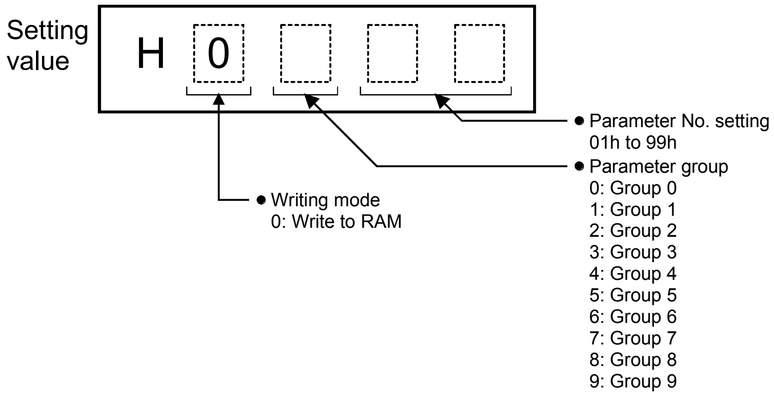
n: Axis No.-1

Setting item	Setting details	
Cd.100 Servo OFF command	• Turns OFF each axis servo. Fetch cycle: Operation cycle POINT When you want to turn ON the servos for other than axis 1 with only the servo for axis 1 turned OFF, write "1" to storage buffer memory address of axis 1 and then turn ON all axis servo ON [Y1] signal.	
Cd.101 Torque output setting value	• Sets the torque output value. Set a ratio against the rated torque in percentage unit. Fetch cycle: At start POINT • If the "Cd.101 Torque output setting value" is "0", the "Pr.17 Torque limit setting value" will be its value. • If a value beside "0" is set in the "Cd.101 Torque output setting value", the torque generated by the servomotor will be limited by that value. • The "Pr.17 Torque limit setting value" of the detailed parameter becomes effective at the PLC ready signal rising edge. • The "Cd.101 Torque output setting value" (refer to the start) axis control data can be changed at all times. Therefore in the "Cd.101 Torque output setting value" is used when you must change. (Refer to Section 13.5.4 "Torque change function".)	
Cd.108 Gain changing command	• The command required to carry out "gain changing" of the servo amplifier from the Simple Motion module. Fetch cycle: Operation cycle POINT • If the setting is other than "0" and "1", operation is performed in the "gain changing" with the setting regard as "0". (Refer to the Servo amplifier Instruction Manual.)	
Cd.112 Torque change function switching request	• Sets "same setting/individual setting" of the forward torque limit value or reverse torque limit value in the torque change function. Fetch cycle: Operation cycle POINT • Set "0" normally. (when the forward torque limit value and reverse torque limit value are not divided.) • When a value except "1" is set, it operates as "forward/reverse torque limit value same setting".	

	Setting value	Default value	Buffer memory address	
			QD77MS2 QD77MS4	QD77MS16
	■ Set with a decimal.  Setting value K ● Servo OFF command 0: Servo ON 1: Servo OFF Valid only when all axes of servo amplifier are turned ON.	0	1551+100n	4351+100n
	■ Set with a decimal.  Setting value K ● Torque output setting 0 to 1000 (%)	0	1552+100n	4352+100n
	■ Set with a decimal.  Setting value K ● Gain changing command 0: Gain changing command OFF 1: Gain changing command ON	0	1559+100n	4359+100n
	■ Set with a decimal.  Setting value K ● Torque change function switching request 0: Forward/reverse torque limit value same setting 1: Forward/reverse torque limit value individual setting	0	1563+100n	4363+100n

n: Axis No.-1

Setting item	Setting details	
Cd.113 Reverse new torque value	• "1" is set in "Cd.112 Torque change function switching request", a new reverse torque limit value is set. (when "0" is set in "Cd.112 Torque change function switching request", the setting value is invalid.) • Set a value within "0" to "Pr.17 Torque limit setting value". Set a ratio against the rated torque in percentage unit. (The new torque value is invalid when "0" is set, and "Pr.17 Torque limit setting value" or "Cd.101 Torque output setting value" becomes valid. The range of torque change is 1 to "Pr.17 Torque limit setting value". Fetch cycle: Operation cycle	
Cd.130 Parameter write request	• Set the write request of servo parameter. Set "1" or "2" after setting "Cd.131 Parameter No." and "Cd.132 Change data". Fetch cycle: Main cycle (Note-1) (Note-1): Cycle of processing executed at free time except for the positioning control. It changes by status of axis start.	
Cd.131 Parameter No.	• Set the servo parameter to be changed. Fetch cycle: At change request	

	Setting value	Default value	Buffer memory address	
			QD77MS2 QD77MS4	QD77MS16
	■ Set with a decimal.  Setting value K □□□□ ●Reverse new torque value 0 to Pr.17 Torque limit setting value (%)	0	1564+100n	4364+100n
	■ Set with a decimal. Set "1" for MR-J4(W)-B and MR-J3(W)-B, and set "2" for VCII series. Writing failure occurs when a value except "1" or "2" is set.  Setting value K □ ● Parameter write request 1 : 1 word write request 2 : 2 words write request Other than 1 and 2: Not request The Simple Motion module resets the value to "0" automatically when the parameter write access completes. (The Simple Motion module resets the value to "3" at writing failure.)	0	1554+100n	4354+100n
	■ Set with a hexadecimal. • MR-J4(W)-B  Setting value H 0 □□□ ● Parameter No. setting 01h to 40h ● Parameter group 0: PA group 1: PB group 2: PC group 3: PD group 4: PE group 5: PF group 9: Po group A: PS group B: PL group ● Writing mode 0: Write to RAM • VCII series  Setting value H 0 □□□ ● Parameter No. setting 01h to 99h ● Parameter group 0: Group 0 1: Group 1 2: Group 2 3: Group 3 4: Group 4 5: Group 5 6: Group 6 7: Group 7 8: Group 8 9: Group 9 ● Writing mode 0: Write to RAM	0000H	1555+100n	4355+100n

Setting item	Setting details	
Cd.132 Change data	• Set the change value of servo parameter set in "Cd.131 Parameter No.". Fetch cycle: At change request	
Cd.133 Semi/Fully closed loop switching request	• Set the switching of semi closed control and fully closed control. Fetch cycle: Operation cycle (Fully closed loop control servo amplifier only)	

<table>
<tr><th rowspan="2"></th><th rowspan="2">Setting value</th><th rowspan="2">Default value</th><th colspan="2">Buffer memory address</th></tr>
<tr><th>QD77MS2
QD77MS4</th><th>QD77MS16</th></tr>
<tr><td></td><td>

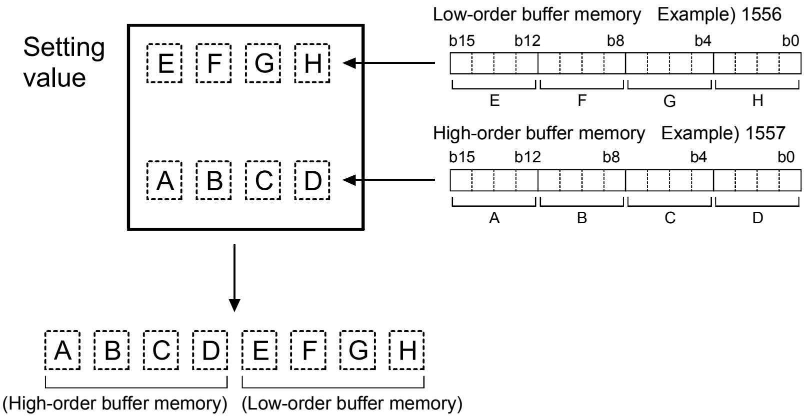
■ Set with a decimal or hexadecimal.

[1 word write request]

When "1" is set in "Cd.130 Parameter write request", set the change value to low-order buffer memory. The value set to high-order buffer memory is invalid.

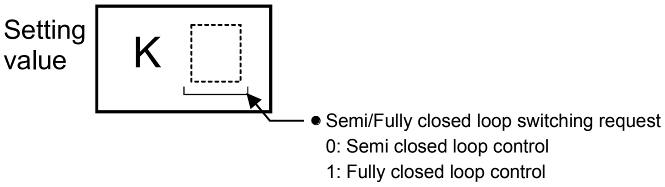
[2 words write request]

When "2" is set in "Cd.130 Parameter write request", set the change value to high-order buffer memory and low-order buffer memory.



</td><td>0</td><td>1556+100n
1557+100n</td><td>4356+100n
4357+100n</td></tr>
<tr><td></td><td>

■ Set with a decimal.



</td><td>0</td><td>1558+100n</td><td>4358+100n</td></tr>
</table>

n: Axis No.-1

<table>
<tr><th>Setting item</th><th>Setting details</th><th></th></tr>
<tr><td>Cd.136 PI-PID switching request</td><td>• Set the PI-PID switching to servo amplifier.

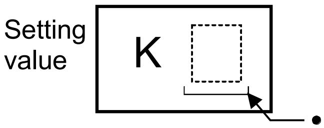
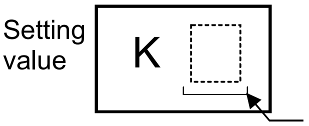
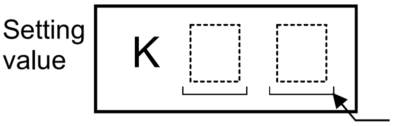
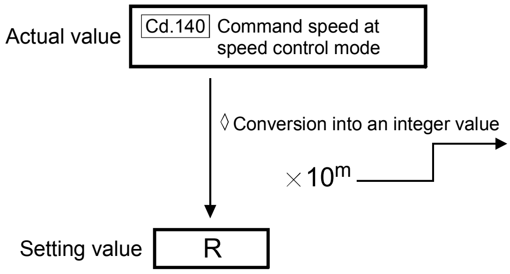
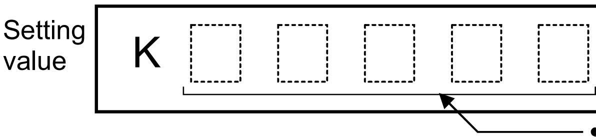
Fetch cycle: Operation cycle</td><td></td></tr>
<tr><td>Cd.138 Control mode switching request</td><td>• Request the control mode switching.
Set "1" after setting "Cd.139 Control mode setting".
• The Simple Motion module sets "0" at completion of control mode switching.

Fetch cycle: Operation cycle</td><td></td></tr>
<tr><td>Cd.139 Control mode setting</td><td>• Set the control mode to be changed in the speed-torque control.

Fetch cycle: At control mode switching</td><td></td></tr>
<tr><td>Cd.140 Command speed at speed control mode</td><td>• Set the command speed at speed control mode.
• Set a value within the following range:
<table>
<tr><th>Pr.1 Unit setting</th><th>mm
($\times 10^{-2}$ mm/min)</th><th>inch
($\times 10^{-3}$ inch/min)</th><th>degree*
($\times 10^{-3}$ degree/min)</th><th>PLS
(PLS/s)</th></tr>
<tr><td>Setting range</td><td>-2000000000 to 2000000000</td><td>-2000000000 to 2000000000</td><td>-2000000000 to 2000000000</td><td>-1000000000 to 1000000000</td></tr>
</table>
*: When "Pr.83 Speed control 10 x multiplier setting for degree axis" is valid, this will be the setting range -2000000000 to 2000000000 ($\times 10^{-2}$degree/min).

Fetch cycle: Operation cycle (At speed control mode)</td><td></td></tr>
<tr><td>Cd.141 Acceleration time at speed control mode</td><td>• Set the acceleration time at speed control mode.
(Set the time for the speed to increase from "0" to "Pr.8 Speed limit value".)
0 to 65535 (ms)

Fetch cycle: At control mode switching</td><td></td></tr>
</table>

	Setting value	Default value	Buffer memory address	
			QD77MS2 QD77MS4	QD77MS16
	■ Set with a decimal.  ● PI-PID switching request 1 : PID control switching request Other than 1: Not request	0	1565+100n	4365+100n
	■ Set with a decimal.  ● Control mode switching request 1 : Switching request Other than 1: Not request	0	1574+100n	4374+100n
	■ Set with a decimal.  ● Control mode setting 0: Position control mode 10: Speed control mode 20: Torque control mode 30: Continuous operation to torque control mode	0	1575+100n	4375+100n
	■ Set with a decimal.  ● Unit conversion table (Cd.140) m : Unit 2 : mm/min 3 : inch/min 3✻ : degree/min 0 : PLS/s ✻: When "Pr.83 Speed control 10 x multiplier setting for degree axis" is valid: "2"	0	1576+100n 1577+100n	4376+100n 4377+100n
	■ Set with a decimal.  ● Acceleration time at speed control mode (ms) 0 to 65535	1000	1578+100n	4378+100n

n: Axis No.-1

<table>
<tr><th>Setting item</th><th>Setting details</th><th></th></tr>
<tr><td>Cd.142 Deceleration time at speed control mode</td><td>• Set the deceleration time at speed control mode.
(Set the time for the speed to decrease from "Pr.8 Speed limit value" to "0".)
0 to 65535 (ms)

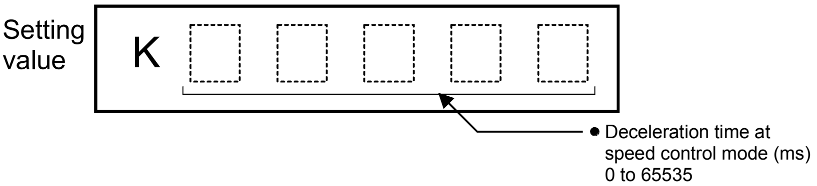
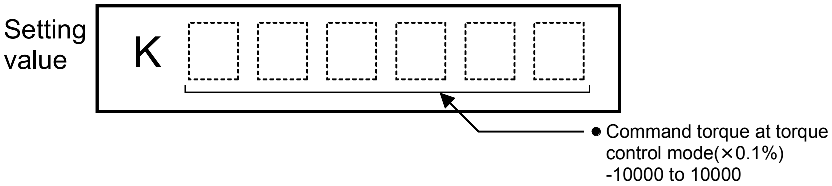
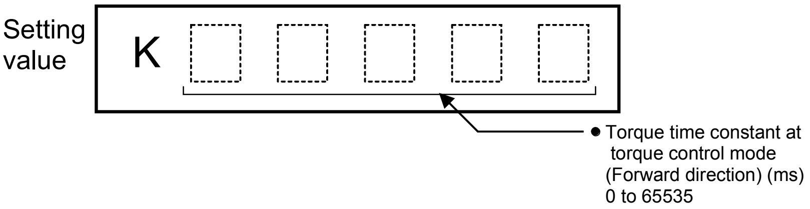
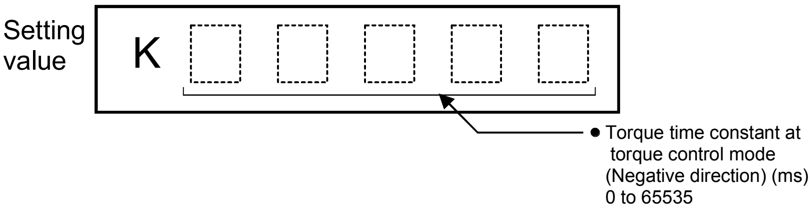
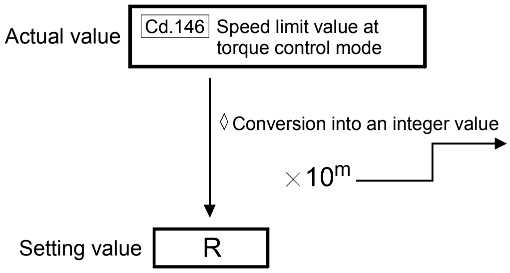
Fetch cycle: At control mode switching</td><td></td></tr>
<tr><td>Cd.143 Command torque at torque control mode</td><td>• Set the command torque at torque control mode. Set a ratio against the rated torque in percentage unit.
-10000 to 10000 (×0.1%)

Fetch cycle: Operation cycle (At torque control mode)</td><td></td></tr>
<tr><td>Cd.144 Torque time constant at torque control mode (Forward direction)</td><td>• Set the time constant at driving during torque control mode.
(Set the time for the torque to increase from "0" to "Pr.17 Torque limit setting value".)
0 to 65535 (ms)

Fetch cycle: At control mode switching</td><td></td></tr>
<tr><td>Cd.145 Torque time constant at torque control mode (Negative direction)</td><td>• Set the time constant at regeneration during torque control mode.
(Set the time for the torque to decrease from "Pr.17 Torque limit setting value" to "0".)
0 to 65535 (ms)

Fetch cycle: At control mode switching</td><td></td></tr>
<tr><td>Cd.146 Speed limit value at torque control mode</td><td>• Set the speed limit value at torque control mode.
• Set a value within the following range:
<table>
<tr><th>Pr.1 Unit setting</th><th>mm
($\times 10^{-2}$ mm/min)</th><th>inch
($\times 10^{-3}$ inch/min)</th><th>degree*
($\times 10^{-3}$ degree/min)</th><th>PLS
(PLS/s)</th></tr>
<tr><td>Setting range</td><td>0 to 2000000000</td><td>0 to 2000000000</td><td>0 to 2000000000</td><td>0 to 1000000000</td></tr>
</table>
*: When "Pr.83 Speed control 10 x multiplier setting for degree axis" is valid, this will be the setting range 0 to 2000000000 ($\times 10^{-2}$degree/min).

Fetch cycle: Operation cycle (At torque control mode)</td><td></td></tr>
</table>

	Setting value	Default value	Buffer memory address	
			QD77MS2 QD77MS4	QD77MS16
	■ Set with a decimal.  ● Deceleration time at speed control mode (ms) 0 to 65535	1000	1579+100n	4379+100n
	■ Set with a decimal.  ● Command torque at torque control mode(×0.1%) -10000 to 10000	0	1580+100n	4380+100n
	■ Set with a decimal.  ● Torque time constant at torque control mode (Forward direction) (ms) 0 to 65535	1000	1581+100n	4381+100n
	■ Set with a decimal.  ● Torque time constant at torque control mode (Negative direction) (ms) 0 to 65535	1000	1582+100n	4382+100n
	■ Set with a decimal.  ● Unit conversion table (Cd.146) m: Unit 2: mm/min 3: inch/min 3*: degree/min 0: PLS/s *: When " Pr.83 Speed control 10 x multiplier setting for degree axis" is valid: "2"	1	1584+100n 1585+100n	4384+100n 4385+100n

n: Axis No.-1

<table>
<tr><th>Setting item</th><th>Setting details</th><th></th></tr>
<tr><td>Cd.147 Speed limit value at continuous operation to torque control mode</td><td>

- Set the speed limit value at continuous operation to torque control mode.
- Set a value within the following range:

<table>
<tr><th>Pr.1 Unit setting</th><th>mm
($\times 10^{-2}$ mm/min)</th><th>inch
($\times 10^{-3}$ inch/min)</th><th>degree∗
($\times 10^{-3}$ degree/min)</th><th>PLS
(PLS/s)</th></tr>
<tr><td>Setting range</td><td>-2000000000 to 2000000000</td><td>-2000000000 to 2000000000</td><td>-2000000000 to 2000000000</td><td>-1000000000 to 1000000000</td></tr>
</table>

∗: When "Pr.83 Speed control 10 x multiplier setting for degree axis" is valid, this will be the setting range -2000000000 to 2000000000 ($\times 10^{-2}$degree/min).

Fetch cycle: Operation cycle (At continuous operation to torque control mode)
</td><td></td></tr>
<tr><td>Cd.148 Acceleration time at continuous operation to torque control mode</td><td>

- Set the acceleration time at continuous operation to torque control mode.
(Set the time for the speed to increase from "0" to "Pr.8 Speed limit value".)
0 to 65535 (ms)

Fetch cycle: At control mode switching
</td><td></td></tr>
<tr><td>Cd.149 Deceleration time at continuous operation to torque control mode</td><td>

- Set the deceleration time at continuous operation to torque control mode.
(Set the time for the speed to decrease from "Pr.8 Speed limit value" to "0".)
0 to 65535 (ms)

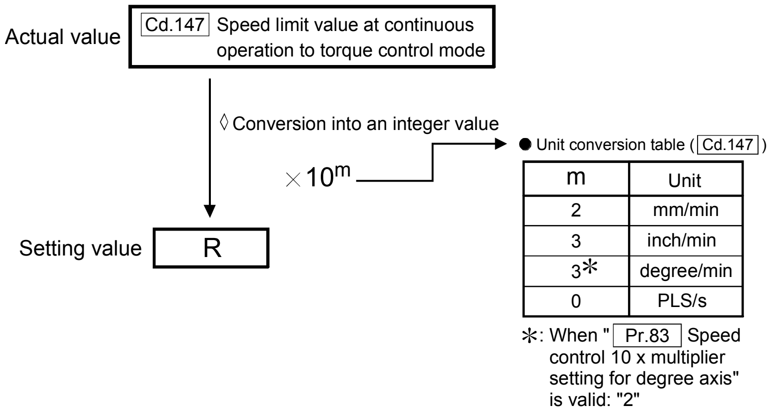
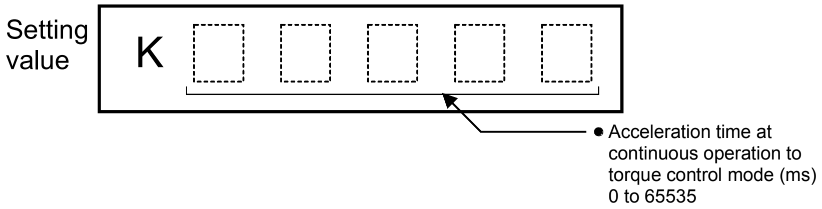
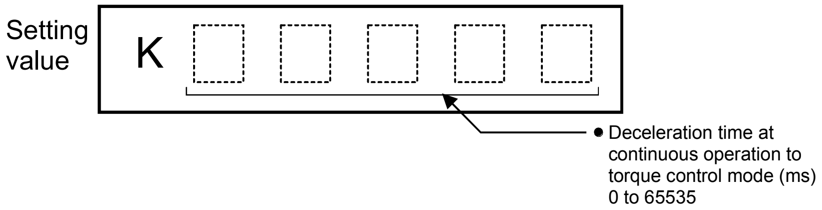
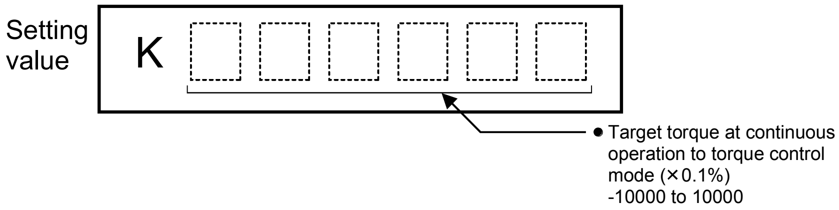
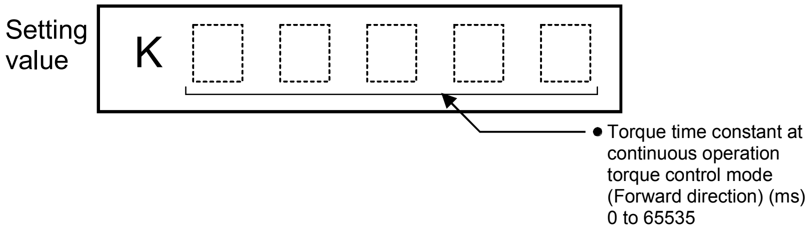
Fetch cycle: At control mode switching
</td><td></td></tr>
<tr><td>Cd.150 Target torque at continuous operation to torque control mode</td><td>

- Set the target torque at continuous operation to torque control mode. Set a ratio against the rated torque in percentage unit.
-10000 to 10000 (×0.1%)

Fetch cycle: Operation cycle (At continuous operation to torque control mode)
</td><td></td></tr>
<tr><td>Cd.151 Torque time constant at continuous operation to torque control mode (Forward direction)</td><td>

- Set the time constant at driving during continuous operation to torque control mode.
(Set the time for the torque to increase from "0" to "Pr.17 Torque limit setting value".)
0 to 65535 (ms)

Fetch cycle: At control mode switching
</td><td></td></tr>
</table>

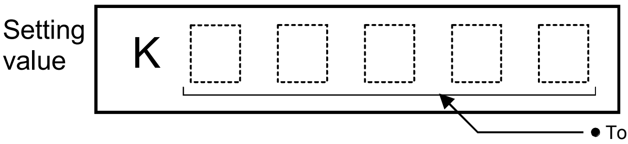
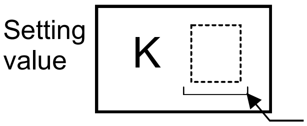
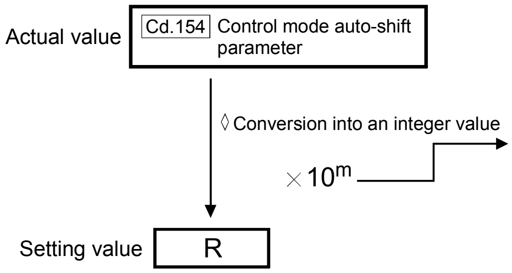
	Setting value	Default value	Buffer memory address	
			QD77MS2 QD77MS4	QD77MS16
	■ Set with a decimal.  Actual value: Cd.147 Speed limit value at continuous operation to torque control mode ◊ Conversion into an integer value × 10^m Setting value: R ● Unit conversion table (Cd.147) m: 2 — Unit: mm/min m: 3 — Unit: inch/min m: 3* — Unit: degree/min m: 0 — Unit: PLS/s *: When " Pr.83 Speed control 10 x multiplier setting for degree axis" is valid: "2"	0	1586+100n 1587+100n	4386+100n 4387+100n
	■ Set with a decimal.  Setting value: K ● Acceleration time at continuous operation to torque control mode (ms) 0 to 65535	1000	1588+100n	4388+100n
	■ Set with a decimal.  Setting value: K ● Deceleration time at continuous operation to torque control mode (ms) 0 to 65535	1000	1589+100n	4389+100n
	■ Set with a decimal.  Setting value: K ● Target torque at continuous operation to torque control mode (×0.1%) -10000 to 10000	0	1590+100n	4390+100n
	■ Set with a decimal.  Setting value: K ● Torque time constant at continuous operation torque control mode (Forward direction) (ms) 0 to 65535	1000	1591+100n	4391+100n

n: Axis No.-1

<table>
<tr><th>Setting item</th><th>Setting details</th><th></th></tr>
<tr><td>Cd.152 Torque time constant at continuous operation to torque control mode (Negative direction)</td><td>• Set the time constant at regeneration during continuous operation to torque control mode.
(Set the time for the torque to decrease from "Pr.17 Torque limit setting value" to "0".)
0 to 65535 (ms)

<u>Fetch cycle: At control mode switching</u></td><td></td></tr>
<tr><td>Cd.153 Control mode auto-shift selection</td><td>• Set the switching condition when switching to continuous operation to torque control mode.
0: No switching condition...... Switching is executed at switching request to continuous operation to torque control mode.
1: Current feed value pass.... Switching is executed when "Md.20 Current feed value" passes the address set in "Cd.154 Control mode auto-shift parameter" after switching request to continuous operation to torque control mode.
2: Real current value pass.... Switching is executed when "Md.101 Real current value" passes the address set in "Cd.154 Control mode auto-shift parameter" after switching request to continuous operation to torque control mode.

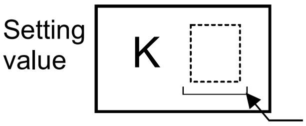
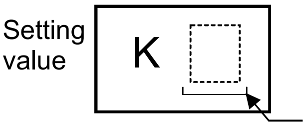
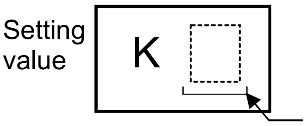
<u>Fetch cycle: At control mode switching</u></td><td></td></tr>
<tr><td>Cd.154 Control mode auto-shift parameter</td><td>• Set the condition value when setting the control mode switching condition.
• The setting value differs depending on the value set in "Cd.153 Control mode auto-shift selection".
When "1" or "2" is set in "Cd.153 Control mode auto-shift selection": Set the switching address.
• Set a value within the following range:
<table>
<tr><th>Pr.1 Unit setting</th><th>mm
($\times 10^{-1}$ mm)</th><th>inch
($\times 10^{-5}$ inch)</th><th>degree
($\times 10^{-5}$ degree)</th><th>PLS
(PLS)</th></tr>
<tr><td>Setting range</td><td>-2147483648 to 2147483647</td><td>-2147483648 to 2147483647</td><td>0 to 35999999</td><td>-2147483648 to 2147483647</td></tr>
</table>
<u>Fetch cycle: At control mode switching</u></td><td></td></tr>
</table>

<table>
<tr><th rowspan="2"></th><th rowspan="2">Setting value</th><th rowspan="2">Default value</th><th colspan="2">Buffer memory address</th></tr>
<tr><th>QD77MS2
QD77MS4</th><th>QD77MS16</th></tr>
<tr><td></td><td>■ Set with a decimal.

● Torque time constant at continuous operation torque control mode (Negative direction) (ms)
0 to 65535</td><td>1000</td><td>1592+100n</td><td>4392+100n</td></tr>
<tr><td></td><td>■ Set with a decimal.

● Control mode auto-shift selection
0: No switching condition
1: Current feed value pass
2: Real current value pass</td><td>0</td><td>1593+100n</td><td>4393+100n</td></tr>
<tr><td></td><td>■ Set with a decimal.

● Unit conversion table (Cd.154)
<table>
<tr><th>m</th><th>Unit</th></tr>
<tr><td>1</td><td>μm</td></tr>
<tr><td>5</td><td>inch</td></tr>
<tr><td>5</td><td>degree</td></tr>
<tr><td>0</td><td>PLS</td></tr>
</table></td><td>0</td><td>1594+100n
1595+100n</td><td>4394+100n
4395+100n</td></tr>
</table>

n: Axis No.-1

5.7.3 Expansion axis control data

Setting item	Setting details
Cd.180 Axis stop QD77MS16	• When the axis stop signal turns ON, the OPR control, positioning control, JOG operation, inching operation, manual pulse generator operation, speed-torque control, etc. will stop. • By turning the axis stop signal ON during positioning operation, the positioning operation will be "stopped". • Whether to decelerate stop or suddenly stop can be selected with "Pr.39 Stop group 3 sudden stop selection". • During interpolation control of the positioning operation, if the axis stop signal of any axis turns ON, all axes in the interpolation control will decelerate and stop. Fetch cycle: Operation cycle
Cd.181 Forward run JOG start QD77MS16	• When the JOG start signal is ON, JOG operation will be carried out at the "Cd.17 JOG speed". When the JOG start signal turns OFF, the operation will decelerate and stop. • When inching movement amount is set, the designated movement amount is output for one operation cycle and then the operation stops. Fetch cycle: Operation cycle
Cd.182 Reverse run JOG start QD77MS16	
Cd.183 Execution prohibition flag QD77MS16	• If the execution prohibition flag is ON when the positioning start signal turns ON, positioning control does not start until the execution prohibition flag turns OFF. Used with the "Pre-reading start function". (Refer to Section 13.7.7) Fetch cycle: At start

	Setting value	Default value	Buffer memory address	
			QD77MS2 QD77MS4	QD77MS16
	■ Set with a decimal.  ● Axis stop 1 : Axis stop requested Other than 1: Axis stop not requested	0		30100+10n
	■ Set with a decimal.  ● Forward run JOG start/Reverse run JOG start 1 : JOG started Other than 1: JOG not started	0		30101+10n
		0		30102+10n
	■ Set with a decimal.  ● Execution prohibition flag 1 : During execution prohibition Other than 1: Not during execution prohibition	0		30103+10n

n: Axis No.-1

MEMO

Chapter 6 Sequence Program Used for Positioning Control

The programs required to carry out positioning control with the Simple Motion module are explained in this chapter.

The sequence program required for control is created allowing for the "start conditions", "start time chart", "device settings" and general control configuration. (The parameters, positioning data, block start data and condition data, etc., must be set in the Simple Motion module according to the control to be executed, and program for setting the control data or a program for starting the various controls must be created.)

The first half of this chapter explains the program configuration of general control, and the latter half explains the program details. Create the required program while referring to the various control details explained in "Section 2", and to Chapter 5 "Data Used for Positioning Control".

6.1 Precautions for creating program

The common precautions to be taken when writing data from the PLC CPU to the buffer memory of Simple Motion module are described below.
When diverting any of the program examples introduced in this manual to the actual system, fully verify that there are no problems in the controllability of the target system.

(1) Reading/writing the data

Setting the data explained in this chapter (various parameters, positioning data, block start data) should be set using GX Works2.
When set with the sequence program, many sequence programs and devices must be used. This will not only complicate the program, but will also increase the scan time.
When rewriting the positioning data during continuous path control or continuous positioning control, rewrite the data four positioning data items before the actual execution. If the positioning data is not rewritten before the positioning data four items earlier is executed, the process will be carried out as if the data was not rewritten.

(2) Restrictions to speed change execution interval

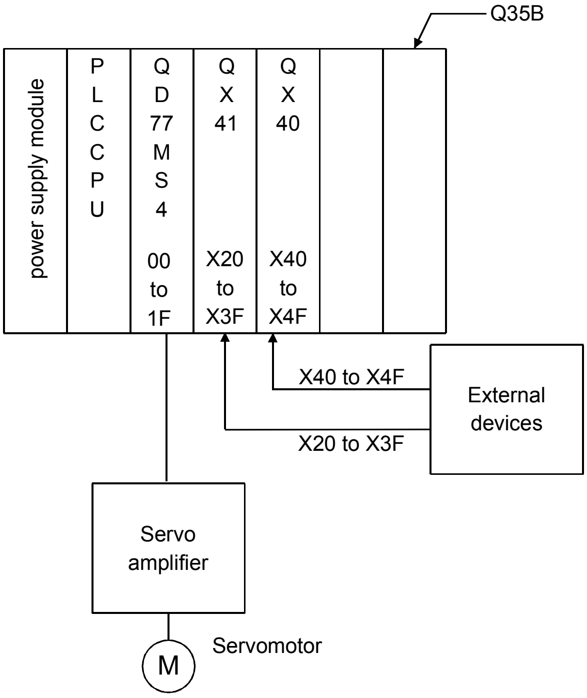
Provide an interval of 100ms or more when changing the speed or performing override function with the Simple Motion module.

(3) Process during overrun

Overrun is prevented by the setting of the upper and lower stroke limits with the detailed parameter 1.
However, this applies only when the Simple Motion module is operating correctly.
It is recommended to create an external circuit including a boundary limit switch to ensure the whole system safety as follows: the external circuit that turns OFF the main circuit power of the servo amplifier when the boundary limit switch operates.

(4) System configuration

Unless particularly designated, the sequence program for the following system using QD77MS4 is shown in this chapter and subsequent.
Refer to Section 6.2 for the application of the devices to be used.



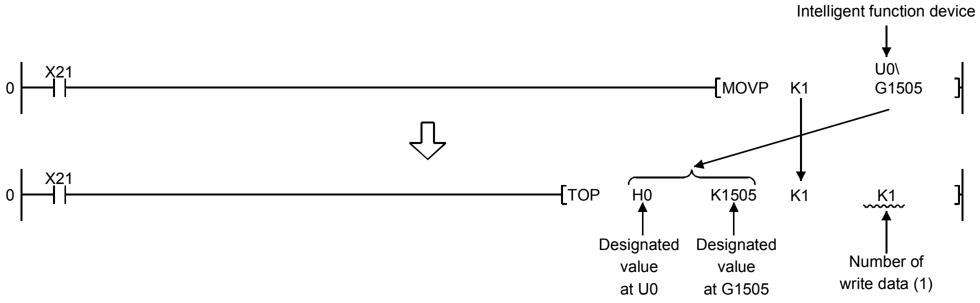
(5) Control unit

In the program, the unit of "0: mm, 2: degree" is set for the basic parameter 1.

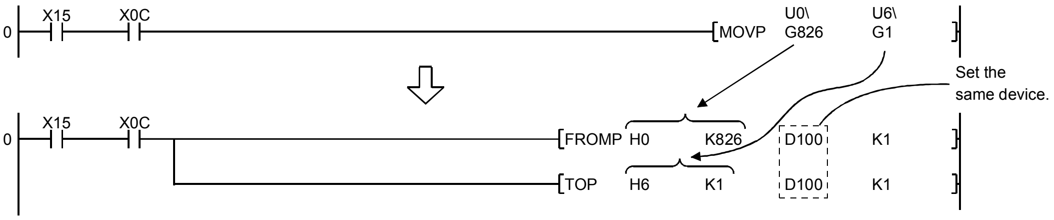
(6) Communication with the Simple Motion module

There are two methods for communication with the Simple Motion module using the sequence program: a method using an "intelligent function device" and a method using a FROM/TO command.
In the sequence program in this chapter and subsequent, the program example using the "intelligent function device" is shown without using a FROM/TO command for communication with the Simple Motion module.
When using the FROM/TO command for communication with the Simple Motion module, change the circuit incorporating the "intelligent function device" as follows.

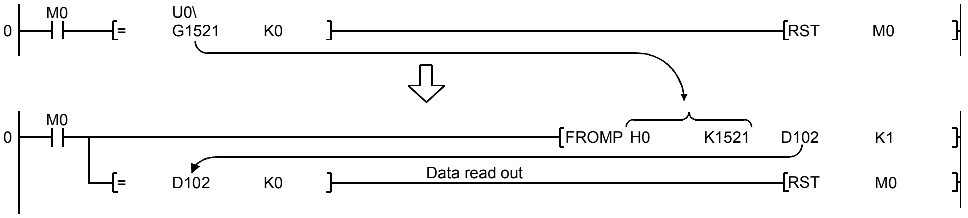
(a) When the circuit uses the "intelligent function device" on the destination (D) side of a MOV command, change the command to a TO command.



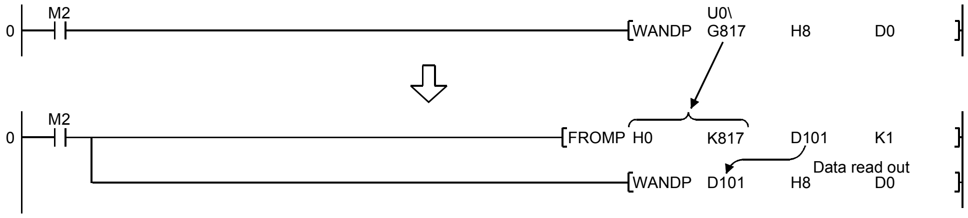
(b) When the circuit uses the "intelligent function device" on the source(s) side and the destination (D) side of a MOV command, change the command to a FROM command and a TO command.



(c) When the circuit uses the "intelligent function device" for a COMPARISON command, change the command to a FROM command and a COMPARISON command.



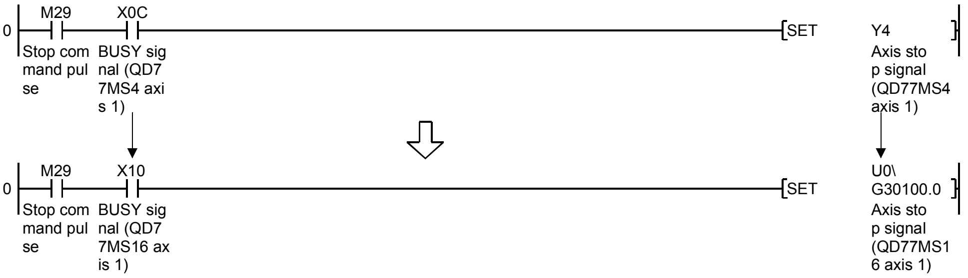
(d) When the circuit uses the "intelligent function device" for a WAND command, change the command to a FROM command and a WAND command.



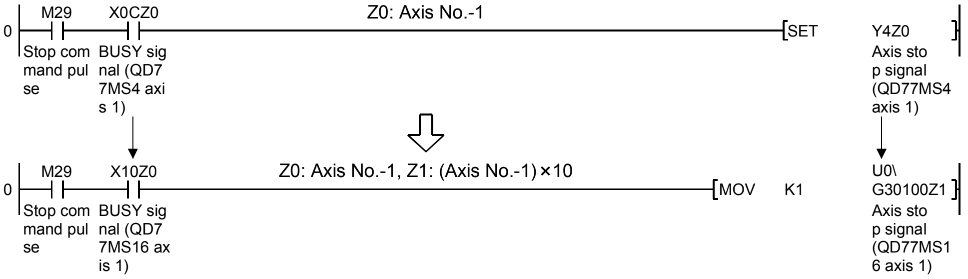
(7) Conversion of sequence program from QD77MS2/QD77MS4 to QD77MS16

When the sequence program is changed from QD77MS2/QD77MS4 to QD77MS16, change the I/O signals with different arrangement as follows.

(a) When not using index modification



(b) When using index modification



REMARK

Refer to the "QnUCPU User's Manual (Function Explanation, Program Fundamentals)" for the intelligent function devices.
Refer to the "MELSEC-Q/L Programming Manual (Common Instructions)" for detail commands used in those programs shown in this chapter and subsequent.

6.2 List of devices used

In the sequence programs using QD77MS4 shown in this chapter and subsequent, the application of the devices used are as follows.
The I/O numbers for Simple Motion module indicate those when the head I/O number is set to "0H".
If it is set to other than "0H", change the I/O number according to setting of head I/O number.
In addition, change the external inputs, external outputs, internal relays, data resisters, and timers according to the system used.

(1) Inputs/outputs, external inputs/external outputs, and internal relays of QD77MS4

Device name		Device				Application	Details when ON
		Axis 1	Axis 2	Axis 3	Axis 4		
Inputs/ outputs of QD77MS4	Input	X0				READY signal	QD77MS preparation completed
		X1				Synchronization flag	QD77MS buffer memory accessible
		X4	X5	X6	X7	M code ON signal	M code outputting
		X8	X9	XA	XB	Error detection signal	Error detected
		XC	XD	XE	XF	BUSY signal	BUSY (operating)
		X10	X11	X12	X13	Start complete signal	Start completed
		X14	X15	X16	X17	Positioning complete signal	Positioning completed
	Out-put	Y0				PLC READY signal	PLC CPU preparation completed
		Y1				All axis servo ON signal	All axis servo ON signal
		Y4	Y5	Y6	Y7	Axis stop signal	Requesting stop
		Y8	YA	YC	YE	Forward run JOG start signal	Starting forward run JOG
		Y9	YB	YD	YF	Reverse run JOG start signal	Starting reverse run JOG
		Y10	Y11	Y12	Y13	Positioning start signal	Requesting start
		Y14	Y15	Y16	Y17	Execution prohibition request	Execution prohibition
External input (command)		X20	—			OPR request OFF command	Commanding OPR request OFF
		X21				External command valid command	Commanding external command valid setting
		X22				External command invalid command	Commanding external command invalid
		X23				Machine OPR command	Commanding machine OPR
		X24				Fast OPR command	Commanding fast OPR
		X25				Positioning start command	Commanding positioning start
		X26				Speed-position switching operation command	Commanding speed-position switching operation
		X27				Speed-position switching enable command	Commanding speed-position switching enable
		X28				Speed-position switching prohibit command	Commanding speed-position switching prohibit
		X29				Movement amount change command	Commanding movement amount change
		X2A				High-level positioning control start command	Commanding high-level positioning control start
		X2B				Positioning start command (dedicated instruction)	Commanding positioning start

Device name	Device				Application	Details when ON
	Axis 1	Axis 2	Axis 3	Axis 4		
External input (command)	X2C	—			M code OFF command	Commanding M code OFF
	X2D				JOG operation speed setting command	Commanding JOG operation speed setting
	X2E				Forward run JOG/inching command	Commanding forward run JOG/inching operation
	X2F				Reverse run JOG/inching command	Commanding reverse run JOG/inching operation
	X30				Manual pulse generator operation enable command	Commanding manual pulse generator operation enable
	X31				Manual pulse generator operation disable command	Commanding manual pulse generator operation disable
	X32				Speed change command	Commanding speed change
	X33				Override command	Commanding override
	X34				Acceleration/deceleration time change command	Commanding acceleration/deceleration time change
	X35				Acceleration/deceleration time change disable command	Commanding acceleration/deceleration time change disable
	X36				Torque change command	Commanding torque change
	X37				Step operation command	Commanding step operation
	X38				Skip command	Commanding skip
	X39				Teaching command	Commanding teaching
	X3A				Continuous operation interrupt command	Commanding continuous operation interrupt
	X3B				Restart command	Commanding restart
	X3C				Parameter initialization command	Commanding parameter initialization
	X3D				Flash ROM write command	Commanding flash ROM write
	X3E	—			Error reset command	Commanding error reset
	X3F				Stop command	Commanding stop
	X40				Position-speed switching operation command	Position-speed switching operation command
	X41				Position-speed switching enable command	Position-speed switching enable command
	X42				Position-speed switching prohibit command	Position-speed switching prohibit command
	X43				Speed change command	Speed change command
	X44				Inching movement amount setting command	Inching movement amount setting command
	X45				Target position change command	Target position change command
	X46				Step start information command	Step start information command
	X47				Positioning start command k10	Positioning start command k10
	X48				Override initialization value command	Override initialization value command
	X4A				Current value changing command	—
	X4B				PLC READY ON	PLC READY ON
	X4C				Error reset clear command	Error reset clear command
	X4D				For unit (degree)	For unit (degree)
	X4E				Positioning start signal command (Y start)	Positioning start command being given
	X4F				All axis servo ON command	All axis servo ON command

Device name	Device				Application	Details when ON
	Axis 1	Axis 2	Axis 3	Axis 4		
Internal relay	M0	—			OPR request OFF command	Commanding OPR request OFF
	M1				OPR request OFF command pulse	OPR request OFF commanded
	M2				OPR request OFF command storage	OPR request OFF command held
	M3				Fast OPR command	Commanding fast OPR
	M4				Fast OPR command storage	Fast OPR command held
	M5				Positioning start command pulse	Positioning start commanded
	M6				Positioning start command storage	Positioning start command held
	M7				In-JOG/Inching operation flag	In-JOG/Inching operation flag
	M8				Manual pulse generator operation enable command	Commanding manual pulse generator operation enable
	M9				Manual pulse generator operating flag	Manual pulse generator operating flag
	M10				Manual pulse generator operation disable command	Commanding manual pulse generator operation disable
	M11				Speed change command pulse	Speed change commanded
	M12				Speed change command storage	Speed change command held
	M13				Override command	Requesting override
	M14				Acceleration/deceleration time change command	Requesting acceleration/deceleration time change
	M15				Torque change command	Requesting torque change
	M16				Step operation command pulse	Step operation commanded
	M17				Skip command pulse	Skip commanded
	M18				Skip command storage	Skip command held
	M19				Teaching command pulse	Teaching commanded
	M20				Teaching command storage	Teaching command held
	M21				Continuous operation interrupt command	Requesting continuous operation interrupt
	M22				Restart command	Requesting restart
	M23				Restart command storage	Restart command held
	M24				Parameter initialization command pulse	Parameter initialization commanded
	M25				Parameter initialization command storage	Parameter initialization command held
	M26				Flash ROM write command pulse	Flash ROM write commanded
	M27				Flash ROM write command storage	Flash ROM write command held
	M28	—			Error reset	Error reset completed
	M29				Stop command pulse	Stop commanded
	M30				Target position change command pulse	Target position change commanded
	M31				Target position change command storage	Target position change command held
	M32				ZP.PSTRT1 instruction complete device	ZP.PSTRT1 instruction completed
	M33				ZP.PSTRT1 instruction error complete device	ZP.PSTRT1 instruction error completed

Device name	Device				Application	Details when ON
	Axis 1	Axis 2	Axis 3	Axis 4		
Internal relay	M34	—			ZP.TEACH1 instruction complete device	ZP.TEACH1 instruction completed
	M35				ZP.TEACH1 instruction error complete device	ZP.TEACH1 instruction error completed
	M36				ZP.PINIT instruction complete device	ZP.PINIT instruction completed
	M37				ZP.PINIT instruction error complete device	ZP.PINIT instruction error completed
	M38				ZP.PFWRT instruction complete device	ZP.PFWRT instruction completed
	M39				ZP.PFWRT instruction error complete device	ZP.PFWRT instruction error completed
	M40				Override initialization value command	Override initialization value
	M50				Parameter setting complete device	Parameter setting completed

(2) Data resisters and timers

Device name	Device				Application	Details of storage
	Axis 1	Axis 2	Axis 3	Axis 4		
Data register	D0	—			OPR request flag	Md.31 Status: b3
	D1				Speed (low-order 16 bits)	Cd.25 Position-speed switching control speed change register
	D2				Speed (high-order 16 bits)	
	D3				Movement amount (low-order 16 bits)	Cd.23 Speed-position switching control movement amount change register
	D4				Movement amount (high-order 16 bits)	
	D5				Inching movement amount	Cd.16 Inching movement amount
	D6				JOG operation speed (low-order 16 bits)	Cd.17 JOG speed
	D7				JOG operation speed (high-order 16 bits)	
	D8				Manual pulse generator 1 pulse input magnification (low-order)	Cd.20 Manual pulse generator 1 pulse input magnification
	D9				Manual pulse generator 1 pulse input magnification (high-order)	
	D10				Manual pulse generator operation enable	Cd.21 Manual pulse generator enable flag
	D11				Speed change value (low-order 16 bits)	Cd.14 New speed value
	D12				Speed change value (high-order 16 bits)	
	D13				Speed change request	Cd.15 Speed change request
	D14				Override value	Cd.13 Positioning operation speed override

Device name	Device				Application	Details of storage
	Axis 1	Axis 2	Axis 3	Axis 4		
Data register	D15	—			Acceleration time setting (low-order 16 bits)	Cd.10 New acceleration time value
	D16				Acceleration time setting (high-order 16 bits)	
	D17				Deceleration time setting (low-order 16 bits)	Cd.11 New deceleration time value
	D18				Deceleration time setting (high-order 16 bits)	
	D19				Acceleration/deceleration time change enable	Cd.12 Acceleration/deceleration time change during speed change, enable/disable selection
	D20				Step mode	Cd.34 Step mode
	D21				Step valid flag	Cd.35 Step valid flag
	D22				Step start information	—
	D23				Target position (low-order 16 bits)	Cd.27 Target position change value (New address)
	D24				Target position (high-order 16 bits)	
	D25				Target speed (low-order 16 bits)	Cd.28 Target position change value (New speed)
	D26				Target speed (high-order 16 bits)	
	D27				Target position change request	Cd.29 Target position change request flag
	D30				ZP.PSTRT1 instruction control data	—
	D31				Completion status	—
	D32				Start number	—
	D33				ZP.TEACH1 instruction control data	—
	D34				Completion status	—
	D35				Teaching data	—
	D36				Positioning data No.	—
	D37				ZP.PINIT instruction control data	—
	D38				Completion status	—
	D39				ZP.PFWRT instruction control data	—
	D40				Completion status	—
	D50				Unit setting	Pr.1 Unit setting
	D51				Unit magnification	Pr.4 Unit magnification (AM)

Device name	Device				Application		Details of storage
	Axis 1	Axis 2	Axis 3	Axis 4			
Data register	D52	—			Number of pulses per rotation (low-order 16 bits)		Pr.2 Number of pulses per rotation (AP)
	D53				Number of pulses per rotation (high-order 16 bits)		
	D54				Movement amount per rotation (low-order 16 bits)		Pr.3 Movement amount per rotation (AL)
	D55				Movement amount per rotation (high-order 16 bits)		
	D56				Bias speed at start (low-order 16 bits)		Pr.7 Bias speed at start
	D57				Bias speed at start (high-order 16 bits)		
	D68				Block start data (Block 0)	Point 1 (shape, start No.)	Da.11 Shape Da.12 Start data No. Da.13 Special start instruction Da.14 Parameter
	D69					Point 2 (shape, start No.)	
	D70					Point 3 (shape, start No.)	
	D71					Point 4 (shape, start No.)	
	D72					Point 5 (shape, start No.)	
	D73					Point 1 (special start instruction)	
	D74					Point 2 (special start instruction)	
	D75					Point 3 (special start instruction)	
	D76					Point 4 (special start instruction)	
	D77					Point 5 (special start instruction)	
	D78				Torque change value		—
	D79				Error code		Md.23 Axis error No.
	D80				Servo series		Pr.100 Servo series
	D81				Absolute position system valid/invalid		Absolute position detection system (PA03)
	D85				Return home position method		Pr.43 OPR method
	D100				Positioning identifier		Data No.1 Da.1 Operation pattern Da.2 Control system Da.3 Acceleration time No. Da.4 Deceleration time No. Da.5 Axis to be interpolated Da.6 Positioning address/ movement amount Da.7 Arc address Da.8 Command speed Da.9 Dwell time Da.10 M code
	D101				M code		
	D102				Dwell time		
	D103				Dummy		
	D104				Command speed (low-order 16 bits)		
	D105				Command speed (high-order 16 bits)		
	D106				Positioning address (low-order 16 bits)		
	D107				Positioning address (high-order 16 bits)		
	D108				Arc address (low-order 16 bits)		
	D109				Arc address (high-order 16 bits)		

Device name	Device				Application	Details of storage
	Axis 1	Axis 2	Axis 3	Axis 4		
Data register	D110	—			Positioning identifier	Data No.2 Da.1 Operation pattern Da.2 Control system Da.3 Acceleration time No. Da.4 Deceleration time No. Da.5 Axis to be interpolated Da.6 Positioning address/ movement amount Da.7 Arc address Da.8 Command speed Da.9 Dwell time Da.10 M code
	D111				M code	
	D112				Dwell time	
	D113				Dummy	
	D114				Command speed (low-order 16 bits)	
	D115				Command speed (high-order 16 bits)	
	D116				Positioning address (low-order 16 bits)	
	D117				Positioning address (high-order 16 bits)	
	D118				Arc address (low-order 16 bits)	
	D119				Arc address (high-order 16 bits)	
	D120				Positioning identifier	Data No.3 Da.1 Operation pattern Da.2 Control system Da.3 Acceleration time No. Da.4 Deceleration time No. Da.5 Axis to be interpolated Da.6 Positioning address/ movement amount Da.7 Arc address Da.8 Command speed Da.9 Dwell time Da.10 M code
	D121				M code	
	D122				Dwell time	
	D123				Dummy	
	D124				Command speed (low-order 16 bits)	
	D125				Command speed (high-order 16 bits)	
	D126				Positioning address (low-order 16 bits)	
	D127				Positioning address (high-order 16 bits)	
	D128				Arc address (low-order 16 bits)	
	D129				Arc address (high-order 16 bits)	
	D130				Positioning identifier	Data No.4 Da.1 Operation pattern Da.2 Control system Da.3 Acceleration time No. Da.4 Deceleration time No. Da.5 Axis to be interpolated Da.6 Positioning address/ movement amount Da.7 Arc address Da.8 Command speed Da.9 Dwell time Da.10 M code
	D131				M code	
	D132				Dwell time	
	D133				Dummy	
	D134				Command speed (low-order 16 bits)	
	D135				Command speed (high-order 16 bits)	
	D136				Positioning address (low-order 16 bits)	
	D137				Positioning address (high-order 16 bits)	
	D138				Arc address (low-order 16 bits)	
	D139				Arc address (high-order 16 bits)	

Device name	Device				Application	Details of storage
	Axis 1	Axis 2	Axis 3	Axis 4		
Data register	D140	—			Positioning identifier	Data No.5 Da.1 Operation pattern Da.2 Control system Da.3 Acceleration time No. Da.4 Deceleration time No. Da.5 Axis to be interpolated Da.6 Positioning address/ movement amount Da.7 Arc address Da.8 Command speed Da.9 Dwell time Da.10 M code
	D141				M code	
	D142				Dwell time	
	D143				Dummy	
	D144				Command speed (low-order 16 bits)	
	D145				Command speed (high-order 16 bits)	
	D146				Positioning address (low-order 16 bits)	
	D147				Positioning address (high-order 16 bits)	
	D148				Arc address (low-order 16 bits)	
	D149				Arc address (high-order 16 bits)	
	D150				Positioning identifier	Data No.6 Da.1 Operation pattern Da.2 Control system Da.3 Acceleration time No. Da.4 Deceleration time No. Da.5 Axis to be interpolated Da.6 Positioning address/ movement amount Da.7 Arc address Da.8 Command speed Da.9 Dwell time Da.10 M code
	D151				M code	
	D152				Dwell time	
	D153				Dummy	
	D154				Command speed (low-order 16 bits)	
	D155				Command speed (high-order 16 bits)	
	D156				Positioning address (low-order 16 bits)	
	D157				Positioning address (high-order 16 bits)	
	D158				Arc address (low-order 16 bits)	
	D159				Arc address (high-order 16 bits)	
	D190				Positioning identifier	Data No.10 Da.1 Operation pattern Da.2 Control system Da.3 Acceleration time No. Da.4 Deceleration time No. Da.5 Axis to be interpolated Da.6 Positioning address/ movement amount Da.7 Arc address Da.8 Command speed Da.9 Dwell time Da.10 M code
	D191				M code	
	D192				Dwell time	
	D193				Dummy	
	D194				Command speed (low-order 16 bits)	
	D195				Command speed (high-order 16 bits)	
	D196				Positioning address (low-order 16 bits)	
	D197				Positioning address (high-order 16 bits)	
	D198				Arc address (low-order 16 bits)	
	D199				Arc address (high-order 16 bits)	

Device name	Device				Application	Details of storage
	Axis 1	Axis 2	Axis 3	Axis 4		
Data register	D200	—			Positioning identifier	Data No.11 Da.1 Operation pattern Da.2 Control system Da.3 Acceleration time No. Da.4 Deceleration time No. Da.5 Axis to be interpolated Da.6 Positioning address/ movement amount Da.7 Arc address Da.8 Command speed Da.9 Dwell time Da.10 M code
	D201				M code	
	D202				Dwell time	
	D203				Dummy	
	D204				Command speed (low-order 16 bits)	
	D205				Command speed (high-order 16 bits)	
	D206				Positioning address (low-order 16 bits)	
	D207				Positioning address (high-order 16 bits)	
	D208				Arc address (low-order 16 bits)	
	D209				Arc address (high-order 16 bits)	
	D240				Positioning identifier	Data No.15 Da.1 Operation pattern Da.2 Control system Da.3 Acceleration time No. Da.4 Deceleration time No. Da.5 Axis to be interpolated Da.6 Positioning address/ movement amount Da.7 Arc address Da.8 Command speed Da.9 Dwell time Da.10 M code
	D241				M code	
	D242				Dwell time	
	D243				Dummy	
	D244				Command speed (low-order 16 bits)	
	D245				Command speed (high-order 16 bits)	
	D246				Positioning address (low-order 16 bits)	
	D247				Positioning address (high-order 16 bits)	
	D248				Arc address (low-order 16 bits)	
	D249				Arc address (high-order 16 bits)	
Timer	T0	—			PLC READY signal OFF confirmation	PLC READY signal OFF
	T1				PLC READY signal OFF confirmation	

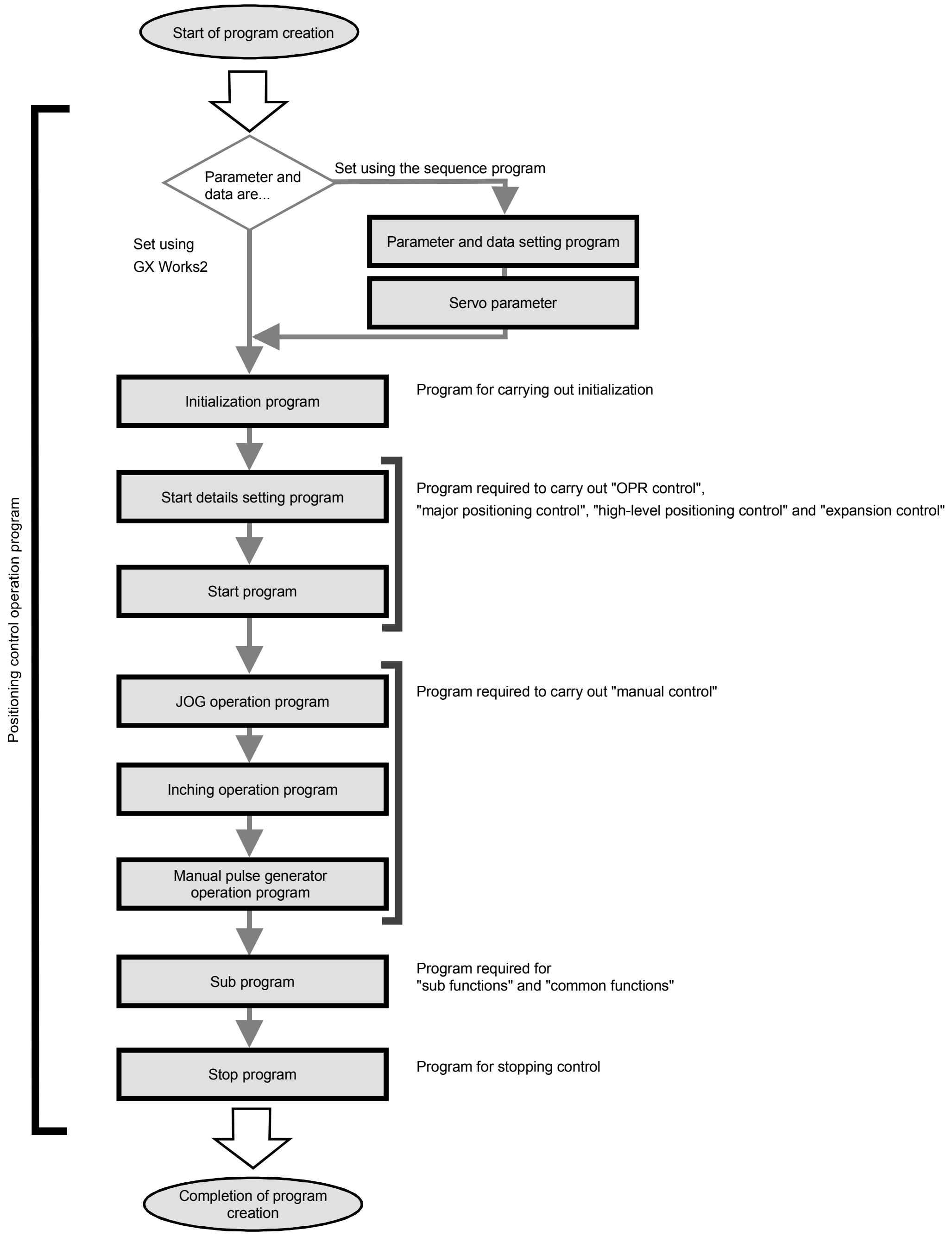
Device name	Device	Application	Details of storage
Code	U0\G806	Error code	Md.23 Axis error No.
	U0\G809	Axis operation status	Md.26 Axis operation status
	U0\G817	Status	Md.31 Status
	U0\G1500	Positioning start No.	Cd.3 Positioning start No.
	U0\G1502	Error reset	Cd.5 Axis error reset
	U0\G1503	Restart command	Cd.6 Restart command
	U0\G1504	M code OFF request (Buffer memory)	Cd.7 M code OFF request
	U0\G1505	External command valid	Cd.8 External command valid
	U0\G1513	Override request	Cd.13 Positioning operation speed override
	U0\G1516	Speed change request	Cd.15 Speed change request
	U0\G1517	Inching movement amount	Cd.16 Inching movement amount
	U0\G1520	Interrupt request during continuous operation	Cd.18 Interrupt request during continuous operation
	U0\G1521	OPR request flag OFF request	Cd.19 OPR request flag OFF request
	U0\G1524	Manual pulse generator enable flag	Cd.21 Manual pulse generator enable flag
	U0\G1526	Speed-position switching control movement amount	Cd.23 Speed-position switching control movement amount change register
	U0\G1528	Speed-position switching enable flag	Cd.24 Speed-position switching enable flag
	U0\G1530	Position-speed switching control speed change	Cd.25 Position-speed switching control speed change register
	U0\G1532	Position-speed switching enable flag	Cd.26 Position-speed switching enable flag
	U0\G1538	Target position change request flag	Cd.29 Target position change request flag
	U0\G1544	Step mode	Cd.34 Step mode
	U0\G1547	Skip command	Cd.37 Skip command

6.3 Creating a program

The "positioning control operation program" actually used is explained in this chapter. The functions and programs explained in "Section 2" are assembled into the "positioning control operation program" explained here. (To monitor the control, add the required monitor program that matches the system. Refer to Section 5.6 "List of monitor data" for details on the monitor items.)

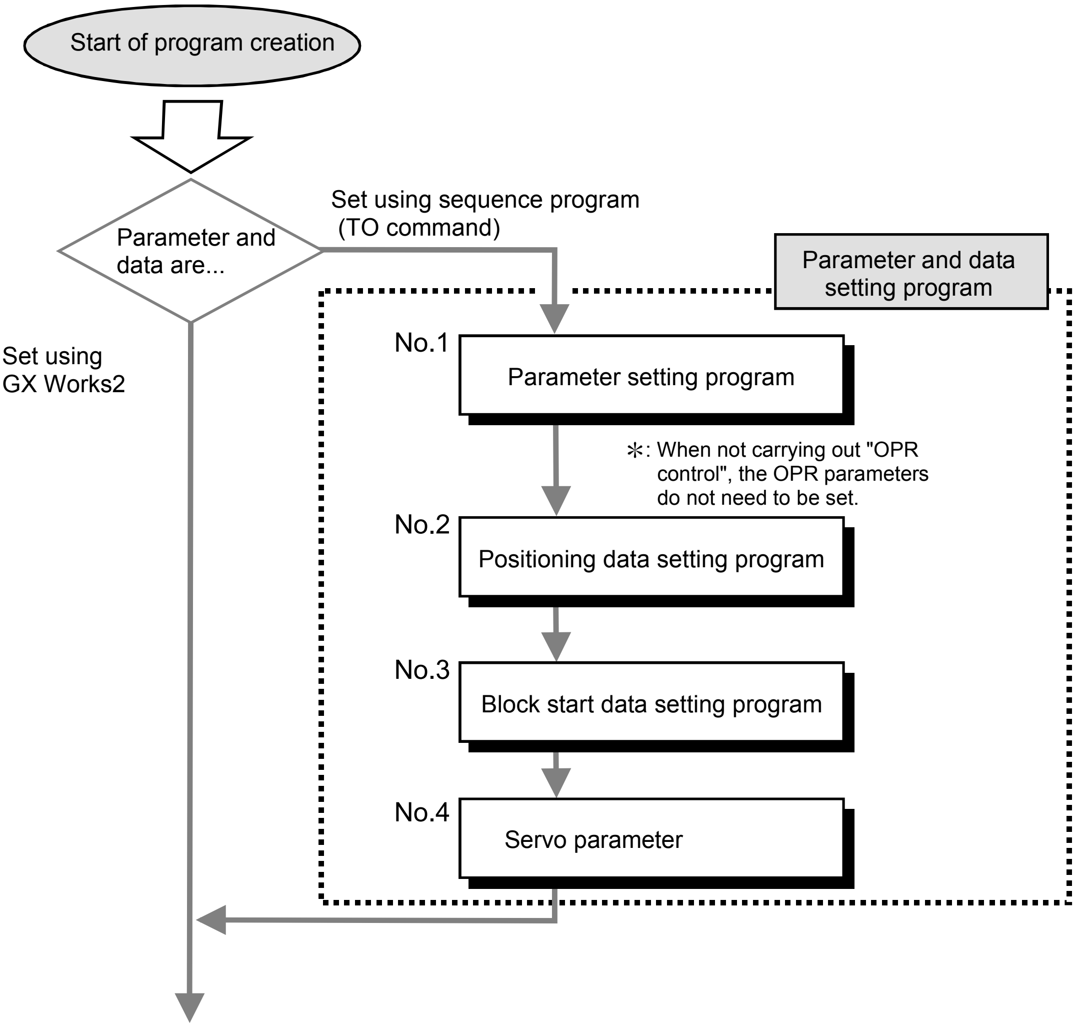
6.3.1 General configuration of program

The general configuration of the "positioning control operation program" is shown below.

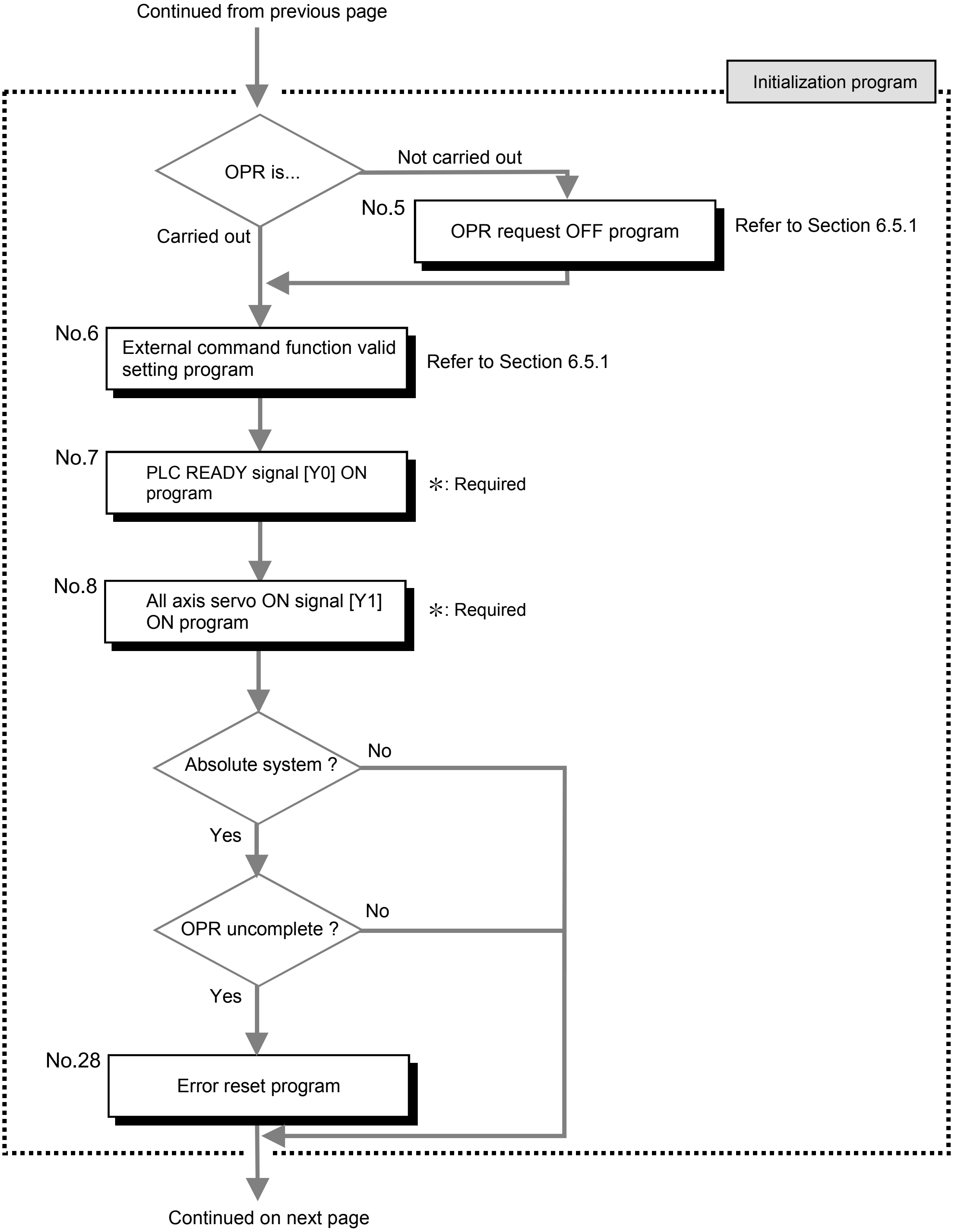


6.3.2 Positioning control operation program

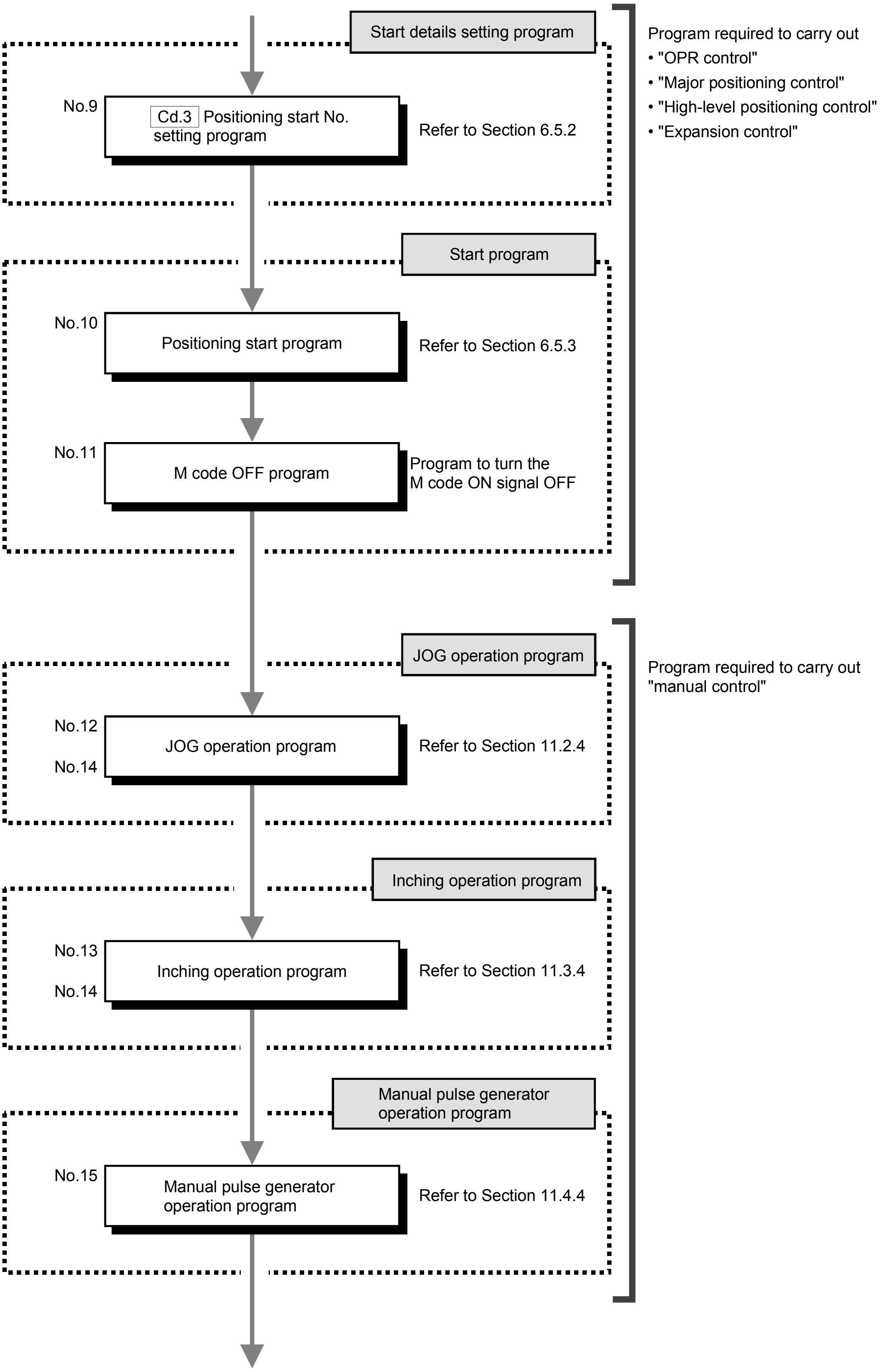
The various programs that configure the "positioning control operation program" are shown below. When creating the program, refer to the explanation of each program and Section 6.4 "Positioning program examples", and create an operation program that matches the positioning system. (Numbers are assigned to the following programs. Configuring the program in the order of these numbers is recommended.)



Continued on next page


Continued from previous page
Initialization program
OPR is...
Not carried out
Carried out
No.5
OPR request OFF program
Refer to Section 6.5.1
No.6
External command function valid setting program
Refer to Section 6.5.1
No.7
PLC READY signal [Y0] ON program
✻: Required
No.8
All axis servo ON signal [Y1] ON program
✻: Required
Absolute system ?
No
Yes
OPR uncomplete ?
No
Yes
No.28
Error reset program
Continued on next page

Continued from previous page



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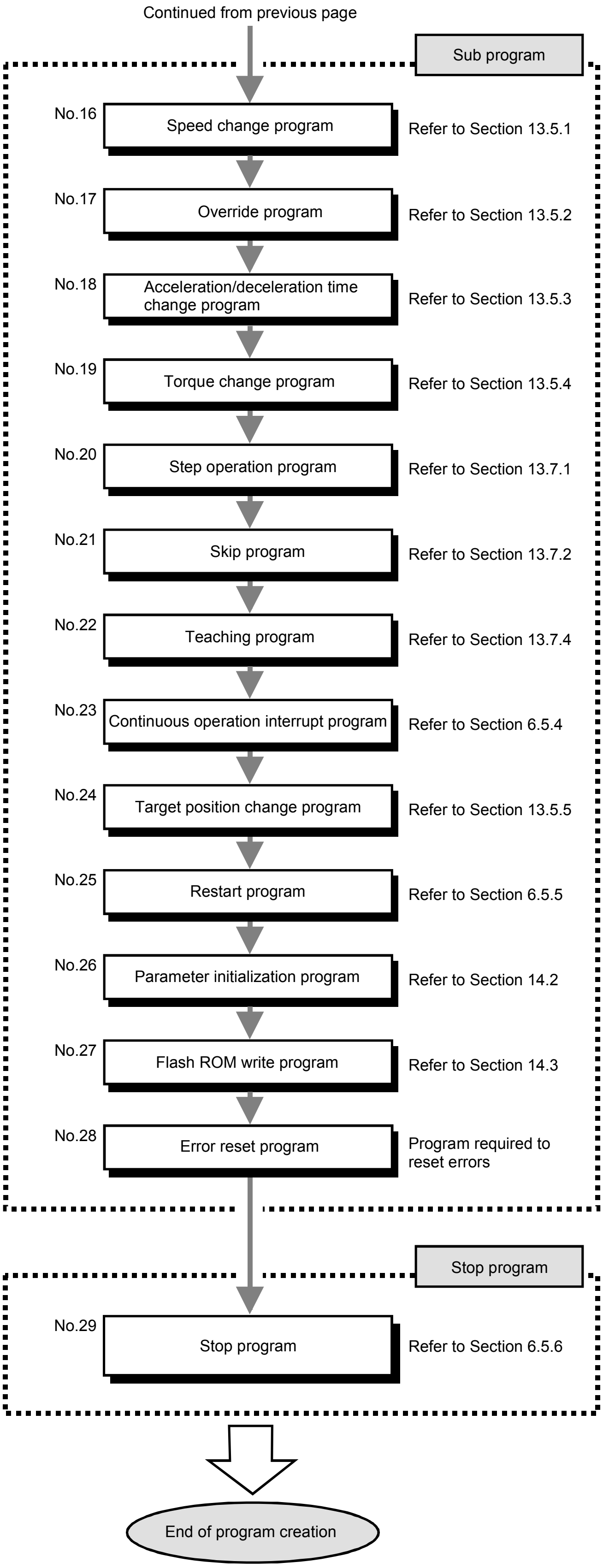


Program added according to control details. (Create as required.)

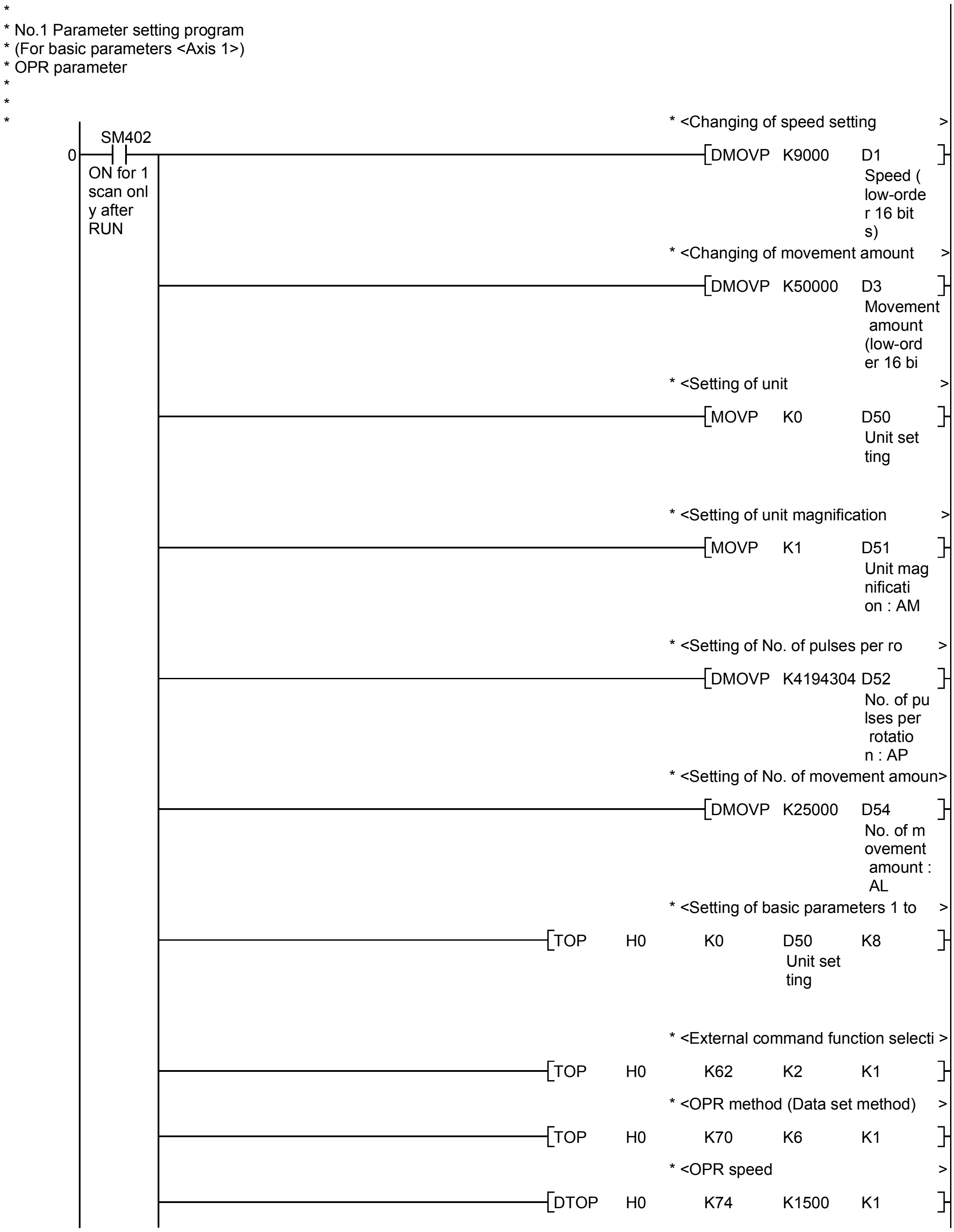
Program used to stop control

6.4 Positioning program examples

An example of the "Axis 1" positioning program using QD77MS4 is given in this section.

[No. 1] to [No. 4] parameter and data setting program

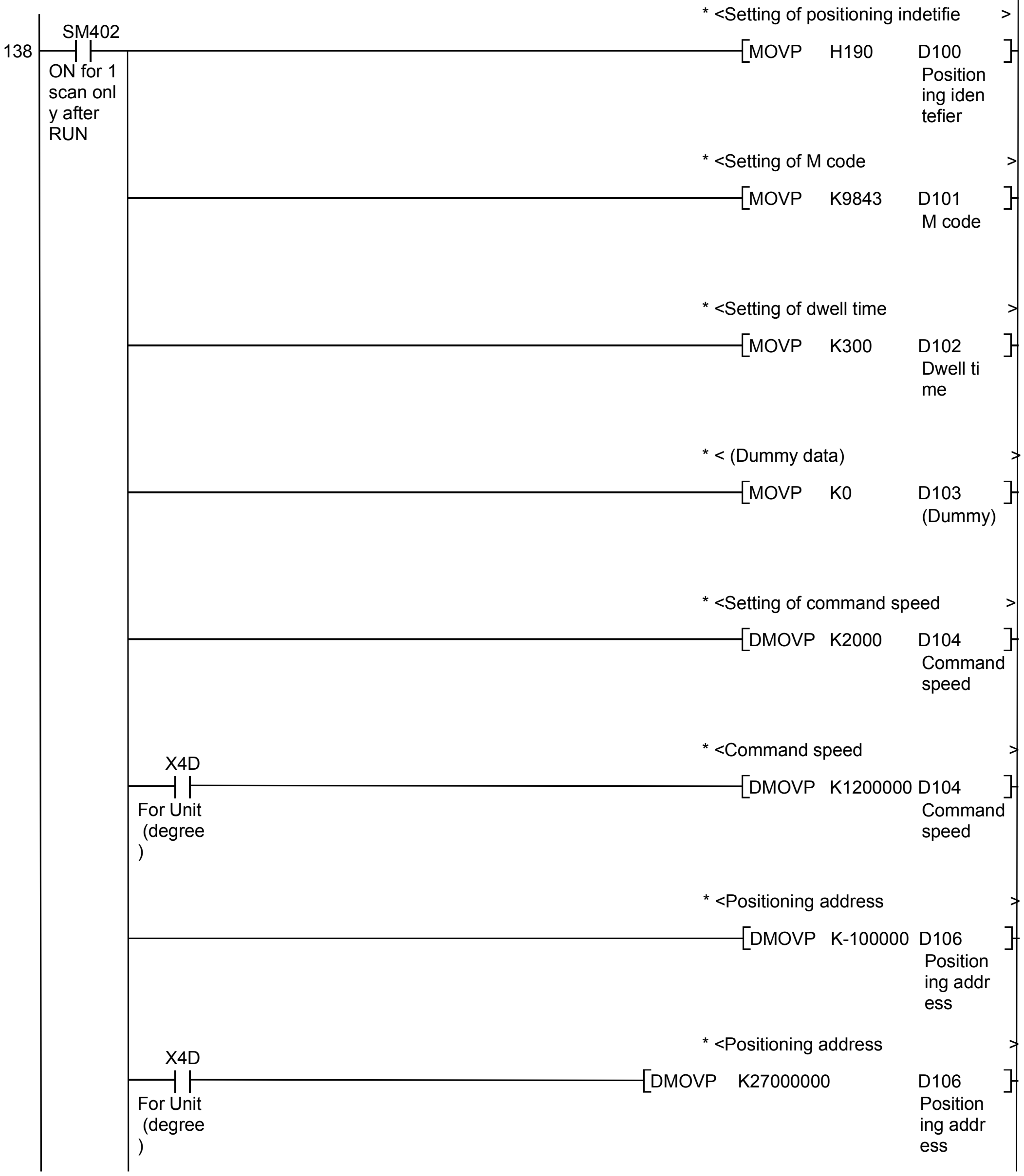
- ∗ When setting the parameters or data with the sequence program, set them in the Simple Motion module using the TO command from the PLC CPU. (Carry out the settings while the PLC READY signal [Y0] is OFF.)
- ∗ When setting the parameters or data with GX Works2, the [No. 1] to [No. 4] program is not necessary.



```
*
* No.1 Parameter setting program
* (For basic parameters <Axis 1>)
* OPR parameter
*
*
*                                                 * <Changing of speed setting            >
     SM402
0 ---| |----------------------------------------[DMOVP  K9000     D1                  ]
     ON for 1                                                      Speed (
     scan onl                                                      low-orde
     y after                                                       r 16 bit
     RUN                                                           s)
                                                  * <Changing of movement amount          >
            ------------------------------------[DMOVP  K50000    D3                  ]
                                                                   Movement
                                                                    amount
                                                                   (low-ord
                                                                   er 16 bi
                                                  * <Setting of unit                      >
            ------------------------------------[MOVP   K0        D50                 ]
                                                                   Unit set
                                                                   ting

                                                  * <Setting of unit magnification        >
            ------------------------------------[MOVP   K1        D51                 ]
                                                                   Unit mag
                                                                   nificati
                                                                   on : AM

                                                  * <Setting of No. of pulses per ro      >
            ------------------------------------[DMOVP  K4194304  D52                 ]
                                                                   No. of pu
                                                                   lses per
                                                                    rotatio
                                                                   n : AP
                                                  * <Setting of No. of movement amoun>
            ------------------------------------[DMOVP  K25000    D54                 ]
                                                                   No. of m
                                                                   ovement
                                                                    amount :
                                                                    AL
                                                  * <Setting of basic parameters 1 to     >
            ---------------------------[TOP    H0     K0     D50     K8               ]
                                                          Unit set
                                                          ting

                                                  * <External command function selecti >
            ---------------------------[TOP    H0     K62    K2      K1               ]
                                                  * <OPR method (Data set method)         >
            ---------------------------[TOP    H0     K70    K6      K1               ]
                                                  * <OPR speed                            >
            ---------------------------[DTOP   H0     K74    K1500   K1               ]
```

```
                                                          *<Creep speed setting              >
                         ------------------[DTOP   H0    K76         K1200      K1          ]

                                                          *<Basic parameters 1 setting compl >
                         ---------------------------------------------[SET      M50         ]
                                                                                Paramete
                                                                                r settin
                                                                                g comple
                                                                                te devic

* Unit "Degree" setting program
* <For axis 1>
* Speed-position change control (ABS mode) execution and etc.
* (X4D turns ON before startup)
*
                                                          *<Setting of Unit setting          >
        SM402     X4D
   64 ---| |-------| |-------------------[TOP    H0    K0          K2         K1          ]
       ON for 1  For Unit
       scan onl   (degree
       y after   )
       RUN
                                                          *<Setting of movement amount per r >
                          |----------------[DTOP   H0    K4          K9000000   K1          ]
                          |                               *<Speed limit value                >
                          |---------[DTOP     H0    K10   K20000000             K1          ]
                          |                               *<(S/W stroke limit upper limit)   >
                          |----------------[DTOP   H0    K18         K0         K1          ]
                          |                               *<(S/W stroke limit lower limit)   >
                          |----------------[DTOP   H0    K20         K0         K1          ]
                          |                               *<Current feed value of the speed  >
                          |----------------[TOP    H0    K30         K1         K1          ]
                          |                               *<Speed-position function selectio >
                          |----------------[TOP    H0    K34         K2         K1          ]
                          |                               *<JOG speed limit value            >
                          |---------[DTOP     H0    K48   K20000000             K1          ]
                          |                               *<OPR speed                        >
                          |----------------[DTOP   H0    K74         K1000000   K1          ]
                          |                               *<Creep speed                      >
                          |----------------[DTOP   H0    K76         K800000    K1          ]
```

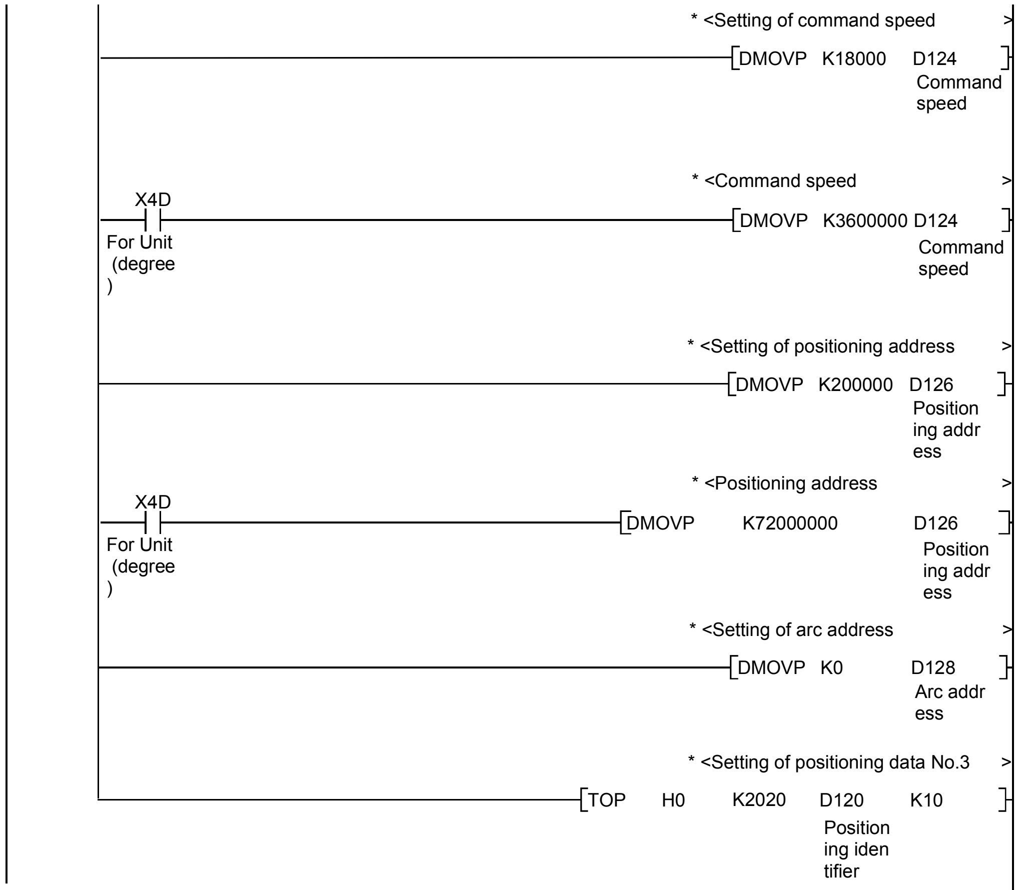
```
*
* No.2-1 Positioning data setting program
* (For positioning data No.1 <Axis 1>)
* <Positioning identifier>
*         Operation pattern: Positioning terminated
*         Control system: 1 axis linear control (ABS)
*         Acceleration time No. : 1, deceleration time No. :2
*
```



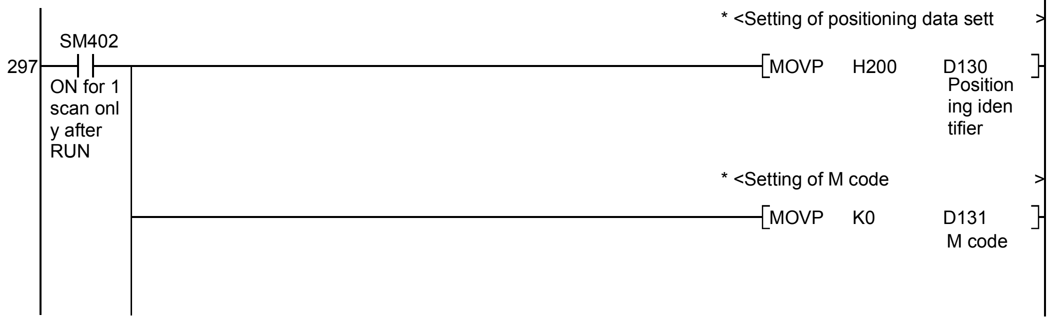
```
                                              * <Setting of positioning indetifie      >
      SM402
138 ──┤ ├──┬──────────────────────────────────[MOVP    H190      D100          ]
      ON for 1                                                  Position
      scan onl                                                  ing iden
      y after                                                   tefier
      RUN
             │                                * <Setting of M code                    >
             ├──────────────────────────────────[MOVP    K9843     D101          ]
             │                                                  M code

             │                                * <Setting of dwell time                >
             ├──────────────────────────────────[MOVP    K300      D102          ]
             │                                                  Dwell ti
             │                                                  me

             │                                * < (Dummy data)                        >
             ├──────────────────────────────────[MOVP    K0        D103          ]
             │                                                  (Dummy)

             │                                * <Setting of command speed             >
             ├──────────────────────────────────[DMOVP   K2000     D104          ]
             │                                                  Command
             │                                                  speed

             │                                * <Command speed                        >
             │  X4D
             ├──┤ ├─────────────────────────────[DMOVP   K1200000 D104           ]
             │ For Unit                                         Command
             │  (degree                                         speed
             │ )
             │                                * <Positioning address                  >
             ├──────────────────────────────────[DMOVP   K-100000  D106          ]
             │                                                   Position
             │                                                   ing addr
             │                                                   ess
             │                                * <Positioning address                  >
             │  X4D
             └──┤ ├──────────────────────────[DMOVP   K27000000          D106    ]
               For Unit                                         Position
                (degree                                         ing addr
               )                                                ess
```

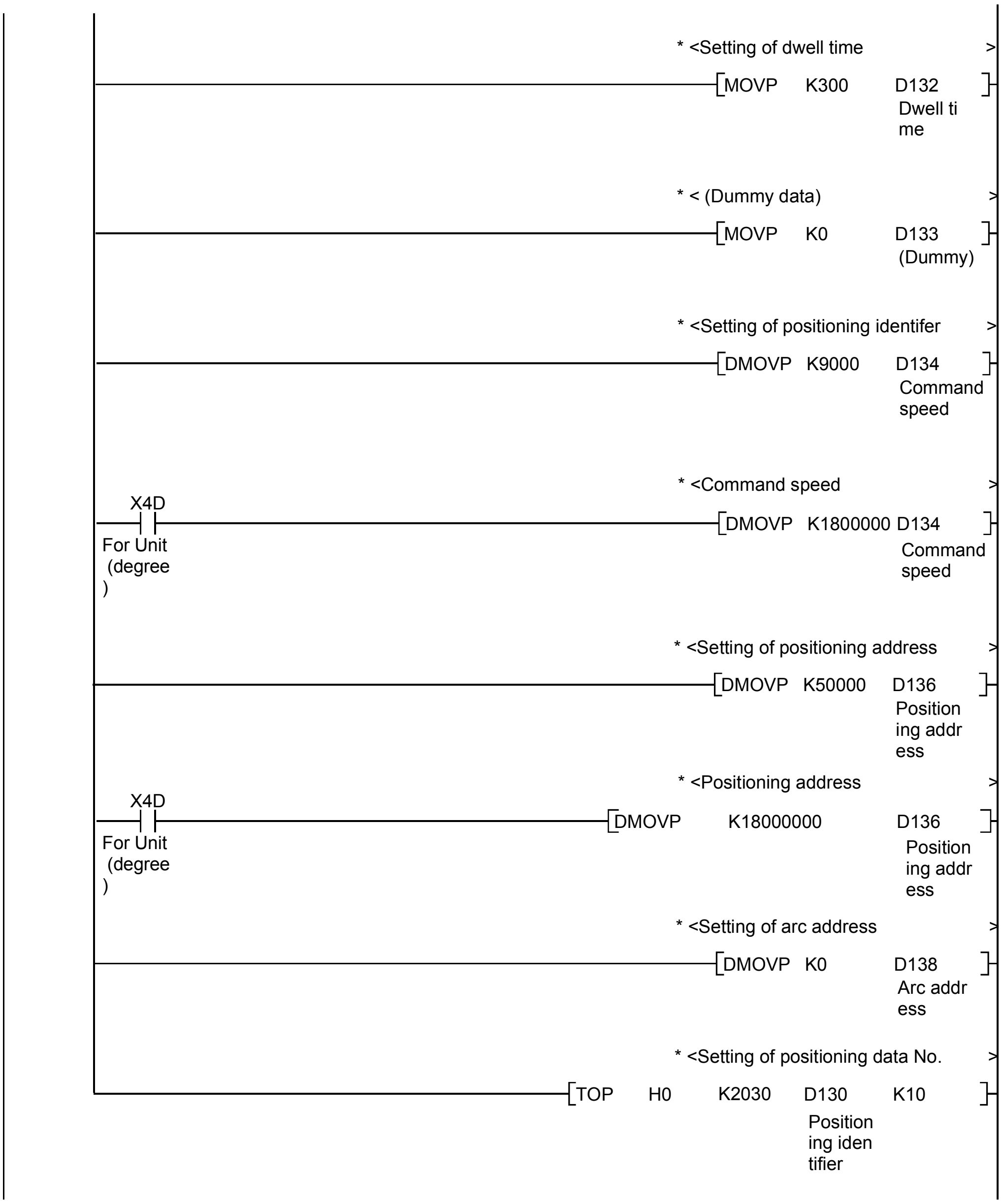
```
                                      * <Setting of arc address             >
        |----------------------------------[DMOVP  K0        D108      ]-
                                                             Arc addr
                                                             ess

                                      * <Setting of positioning data No.    >
        |--------------------------[TOP    H0    K2000    D100      K10    ]-
                                                          Position
                                                          ing iden
                                                          tifier
*
* No.2-2 Positioning data setting program
* (For positioning data No.2 <Axis 1>)
* <Positioning identifier>
*       Operation pattern: Positioning terminated
*       Control system: Speed-position switching control (Forward)
*       Acceleration time No. : 0, deceleration time No. : 0
*
                                      * <Setting of positioning identifie   >
      SM402
191|--| |--+-------------------------------[MOVP   H600      D110      ]-
   ON for 1|                                                 Position
   scan onl|                                                 ing iden
   y after |                                                 tifier
   RUN     |
           |                          * <Setting of M code                  >
           +-------------------------------[MOVP   K0        D111      ]-
           |                                                 M code
           |
           |                          * <Setting of dwell time              >
           +-------------------------------[MOVP   K300      D112      ]-
           |                                                 Dwell ti
           |                                                 me
           |
           |                          * < (Dummy data)                      >
           +-------------------------------[MOVP   K0        D113      ]-
           |                                                 (Dummy)
           |
           |                          * <Setting of command speed           >
           +-------------------------------[DMOVP  K18000    D114      ]-
           |                                                 Command
           |                                                 speed
           |
           |                          * <Command speed                      >
           |   X4D
           +--| |--------------------------[DMOVP  K3600000 D114       ]-
           For Unit                                          Command
            (degree                                          speed
           )
```

```
                                                        * <Setting of Positioning address         >
     |                                                  [DMOVP  K25000     D116      ]
     |                                                                     Position
     |                                                                     ing addr
     |                                                                     ess
     |                                                  * <Positioning address                    >
     |      X4D
     |------| |-----------------------------------------[ DMOVP  K9000000 D116      ]
     |  For Unit                                                           Position
     |   (degree                                                           ing addr
     |  )                                                                  ess
     |                                                  * <Setting of arc address                 >
     |--------------------------------------------------[DMOVP  K0         D118      ]
     |                                                                     Arc addr
     |                                                                     ess
     |                                                  * <Setting of positioning data No.        >
     |------------------------------------[TOP     H0      K2010    D110       K10    ]
                                                                  Position
*                                                                 ing iden
* No.2-3 Positioning data setting program                         tifier
* (For positioning data No.3 <Axis 1>)
* <Positioning identifier>
*       Operation pattern: Positioning terminated
*       Control system: Position-speed switching control (Forward)
*       Acceleration time No. : 0, deceleration time No. : 0
*
                                                        * <Setting of positioning identifie       >
       SM402
 244---| |--+-------------------------------------------[MOVP   H800       D120      ]
  ON for 1  |                                                              Position
  scan onl  |                                                              ing iden
  y after   |                                                              tifier
  RUN       |                                           * <Setting of M code                      >
            +-------------------------------------------[MOVP   K0         D121      ]
            |                                                              M code
            |                                           * <Setting of dwell time                  >
            +-------------------------------------------[MOVP   K300       D122      ]
            |                                                              Dwell ti
            |                                                              me
            |                                           * < (Dummy data)                          >
            +-------------------------------------------[MOVP   K0         D123      ]
            |                                                              (Dummy)
```

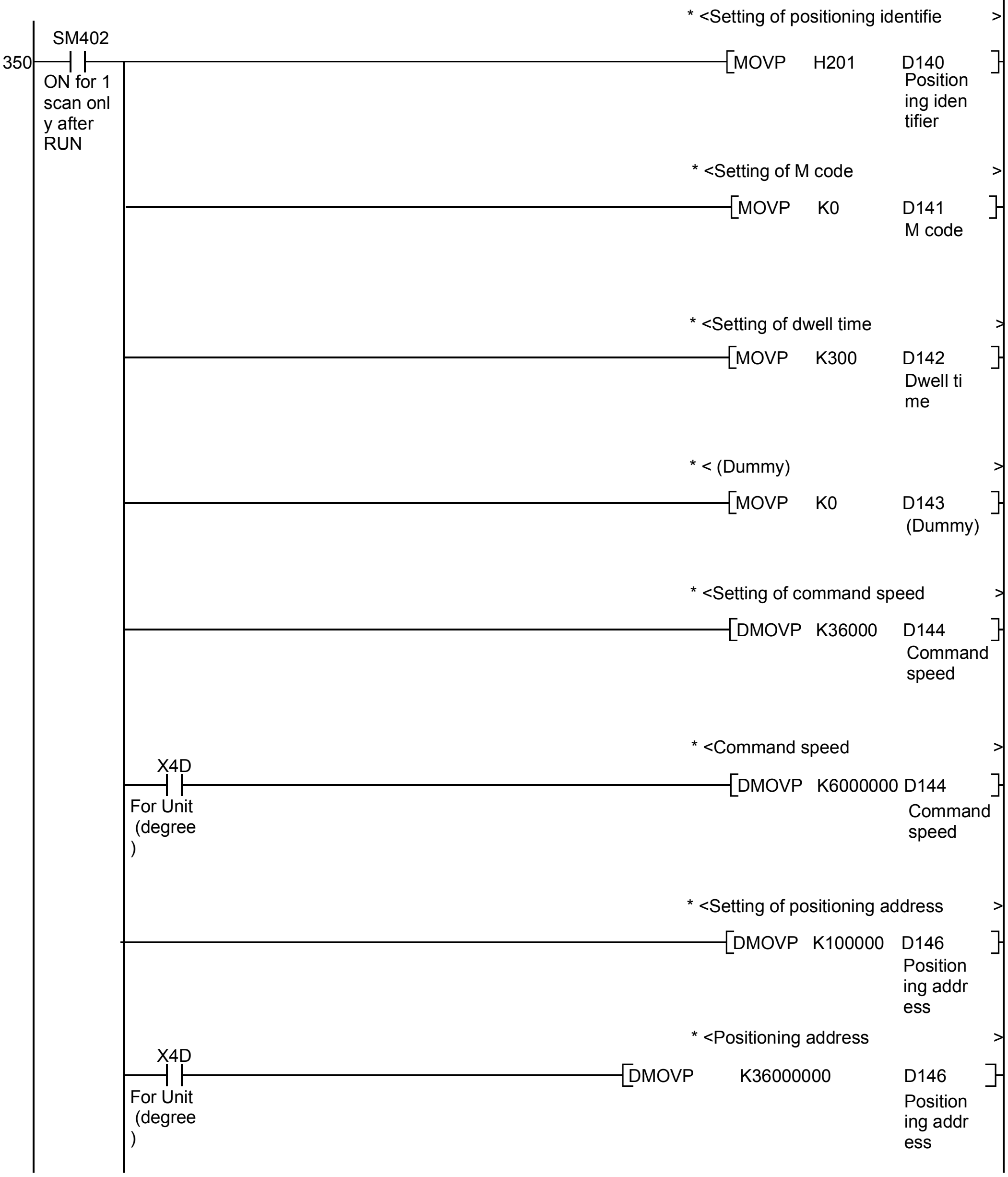


```
*
* No.2-4 Positioning data setting program
* (For positioning data No.4 <Axis 1>)
* <Positioning identifier>
*       Operation pattern: Positioning terminated
*       Control system: 1-axis linear control (INC)
*       Acceleration time No. : 0, deceleration time No. : 0
*
```

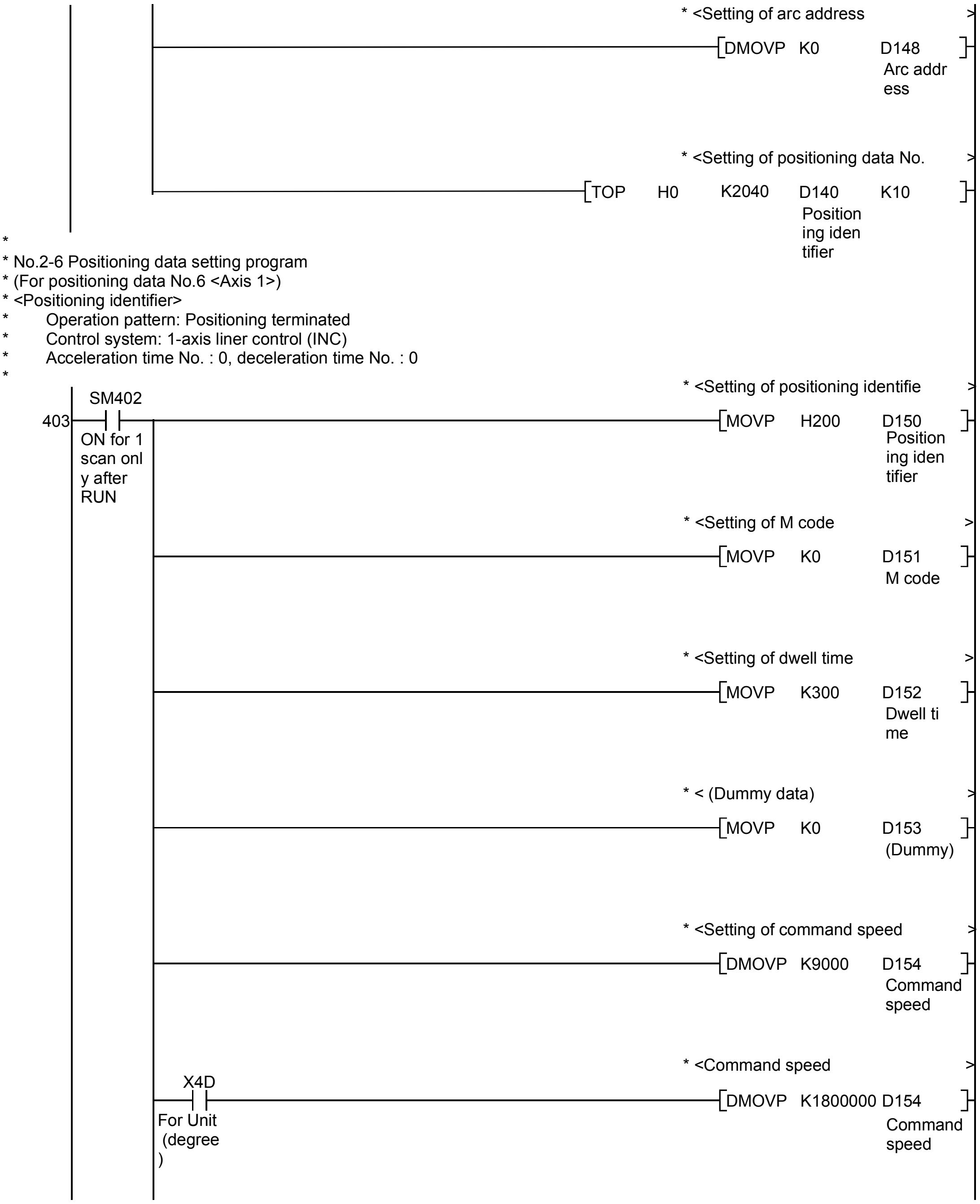



* <Setting of dwell time >
MOVP K300 D132
Dwell ti me
* < (Dummy data) >
MOVP K0 D133
(Dummy)
* <Setting of positioning identifer >
DMOVP K9000 D134
Command speed
* <Command speed >
X4D
For Unit (degree)
DMOVP K1800000 D134
Command speed
* <Setting of positioning address >
DMOVP K50000 D136
Position ing addr ess
* <Positioning address >
X4D
For Unit (degree)
DMOVP K18000000 D136
Position ing addr ess
* <Setting of arc address >
DMOVP K0 D138
Arc addr ess
* <Setting of positioning data No. >
TOP H0 K2030 D130 K10
Position ing iden tifier

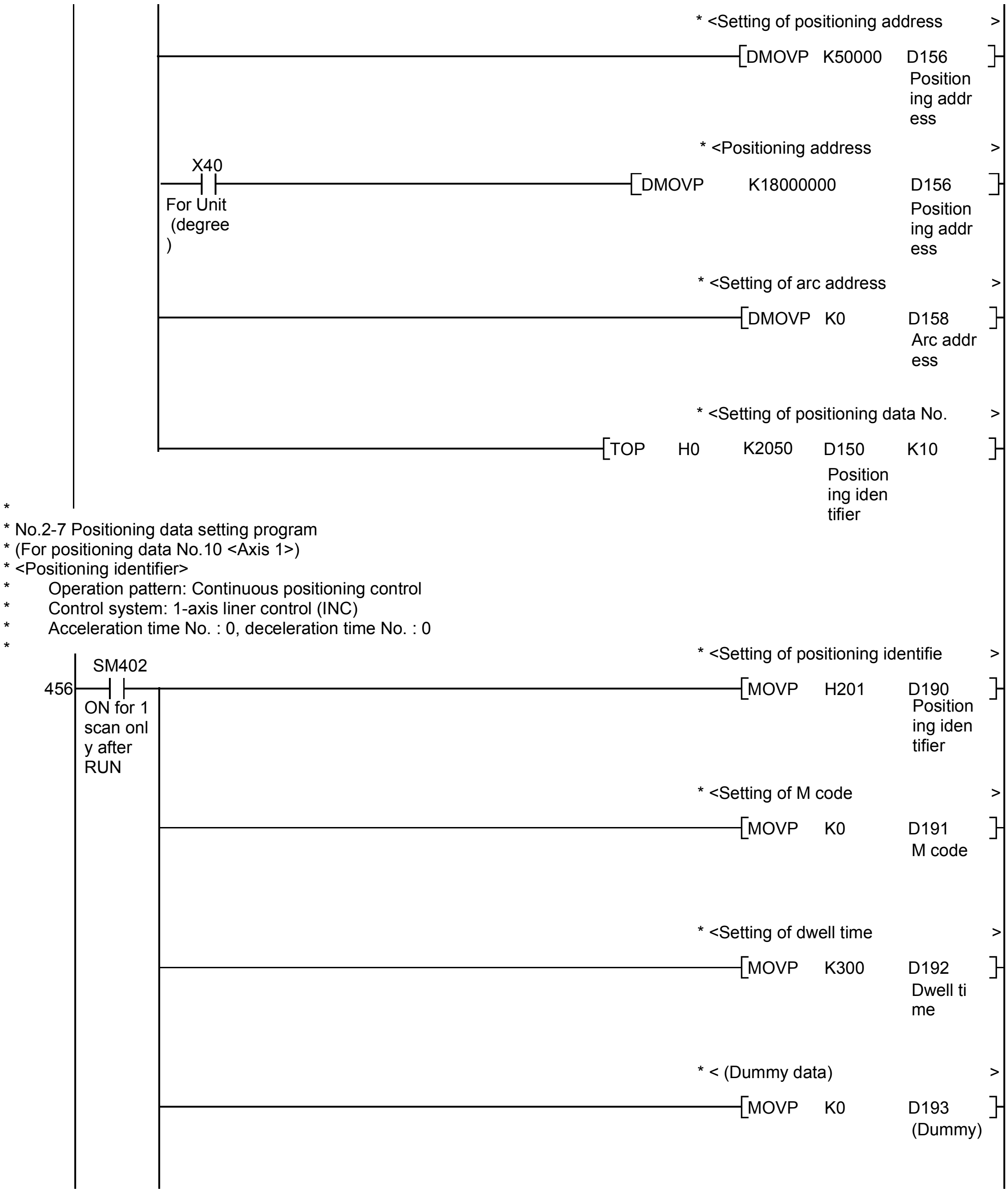
```
*
* No.2-5 Positioning data setting program
* (For positioning data No.5 <Axis 1>)
* <Positioning identifier>
*       Operation pattern: Positioning terminated
*       Control system: 1-axis liner control (INC)
*       Acceleration time No. : 0, deceleration time No. : 0
*
```



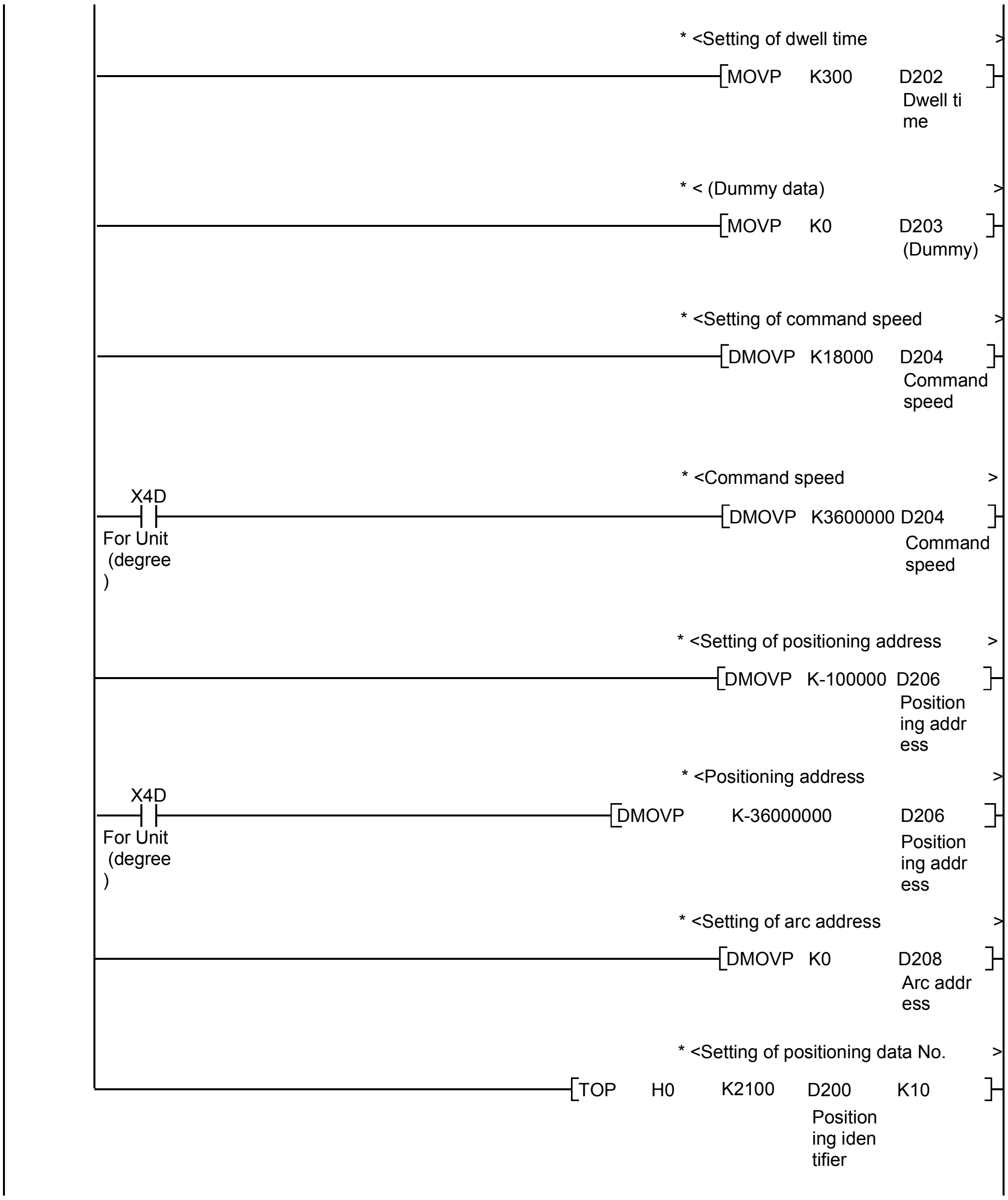
```
                                              * <Setting of positioning identifie    >
     SM402
350--| |--+--------------------------------[MOVP    H201       D140      ]
  ON for 1 |                                                    Position
  scan onl |                                                    ing iden
  y after  |                                                    tifier
  RUN      |
           |                                  * <Setting of M code                 >
           +--------------------------------[MOVP    K0         D141      ]
           |                                                    M code
           |
           |                                  * <Setting of dwell time              >
           +--------------------------------[MOVP    K300       D142      ]
           |                                                    Dwell ti
           |                                                    me
           |
           |                                  * < (Dummy)                           >
           +--------------------------------[MOVP    K0         D143      ]
           |                                                    (Dummy)
           |
           |                                  * <Setting of command speed           >
           +--------------------------------[DMOVP   K36000     D144      ]
           |                                                    Command
           |                                                    speed
           |
           |                                  * <Command speed                      >
           |   X4D
           +---| |--------------------------[DMOVP   K6000000   D144      ]
           |  For Unit                                          Command
           |   (degree                                          speed
           |  )
           |
           |                                  * <Setting of positioning address     >
           +--------------------------------[DMOVP   K100000    D146      ]
           |                                                    Position
           |                                                    ing addr
           |                                                    ess
           |                                  * <Positioning address                >
           |   X4D
           +---| |-------------------[DMOVP        K36000000        D146      ]
           |  For Unit                                          Position
           |   (degree                                          ing addr
           |  )                                                 ess
```



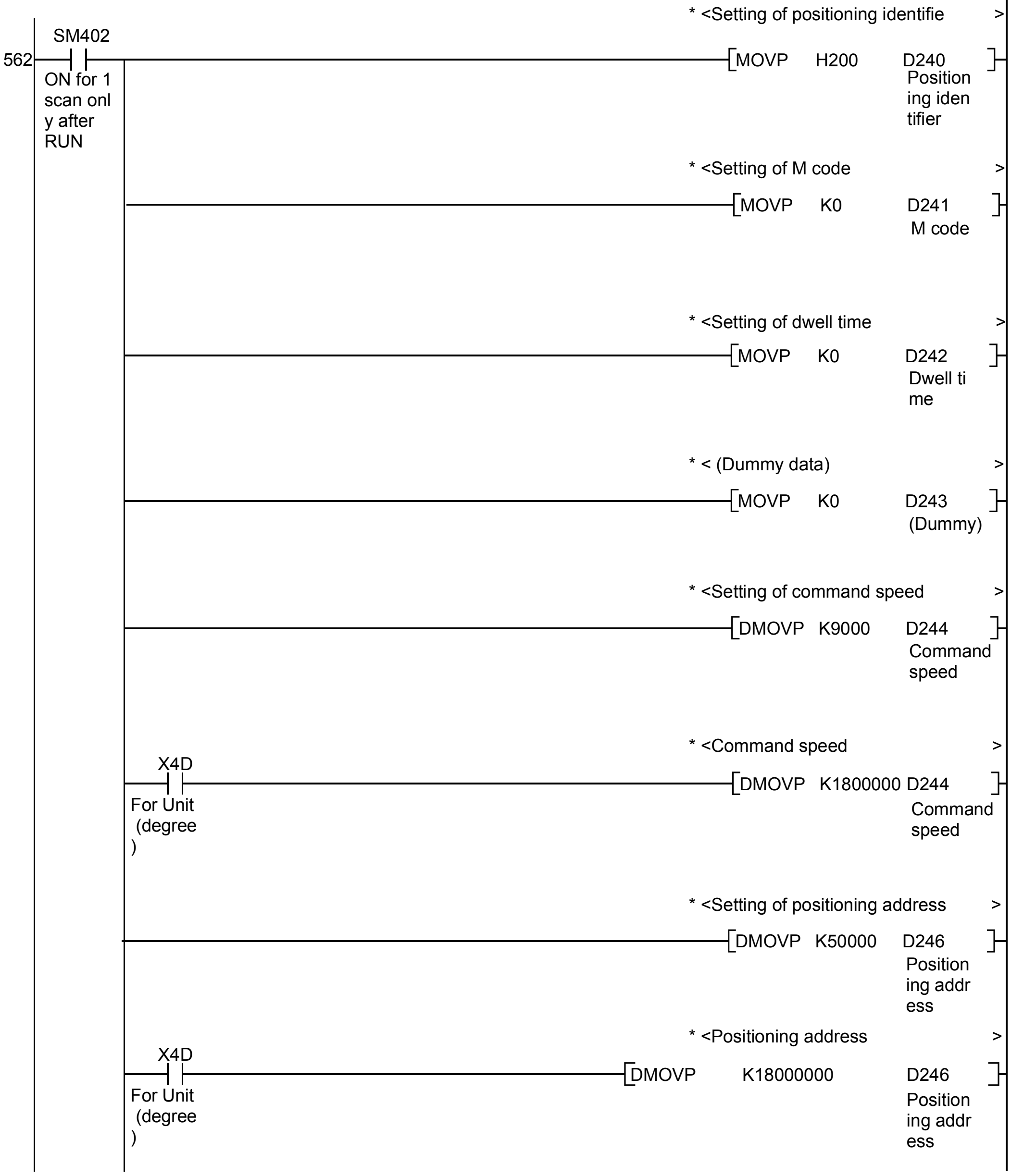
```
                                     * <Setting of arc address                >
                                      [DMOVP  K0       D148           ]
                                                       Arc addr
                                                       ess

                                     * <Setting of positioning data No.       >
                          [TOP    H0     K2040    D140     K10        ]
                                                  Position
*                                                 ing iden
* No.2-6 Positioning data setting program         tifier
* (For positioning data No.6 <Axis 1>)
* <Positioning identifier>
*       Operation pattern: Positioning terminated
*       Control system: 1-axis liner control (INC)
*       Acceleration time No. : 0, deceleration time No. : 0
*
                                     * <Setting of positioning identifie      >
     SM402
403--| |-----------------------------[MOVP   H200     D150           ]
     ON for 1                                          Position
     scan onl                                          ing iden
     y after                                           tifier
     RUN
                                     * <Setting of M code                     >
                                     [MOVP   K0       D151            ]
                                                       M code

                                     * <Setting of dwell time                 >
                                     [MOVP   K300     D152            ]
                                                       Dwell ti
                                                       me

                                     * < (Dummy data)                         >
                                     [MOVP   K0       D153            ]
                                                       (Dummy)

                                     * <Setting of command speed              >
                                     [DMOVP  K9000    D154            ]
                                                       Command
                                                       speed

                                     * <Command speed                         >
          X4D
        --| |------------------------[DMOVP  K1800000 D154            ]
        For Unit                                       Command
         (degree                                       speed
        )
```


* <Setting of positioning address >
DMOVP K50000 D156
Positioning address
* <Positioning address >
X40
For Unit (degree)
DMOVP K18000000 D156
Positioning address
* <Setting of arc address >
DMOVP K0 D158
Arc address
* <Setting of positioning data No. >
TOP H0 K2050 D150 K10
Positioning identifier
*
* No.2-7 Positioning data setting program
* (For positioning data No.10 <Axis 1>)
* <Positioning identifier>
* Operation pattern: Continuous positioning control
* Control system: 1-axis liner control (INC)
* Acceleration time No. : 0, deceleration time No. : 0
*
* <Setting of positioning identifie >
SM402
456
ON for 1 scan only after RUN
MOVP H201 D190
Positioning identifier
* <Setting of M code >
MOVP K0 D191
M code
* <Setting of dwell time >
MOVP K300 D192
Dwell time
* < (Dummy data) >
MOVP K0 D193
(Dummy)

```
                                              * <Setting of command speed          >
        |--------------------------------------[DMOVP  K18000    D194        ]
                                                                 Command
                                                                 speed

                                              * <Command speed                     >
        |  X4D
        |--| |---------------------------------[DMOVP  K3600000  D194        ]
        | For Unit                                               Command
        |  (degree                                               speed
        | )

                                              * <Setting of positioning address    >
        |--------------------------------------[DMOVP  K10000    D196        ]
                                                                 Position
                                                                 ing addr
                                                                 ess
                                              * <Positioning address               >
        |  X4D
        |--| |-----------------------------[DMOVP     K36000000  D196        ]
        | For Unit                                               Position
        |  (degree                                               ing addr
        | )                                                      ess
                                              * <Setting of arc address            >
        |--------------------------------------[DMOVP  K0        D198        ]
                                                                 Arc addr
                                                                 ess
                                              * <Setting of positioning data No.   >
        |------------------------------[TOP    H0     K2090   D190     K10   ]
                                                              Position
                                                              ing iden
                                                              tifier
*
* No.2-8 Positioning data setting program
* (For positioning data No.11 <Axis 1>)
* <Positioning identifier>
*       Operation pattern: Positioning terminated
*       Control system: 1-axis liner control (INC)
*       Acceleration time No. : 0, deceleration time No. : 0
*
                                              * <Setting of positioning identifie  >
      SM402
509 --| |---+----------------------------------[MOVP   H200      D200        ]
   ON for 1 |                                                    Position
   scan onl |                                                    ing iden
   y after  |                                                    tifier
   RUN      |
            |                                 * <Setting of M code                 >
            +----------------------------------[MOVP   K0        D201        ]
            |                                                    M code
```


* <Setting of dwell time >
MOVP K300 D202
Dwell time
* < (Dummy data) >
MOVP K0 D203
(Dummy)
* <Setting of command speed >
DMOVP K18000 D204
Command speed
* <Command speed >
X4D
For Unit (degree)
DMOVP K3600000 D204
Command speed
* <Setting of positioning address >
DMOVP K-100000 D206
Positioning address
* <Positioning address >
X4D
For Unit (degree)
DMOVP K-36000000 D206
Positioning address
* <Setting of arc address >
DMOVP K0 D208
Arc address
* <Setting of positioning data No. >
TOP H0 K2100 D200 K10
Positioning identifier

```
*
* No.2-9 Positioning data setting program
* (For positioning data No.15 <Axis 1>)
* <Positioning identifier>
*       Operation pattern: Positioning terminated
*       Control system: 1-axis liner control (INC)
*       Acceleration time No. : 0, deceleration time No. : 0
*
```

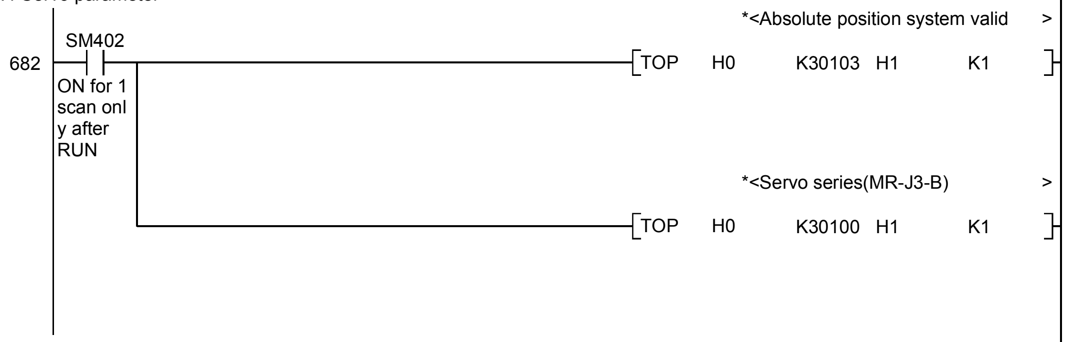


```
                                          * <Setting of positioning identifie        >
     SM402
562--| |----------------------------------[MOVP    H200       D240      ]
     ON for 1                                                  Position
     scan onl                                                  ing iden
     y after                                                   tifier
     RUN
                                          * <Setting of M code                       >
          --------------------------------[MOVP    K0         D241      ]
                                                               M code

                                          * <Setting of dwell time                   >
          --------------------------------[MOVP    K0         D242      ]
                                                               Dwell ti
                                                               me

                                          * < (Dummy data)                           >
          --------------------------------[MOVP    K0         D243      ]
                                                               (Dummy)

                                          * <Setting of command speed                >
          --------------------------------[DMOVP   K9000      D244      ]
                                                               Command
                                                               speed

                                          * <Command speed                           >
           X4D
          --| |---------------------------[DMOVP   K1800000   D244      ]
          For Unit                                             Command
           (degree                                             speed
          )
                                          * <Setting of positioning address          >
          --------------------------------[DMOVP   K50000     D246      ]
                                                               Position
                                                               ing addr
                                                               ess
                                          * <Positioning address                     >
           X4D
          --| |-----------------------[DMOVP       K18000000      D246      ]
          For Unit                                             Position
           (degree                                             ing addr
          )                                                    ess
```

```
                                                  * <Setting of arc address                    >
         |                                        [DMOVP  K0            D248              ]
         |                                                              Arc addr
         |                                                              ess

                                                  * <Setting of positioning data No.           >
         |                               [TOP     H0      K2140   D240      K10           ]
                                                                  Position
*                                                                 ing iden
* No.3 Block start data setting program                           tifier
*       Block start data of start block 0 (Axis1)
*       For setting of points 1 to 5
*          (Conditions)
*              Shape: Continued at points 1 to 4, ended at points 5
*              Special start instruction: Normal start (Points 1 to 5)
*              <Positioning data are already preset>
*
*
*
*          <Setting of shape and start data No.>
*
*
                                                  * <Continuous, setting of start dat          >
        SM402
    615 --| |--+----------------------------------[MOVP   H8001    D68                    ]
        ON for 1                                                   Point 1
        scan onl
        y after
        RUN
                                                  * <Continuous, setting of start dat          >
               +----------------------------------[MOVP   H8004    D69                    ]
                                                                   Point 2

                                                  * <Continuous, setting of start dat          >
               +----------------------------------[MOVP   H8005    D70                    ]
                                                                   Point 3

                                                  * <Continuous, setting of start dat          >
               +----------------------------------[MOVP   H800A    D71                    ]
                                                                   Point 4

                                                  * <End. setting of start data No. 15         >
               +----------------------------------[MOVP   H0F      D72                    ]
                                                                   Point 5
```

```
                                                     *<Setting block start data to QD77    >
     |         |
     |         +---------------------------[TOP    H0       K26000  D68        K5     ]-|
     |                                                              Point 1             |
     |                                                                                  |
*
*<Special start instruction to normal start          >
*
     |                                               *<Setting of normal start          >
     | SM402                                                                            |
 651 |--| |---+------------------------------------------[MOVP   H0         D73    ]-|
     |ON for 1 |                                                           Point 1      |
     |scan onl |                                                                        |
     |y after  |                                                                        |
     |RUN      |                                     *<Setting of normal start          >
     |         +------------------------------------------[MOVP   H0         D74    ]-|
     |         |                                                           Point 2      |
     |         |                                                                        |
     |         |                                     *<Setting of normal start          >
     |         +------------------------------------------[MOVP   H0         D75    ]-|
     |         |                                                           Point 3      |
     |         |                                                                        |
     |         |                                     *<Setting of normal start          >
     |         +------------------------------------------[MOVP   H0         D76    ]-|
     |         |                                                           Point 4      |
     |         |                                                                        |
     |         |                                     *<Setting of normal start          >
     |         +------------------------------------------[MOVP   H0         D77    ]-|
     |         |                                                           Point 5      |
     |         |                                                                        |
     |         |                                     *<Setting block start data to QD77    >
     |         +---------------------------[TOP    H0       K26050  D73        K5     ]-|
     |                                                              Point 1             |
     |                                                                                  |
```

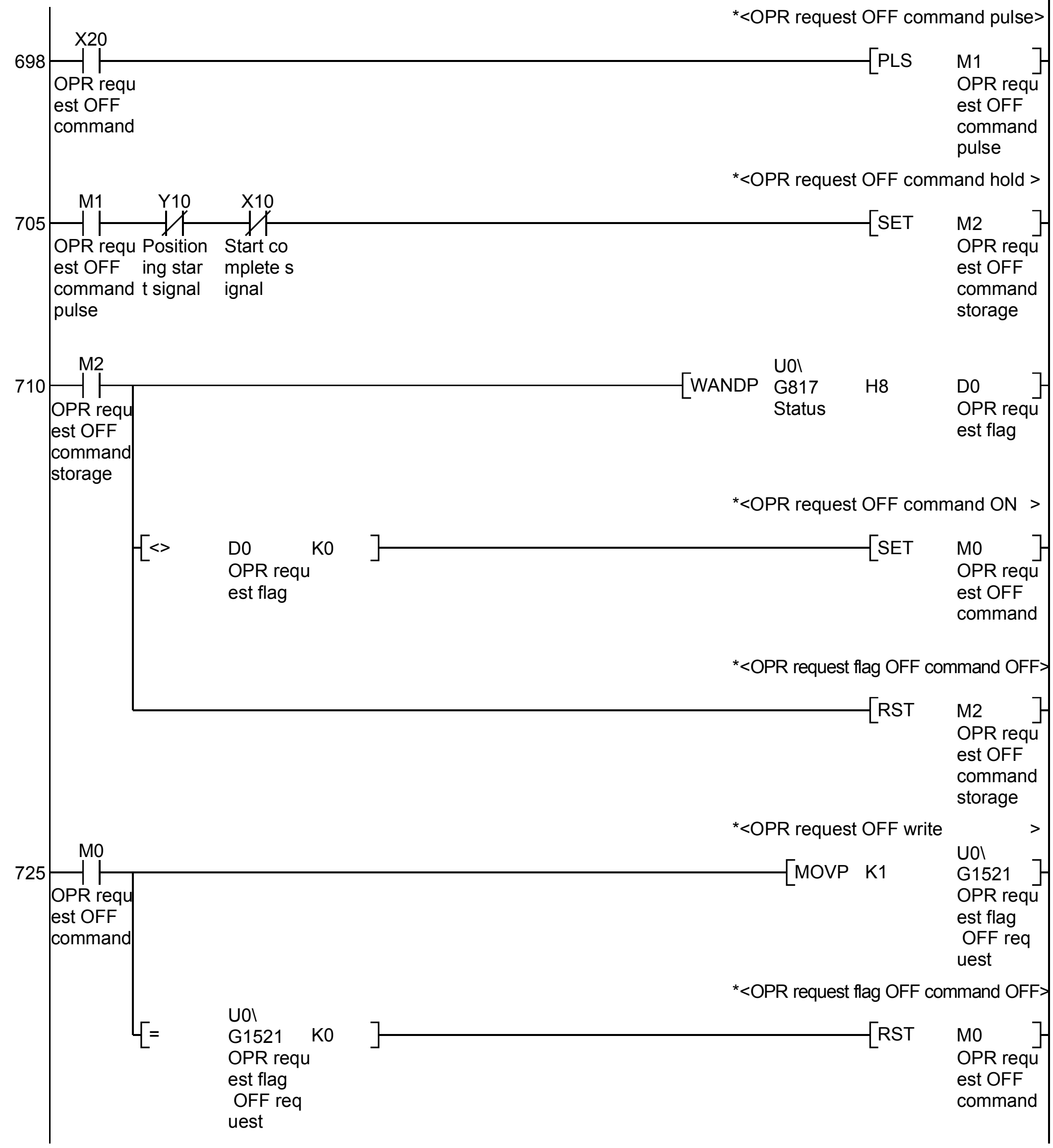
*No.4 Servo parameter

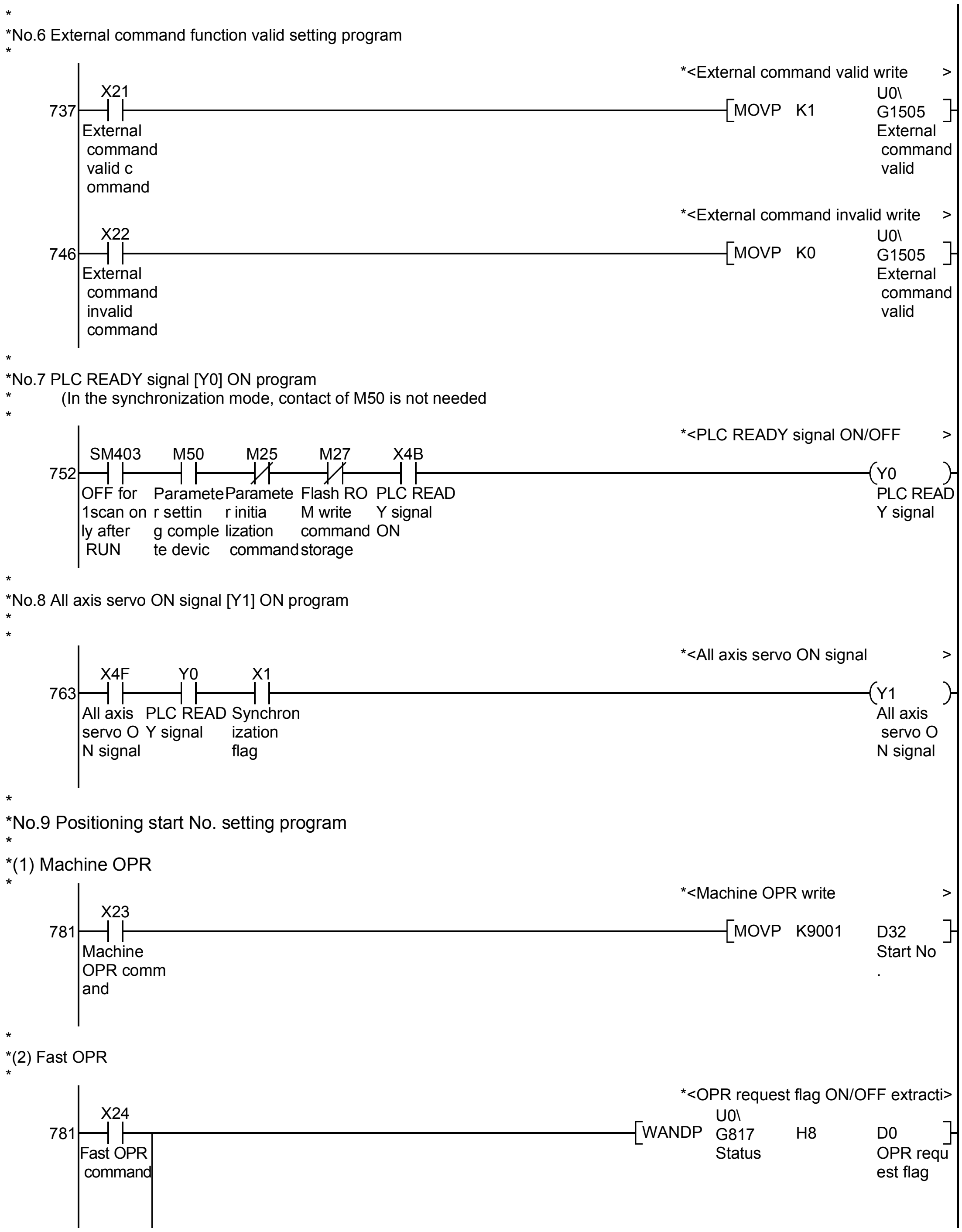


*

*No.5 OPR request OFF program

*

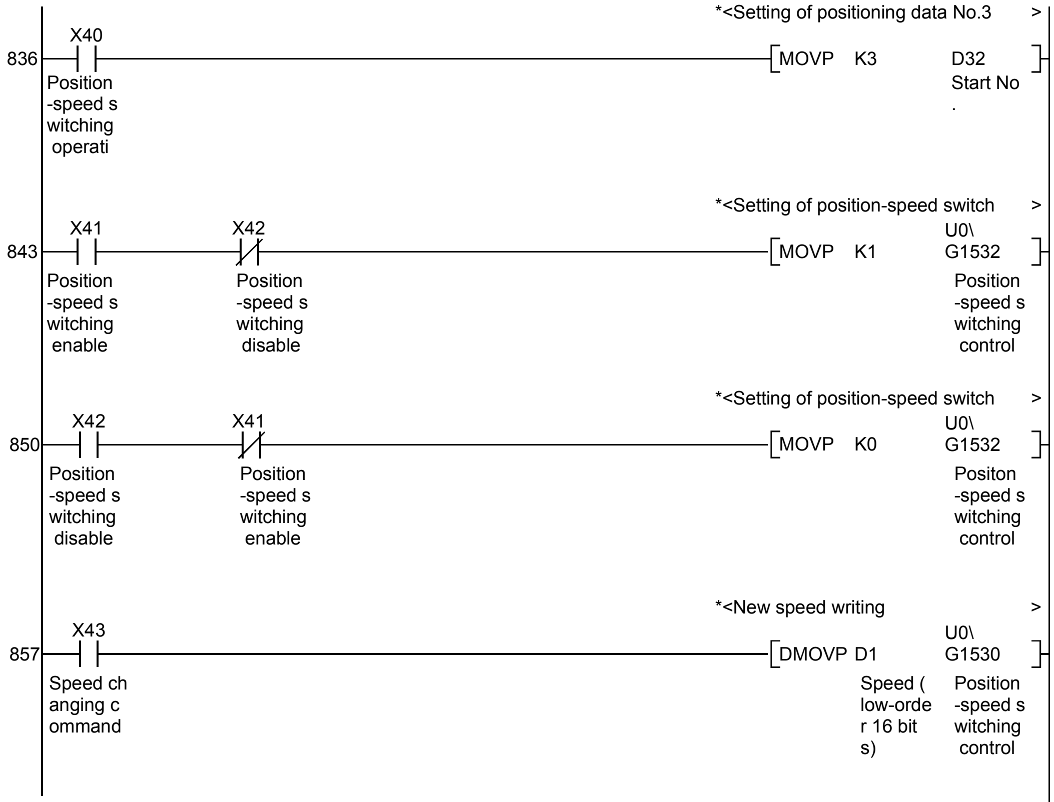




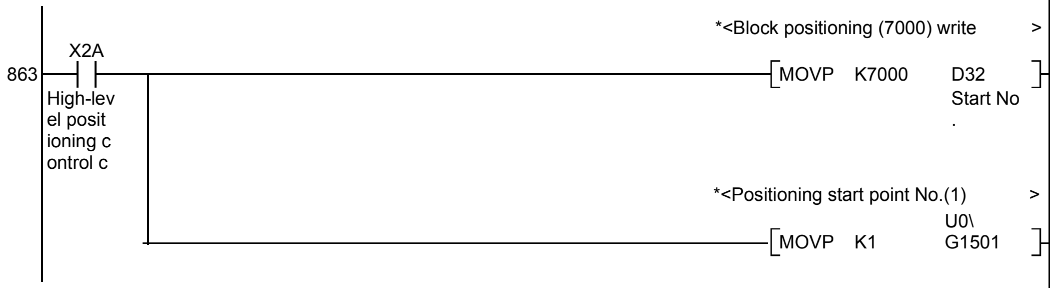
```
*
*No.6 External command function valid setting program
*
                                                   *<External command valid write   >
     X21                                                                U0\
737 -| |-------------------------------------------[MOVP  K1            G1505  ]
    External                                                            External
     command                                                             command
     valid c                                                             valid
     ommand
                                                   *<External command invalid write >
     X22                                                                U0\
746 -| |-------------------------------------------[MOVP  K0            G1505  ]
    External                                                            External
     command                                                             command
     invalid                                                             valid
     command
*
*No.7 PLC READY signal [Y0] ON program
*        (In the synchronization mode, contact of M50 is not needed
*
                                                   *<PLC READY signal ON/OFF        >
     SM403     M50       M25       M27       X4B
752 -| |------| |-------|/|-------|/|-------| |----------------------------(Y0      )
    OFF for   Paramete Paramete  Flash RO  PLC READ                       PLC READ
    1scan on  r settin r initia  M write   Y signal                       Y signal
    ly after  g comple lization  command   ON
     RUN      te devic command   storage
*
*No.8 All axis servo ON signal [Y1] ON program
*
*
                                                   *<All axis servo ON signal       >
     X4F       Y0        X1
763 -| |------| |-------| |-----------------------------------------------(Y1      )
    All axis  PLC READ Synchron                                           All axis
    servo O   Y signal ization                                             servo O
    N signal           flag                                               N signal
*
*No.9 Positioning start No. setting program
*
*(1) Machine OPR
*
                                                   *<Machine OPR write              >
     X23
781 -| |-------------------------------------------[MOVP  K9001         D32    ]
    Machine                                                               Start No
    OPR comm                                                              .
    and
*
*(2) Fast OPR
*
                                                   *<OPR request flag ON/OFF extracti>
     X24                                          U0\
781 -| |----------------------------------[WANDP  G817      H8          D0     ]
    Fast OPR                                      Status                  OPR requ
     command                                                              est flag
```

```
                                                    *<Fast OPR start enable        >
        [=    D0        K0   ]----------------------[SET   M3          ]
              OPR requ                                     Fast OPR
              est flag                                     signal

                                                    *<Fast OPR write               >
        ------------------------------------[MOVP  K9002    D32        ]
                                                            Start No
                                                            .

                                                    *<Fast OPR command hold        >
        ----------------------------------------[SET   M4          ]
                                                       Fast OPR
                                                       command
                                                       hold
*
*  (3)  Positioning with positioning data No.1
*
                                                    *<Setting of positioning data No.1   >
      X25
803 --| |-----------------------------------[MOVP  K1       D32        ]
      Position                                              Start No
      ing star                                              .
      t comman
      d
*
*  (4)  Speed-position switching operation (Positioning data No.2)
*        (In the ABS mode, new movement amount write is not needed)
*
                                                    *<Setting of positioning data No.2   >
      X26
810 --| |-----------------------------------[MOVP  K2       D32        ]
      Speed-po                                              Start No
      sition s                                              .
      witching
       operati

                                                    *<Setting of speed-position switch   >
      X27                                                   U0\
818 --| |-----------------------------------[MOVP  K1       G1528      ]
      Speed-po                                              Speed-po
      sition s                                              sition s
      witching                                              witching
       enable                                                enable

                                                    *<Setting of speed-position switch   >
      X28                                                   U0\
824 --| |-----------------------------------[MOVP  K0       G1528      ]
      Speed-po                                              Speed-po
      sition s                                              sition s
      witching                                              witching
       disable                                               enable

                                                    *<New movement amount writing        >
      X29                                                   U0\
830 --| |-----------------------------------[DMOVP D3       G1526      ]
      Movement                                     Movement Speed-po
       amount                                       amount  sition s
      changing                                     (low-ord witching
       command                                     er 16 bi  control
```

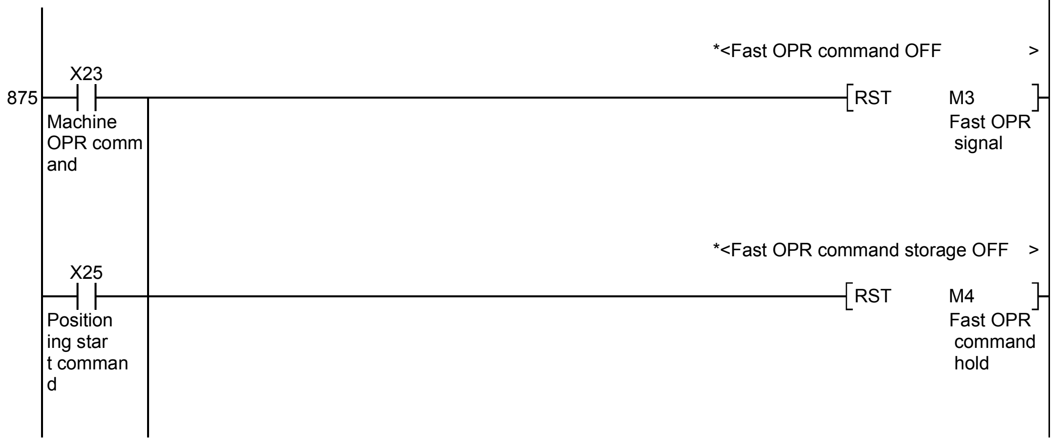
*
* (5) Position-speed switching operation (Positioning data No.3)
*

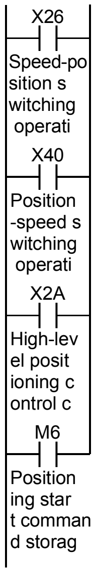


*
* (6) High-level positioning control
*



*
* (7) Fast OPR command and fast OPR command storage OFF
* (Not required when fast OPR is not used)
*





*

* No.10 Positioning start program

*

* (1) When dedicated instruction (ZP.PSTRT1) is used

* (When fast OPR is not made, contacts of M3 and M4 are not

* needed)

* (When M code is not used, contact of X04 is not needed)

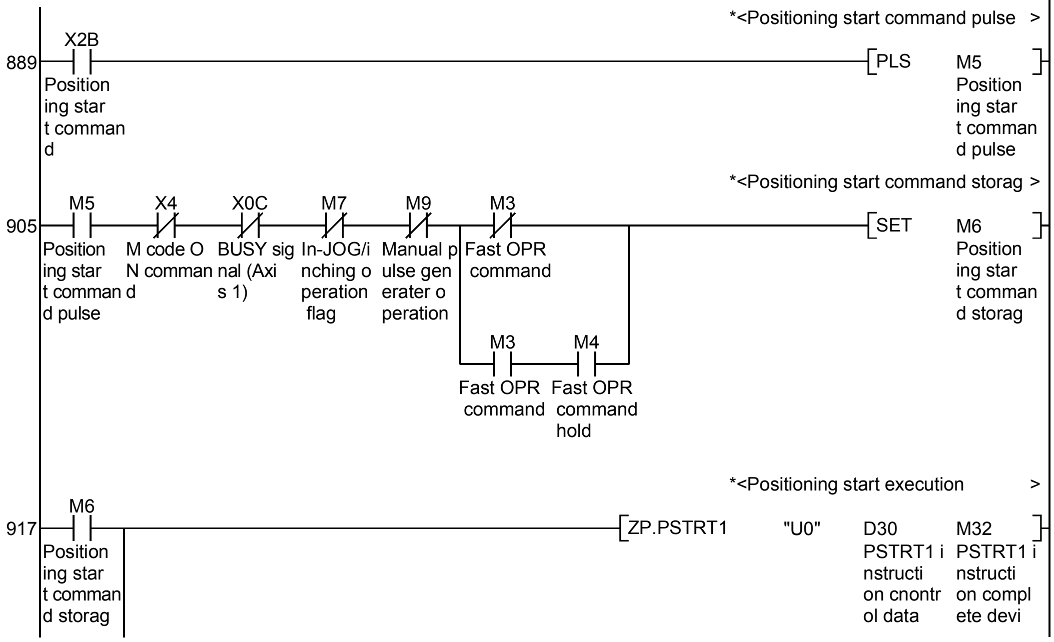
* (When JOG operation/inching operation is not performed,

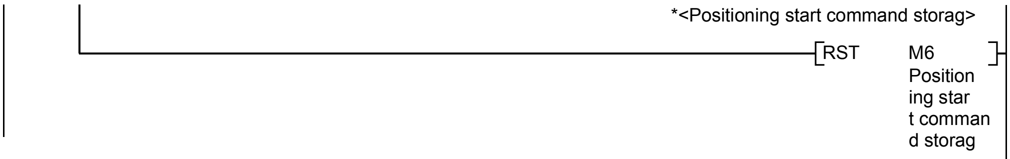
* contact of M7 is not needed)

* (When manual pulse generator is not performed, contacts of

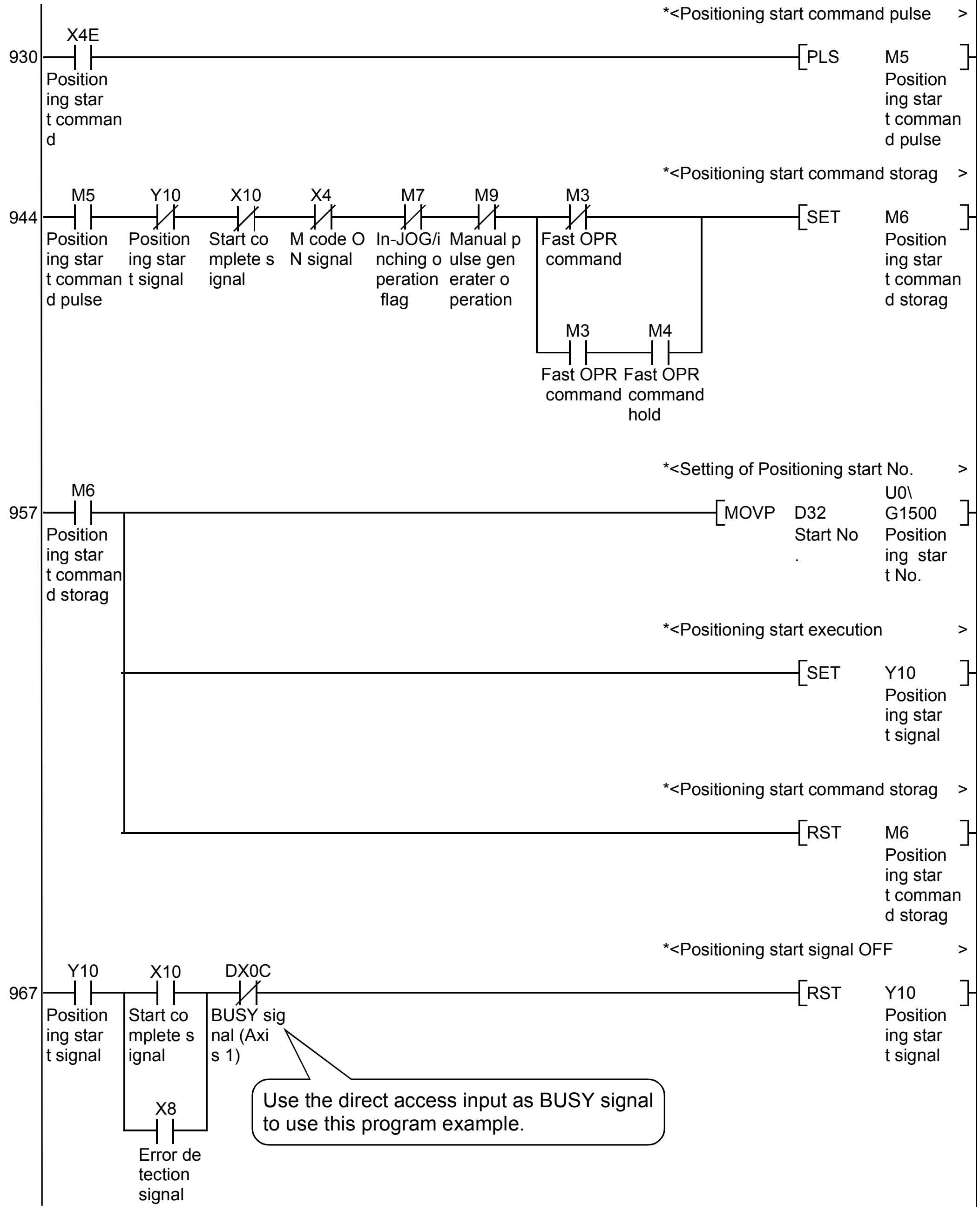
* M9 is not needed)

*





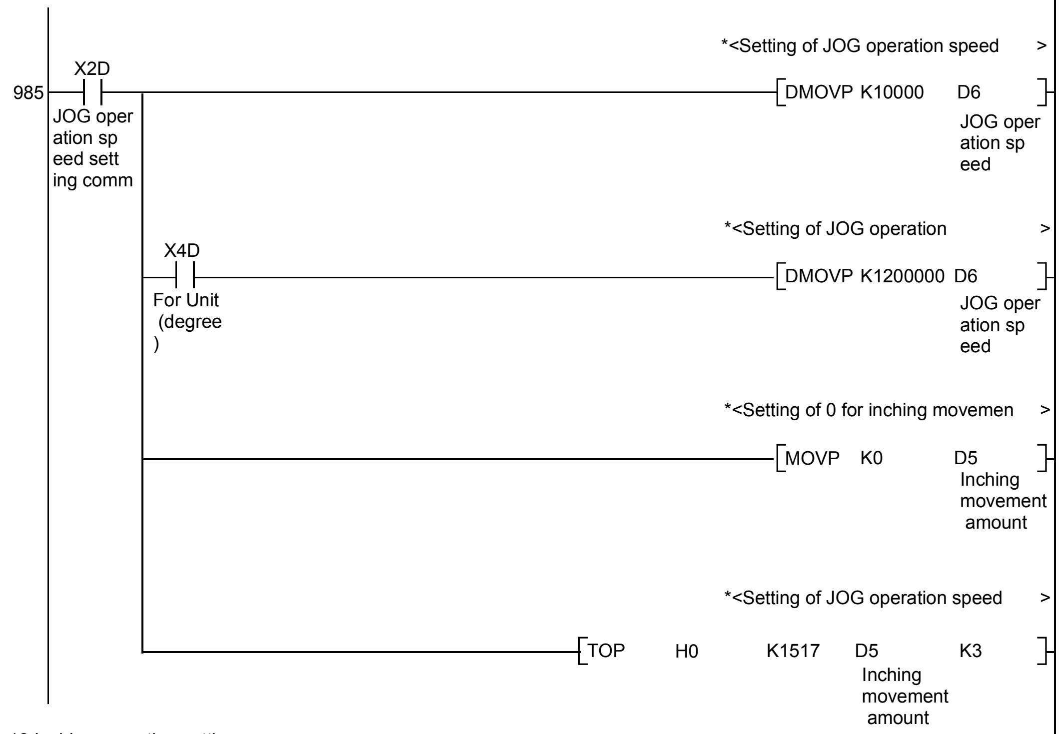
*
*(2) When positioning start signal [Y10] is used
* (When fast OPR is not made, contacts of M5 and M6 are not
* needed)
* (When M code is not used, contact of X04 is not needed)
* (When JOG operation/inching operation is not performed,
* contact of M7 is not needed)
* (When manual pulse generator is not performed, contacts of
* M9 is not needed)
*



Use the direct access input as BUSY signal to use this program example.

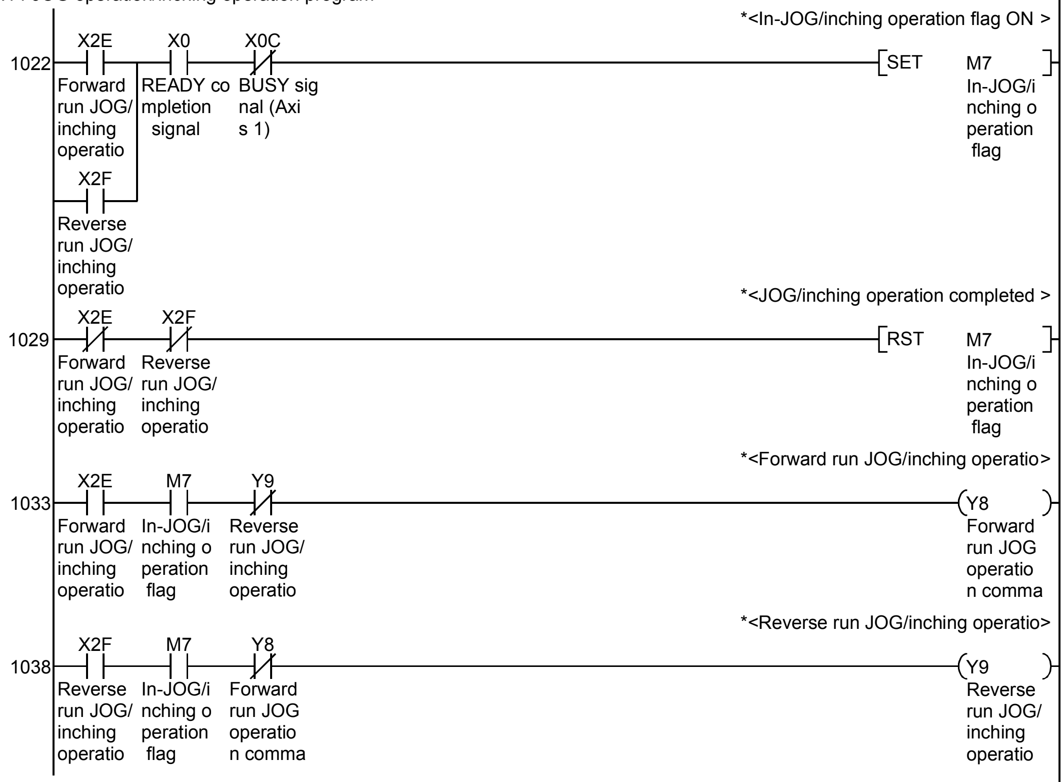
*
* No.11 M code OFF program
* (Not required when M code is not used)

*
* No.12 JOG operation/inching operation setting program
*



*
* No.13 Inching operation setting program
*

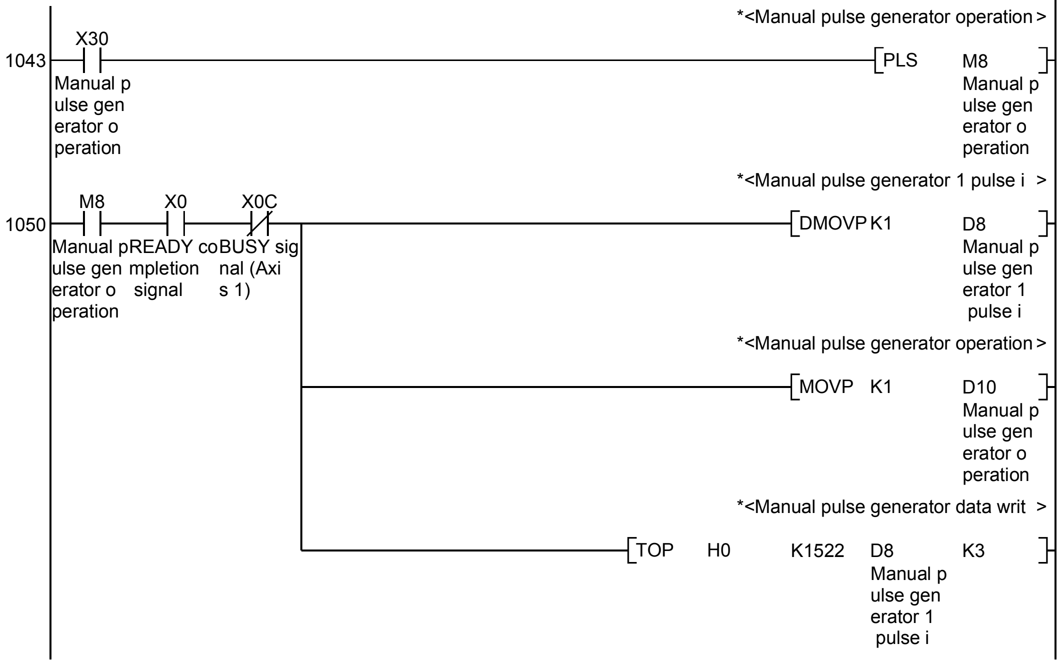
*No.14 JOG operation/inching operation program

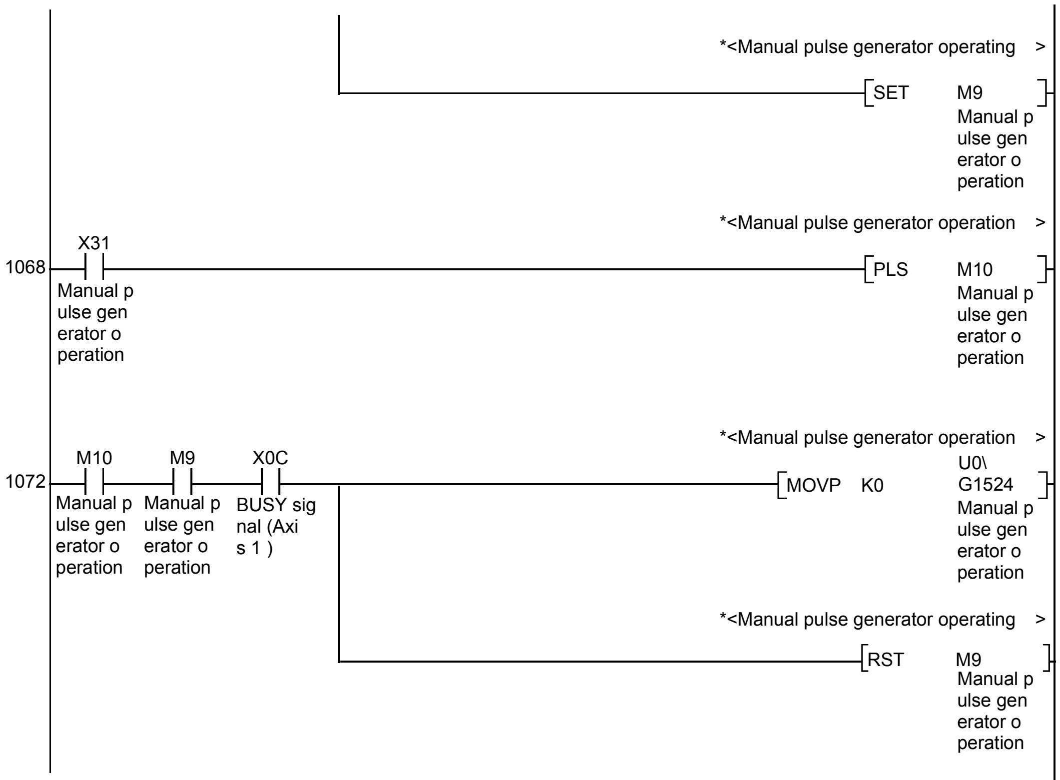


*

*No.15 Manual pulse generator operation program

*

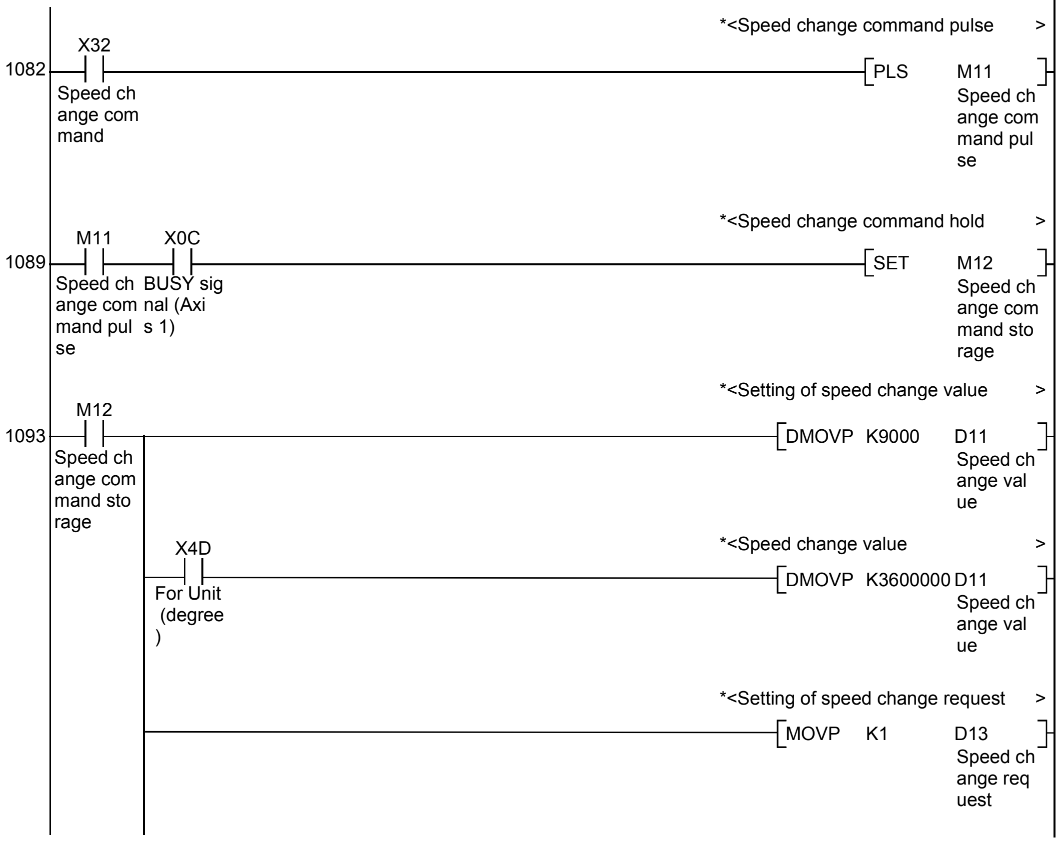


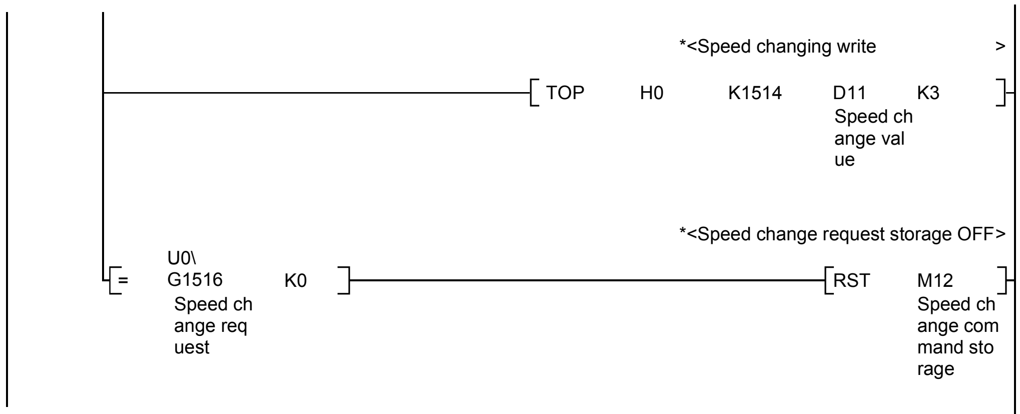


*

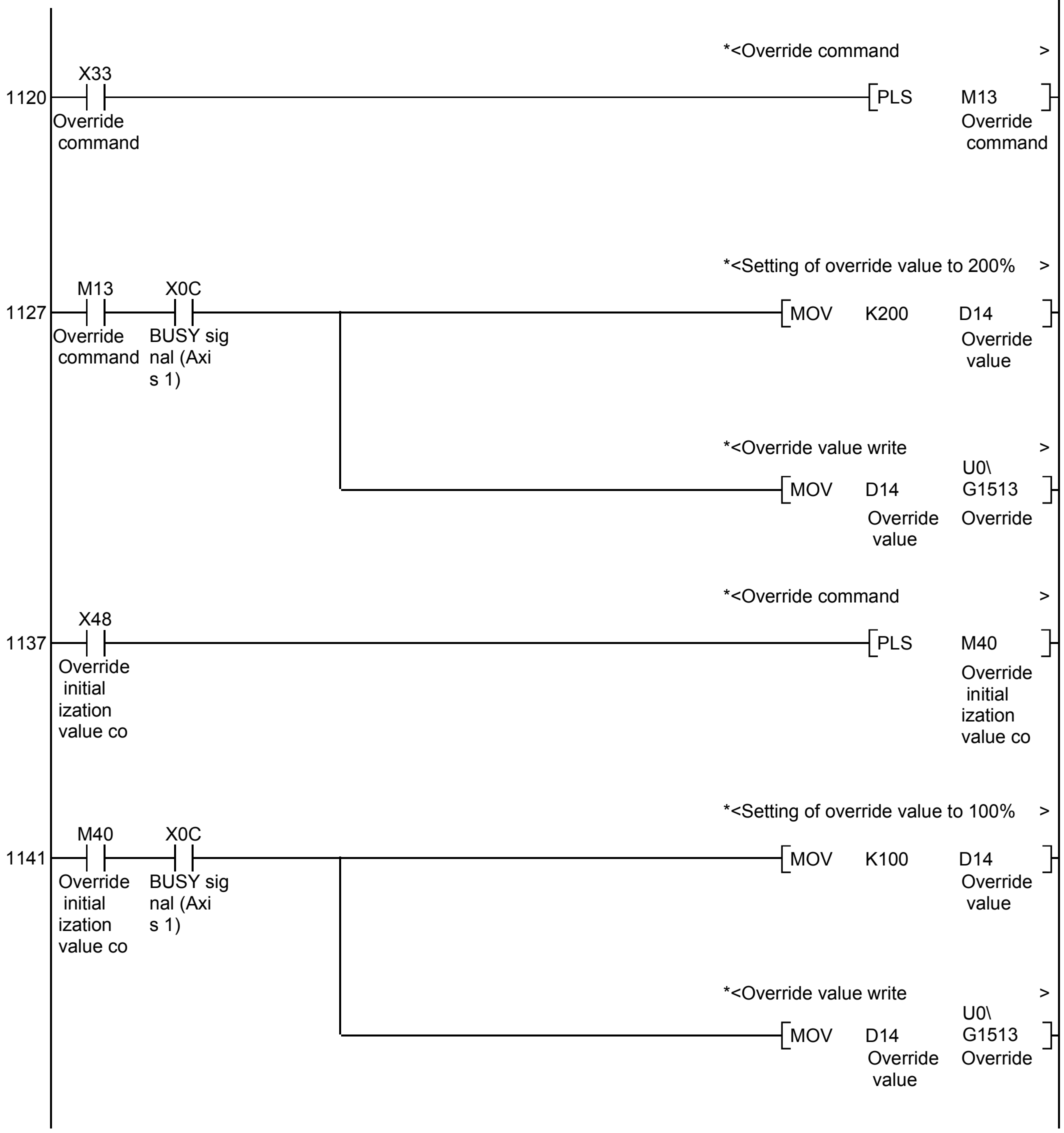
* No.16 Speed change program

*

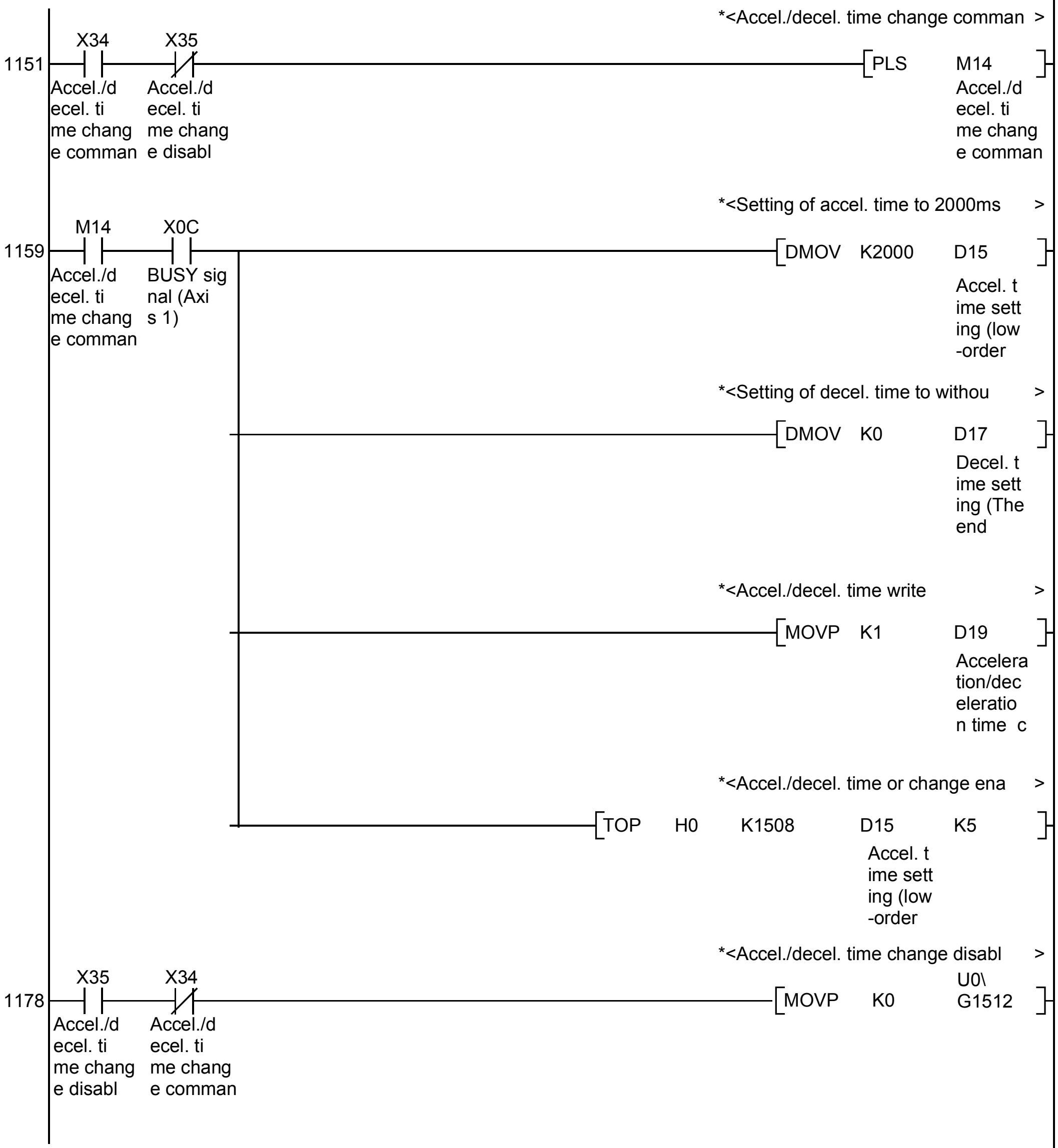




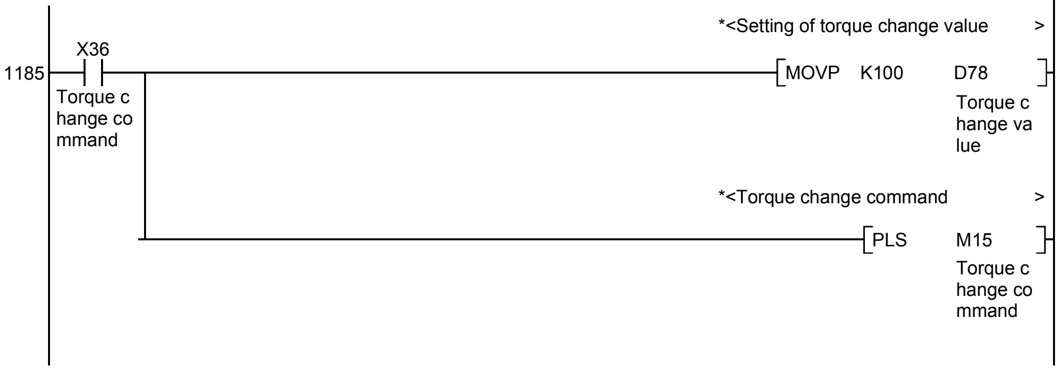
*
* No.17 Override program
*



*
* No.18 Acceleration/deceleration time change program
*

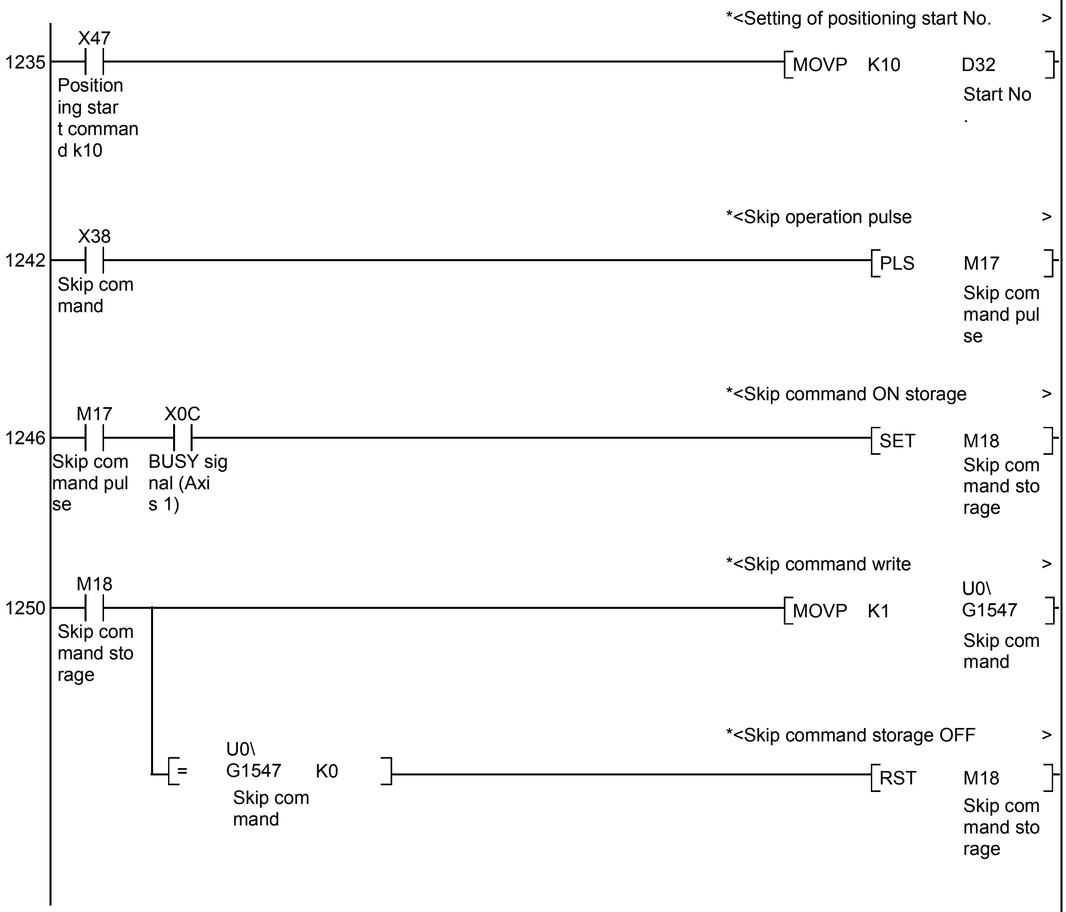


*
* No.19 Torque change program
*

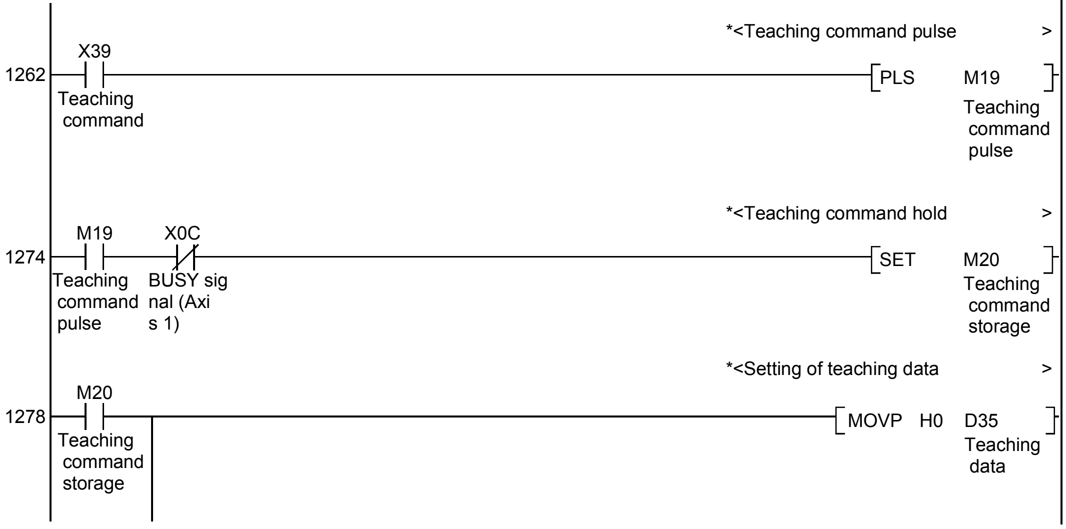


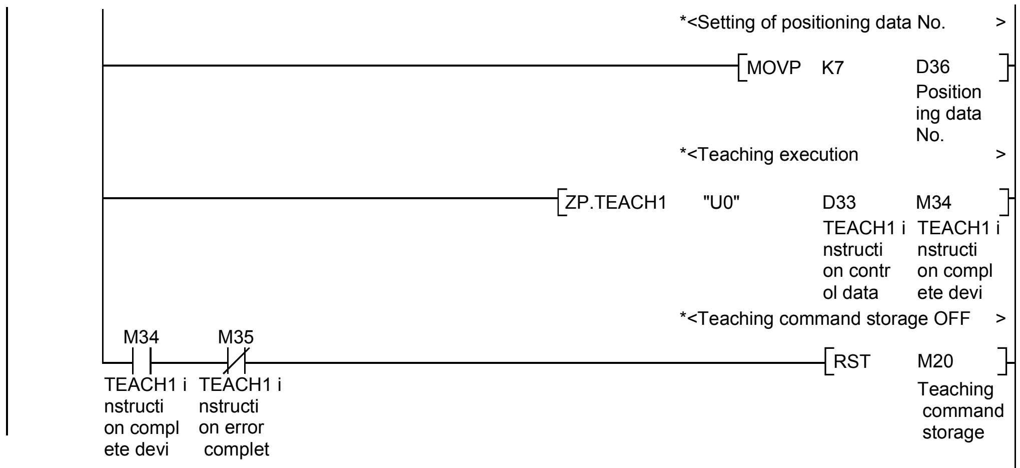
```
                                                       *<Setting of torque limit value        >
      M15      X0C                                                         U0\
1195 ─┤ ├──────┤ ├─────────────────────────────────────[MOVP   D78         G1525     ]
      Torque c BUSY sig                                        Torque c
      hange co nal (Axi                                        hange va
      mmand    s 1)                                            lue

*
*  No.20 Step operation program
*
                                                       *<Step operation command pulse         >
      X37
1202 ─┤ ├──┬───────────────────────────────────────────────────[PLS          M16       ]
      Step ope                                                               Step ope
      ration c                                                               ration c
      ommand                                                                 ommand p
           │                                                                 ulse
           │                                           *<Start program K10                     >
           └───────────────────────────────────────────[MOVP   K10         D32       ]
                                                                           Start No
                                                                           .

                                                       *<Step operation run selection         >
      M16      Y10      X10
1212 ─┤ ├──────┤/├──────┤/├──┬─────────────────────────[MOVP   K1          D20       ]
      Step ope Position Start co                                           Step mod
      ration co ing star mplete s                                          e
      mmand p  t signal ignal
      ulse                   │
                             │                         *<Data No. unit step mode selectio     >
                             ├─────────────────────────[MOVP   K1          D21       ]
                             │                                             Step val
                             │                                             id flag
                             │
                             │                         *<Step start information               >
                             ├─────────────────────────[MOVP   K1          D22       ]
                             │                                             Step sta
                             │                                             rt infor
                             │                                             mation
                             │
                             │                         *<Step operation command write         >
                             │                                              U0\
                             └─────────────────────────[DMOVP  D20          G1544    ]
                                                               Step mod     Step mod
                                                               e            e

                                                       *<To next positioning data             >
      X46                                                                  U0\
1229 ─┤ ├──────────────────────────────────────────────[MOVP   D22         G1546     ]
      Step sta                                                 Step sta
      rt infor                                                 rt infor
      mation c                                                 mation
      ommand
```

*
* No.21 Skip operation program
*



*
* No.22 Teaching program
*
*
* ▪ A location to the target position is executed by manual operation
*
*

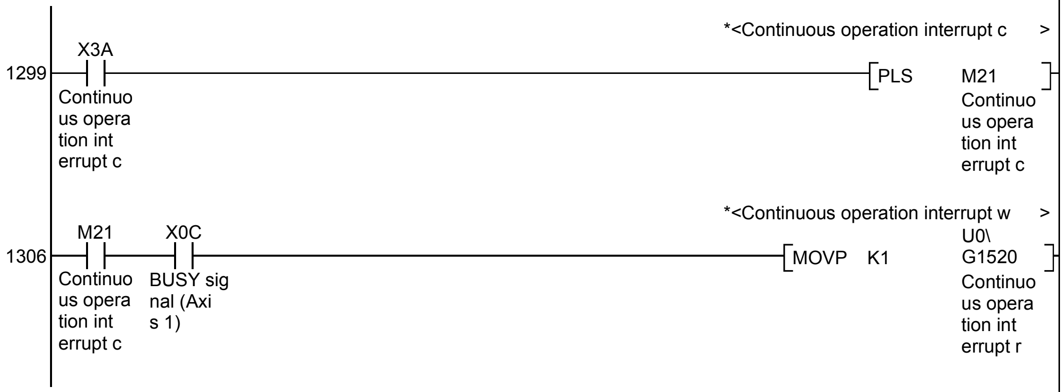




*

* No. 23 Continuous operation interrupt program

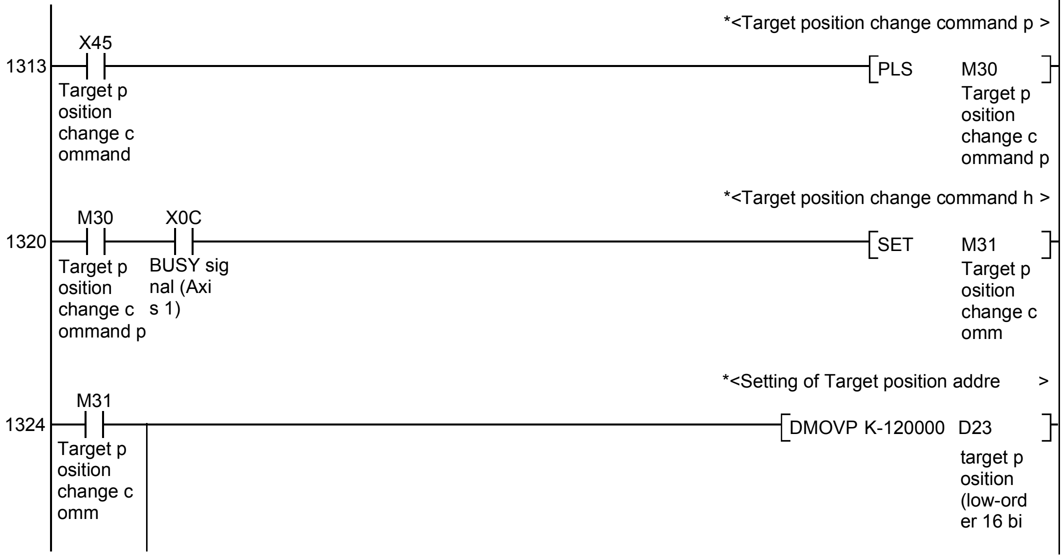
*

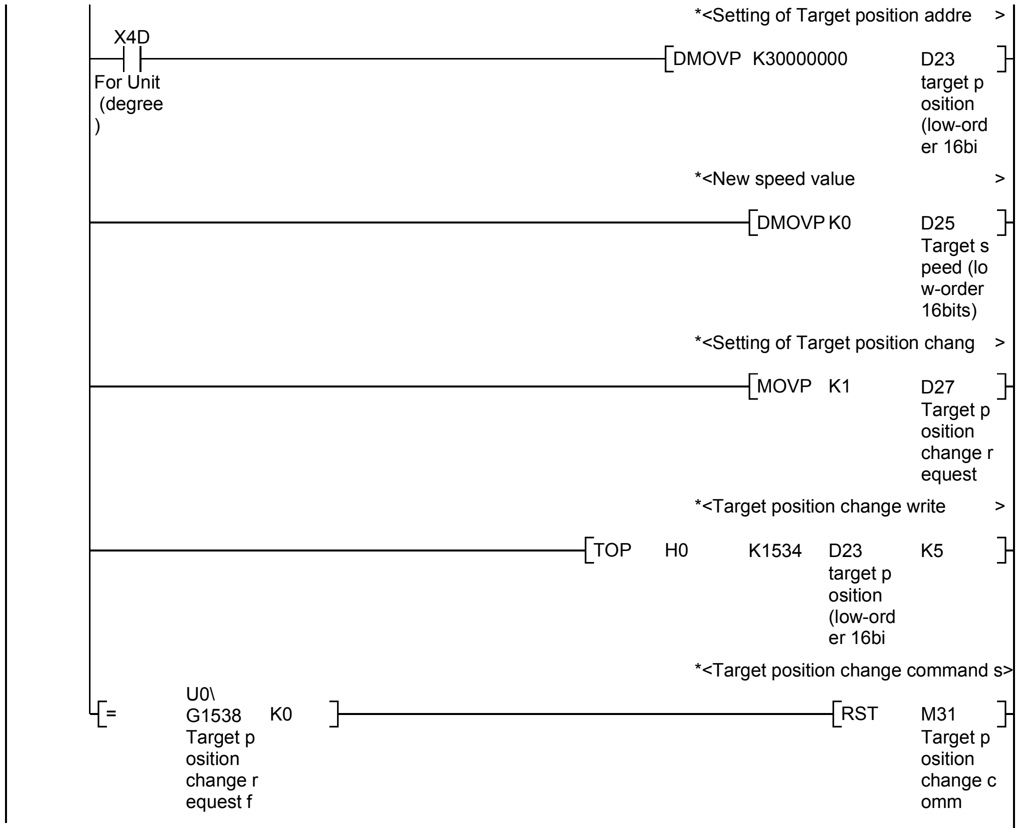


*

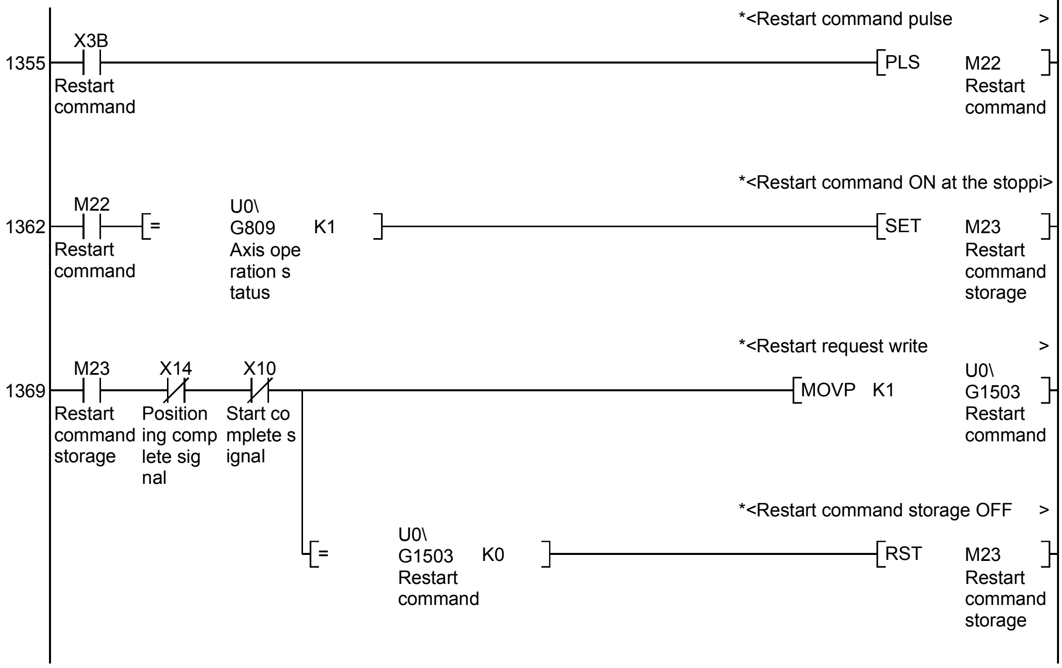
* No. 24 Target position change program

*

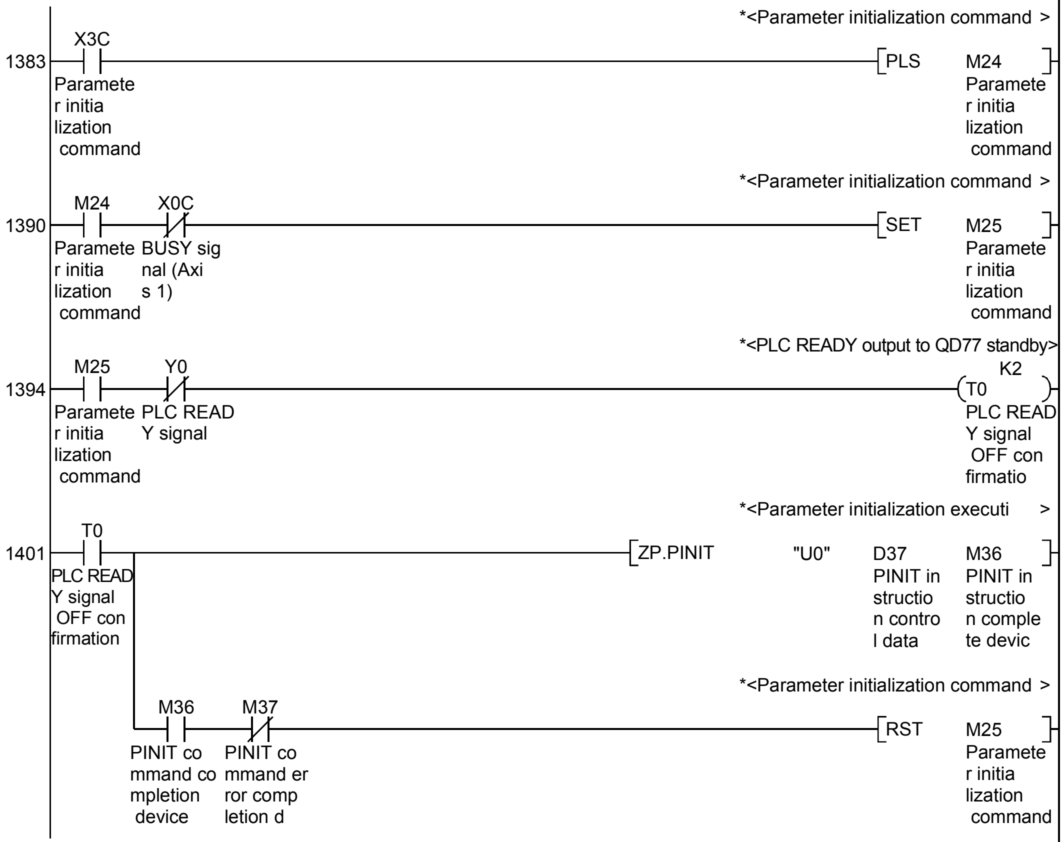




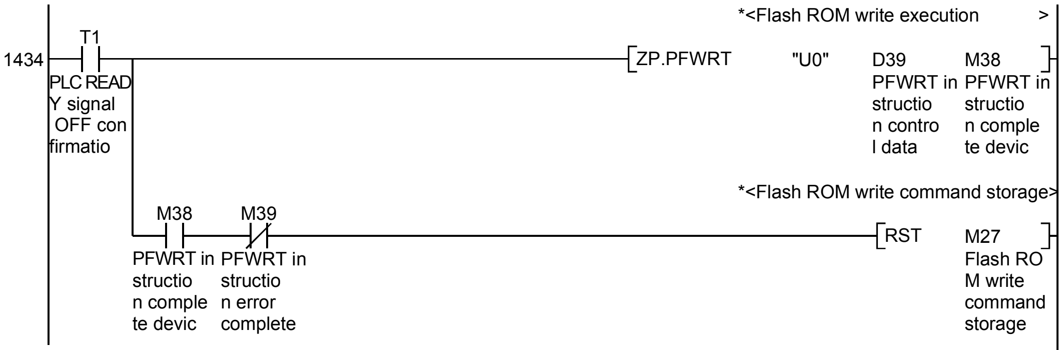
*
*No.25 Restart program
*



*
*No.26 Parameter initialization program
*



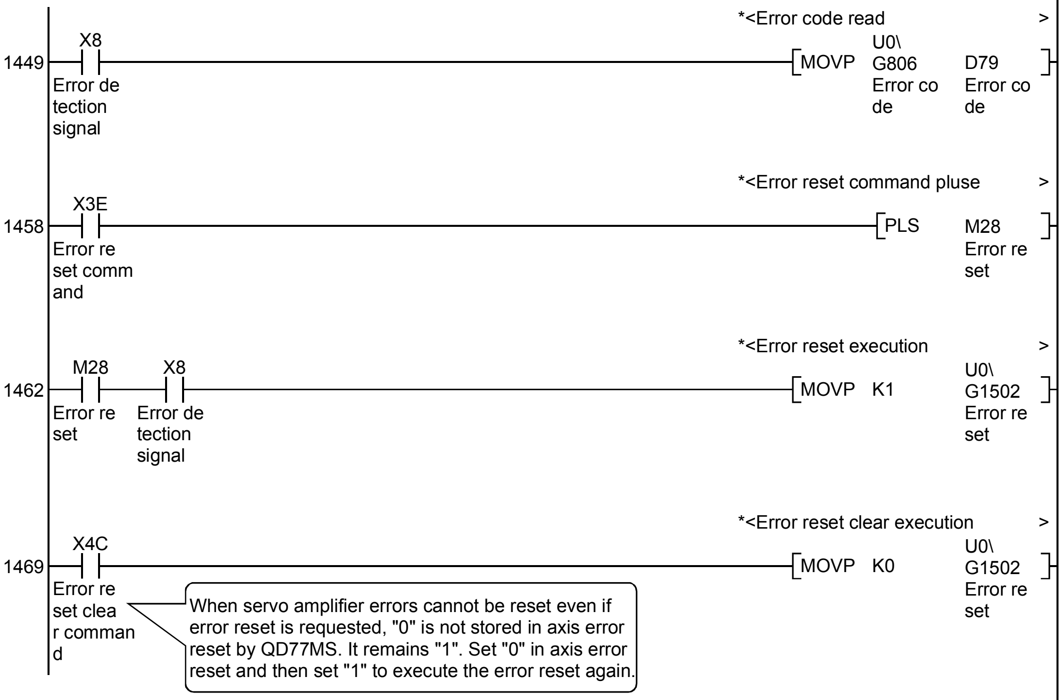
*
*No.27 Flash ROM write program
*



*

*No.28 Error reset program

*

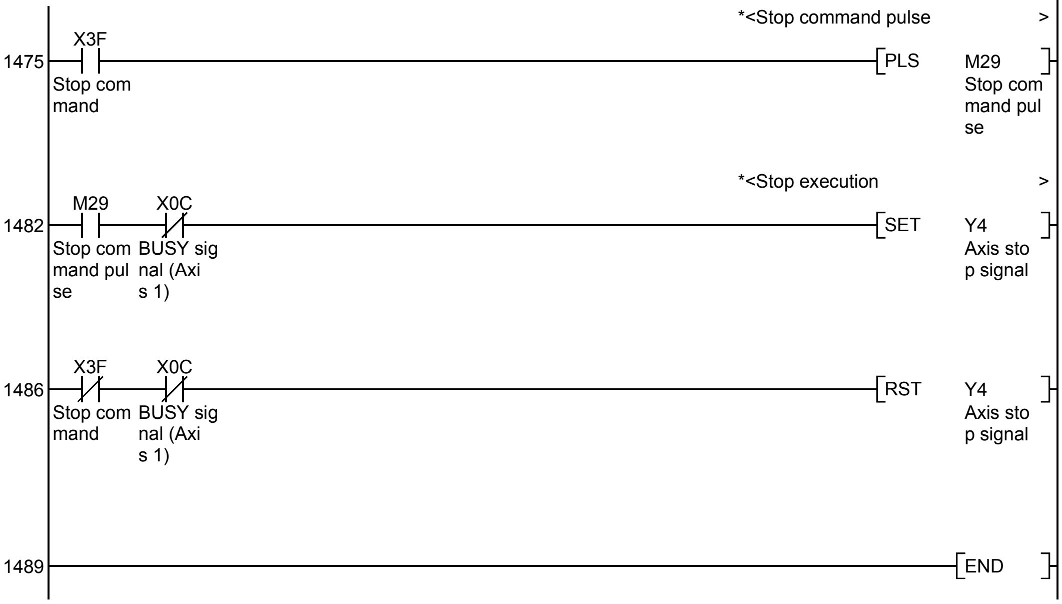


When servo amplifier errors cannot be reset even if error reset is requested, "0" is not stored in axis error reset by QD77MS. It remains "1". Set "0" in axis error reset and then set "1" to execute the error reset again.

*

*No.29 Stop program

*



6.5 Program details

6.5.1 Initialization program

[1] OPR request OFF program

This program forcibly turns OFF the "OPR request flag" (Md.31 Status: b3) which is ON.

When using a system that does not require OPR, assemble the program to cancel the "OPR request" made by the Simple Motion module when the power is turned ON, etc.

■ Data requiring setting

Set the following data to use the OPR request flag OFF request.

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Cd.19	OPR request flag OFF request	1	Set to "1: Turn OPR request flag OFF".	1521+100n	4321+100n

n: Axis No.-1

*: Refer to Section 5.7 "List of control data" for details on the setting details.

■ Time chart for OPR OFF request

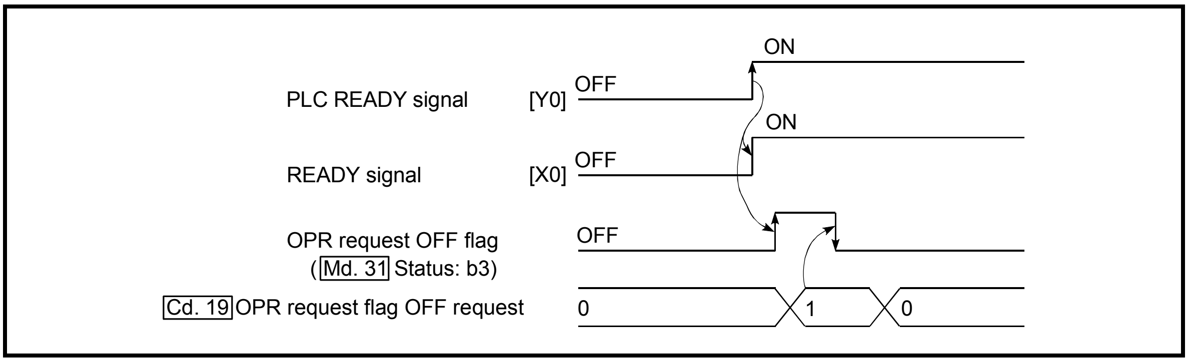


Fig. 6.1 Time chart for OPR OFF request

[2] External command function valid setting program

This program is used to validate the "external command signal" beforehand when using the external command functions (external start, speed change, speed-position switching, position-speed switching, skip). Set which function to use beforehand in "Pr.42 External command function selection".

(Set the external command signal (DI) in "Pr.95 External command signal selection" at QD77MS16 use.)

Set the following data to validate the "external command signal".

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Cd.8	External command valid	1	Set to "1: Validate external command".	1505+100n	4305+100n

n: Axis No.-1

*: Refer to Section 5.7 "List of control data" for details on the setting details.

6.5.2 Start details setting program

This program sets which control, out of "OPR", "major positioning control", "high-level positioning control" or "expansion control" to execute. For "high-level positioning control", "fast OPR", "speed-position switching control" and "position-speed switching control", add the respectively required sequence program.
(Refer to "Chapter 10" for details of "high-level positioning control" and "Chapter 12" for details on the "expansion control".)

■ Procedures for setting the starting details

(1) Set the "positioning start No." corresponding to the control to be started in "Cd.3 Positioning start No.".

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Cd.3	Positioning start No.	→	1 to 600 : Positioning data No. 9001 : Machine OPR 9002 : Fast OPR 9003 : Current value changing 9004 : Simultaneous start 7000 to 7004 : Block No. (For "high-level positioning control")	1500+100n	4300+100n

n: Axis No.-1

*: Refer to Section 5.7 "List of control data" for details on the setting details.

(2) For "high-level positioning control", set the "positioning start point No." of the block to be started in "Cd.4 Positioning starting point No.".

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Cd.4	Positioning starting point No.	→	1 to 50 : Point No. of block start data	1501+100n	4301+100n

n: Axis No.-1

*: Refer to Section 5.7 "List of control data" for details on the setting details.

(3) Set the following control data for "speed-position switching control (INC mode)".
(Set "Cd.23 Speed-position switching control movement amount change register" as required. Setting is not required in the ABS mode.)

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Cd.23	Speed-position switching control movement amount change register	→	Set the new value when the position control's movement amount is to be changed during speed control.	1526+100n 1527+100n	4326+100n 4327+100n
Cd.24	Speed-position switching enable flag	1	When "1" is set, the speed-position switching signal will be validated.	1528+100n	4328+100n

n: Axis No.-1

*: Refer to Section 5.7 "List of control data" for details on the setting details.

(4) For "position-speed switching control", set the control data shown below. (As required, set the "Cd.25 Position-speed switching control speed change register".)

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Cd.25	Position-speed switching control speed change register	→	Used to set a new value when speed is changed during positioning control.	1530+100n 1531+100n	4330+100n 4331+100n
Cd.26	Position-speed switching enable flag	1	To validate position-speed switching signal, this is set to 1.	1532+100n	4332+100n

n: Axis No.-1

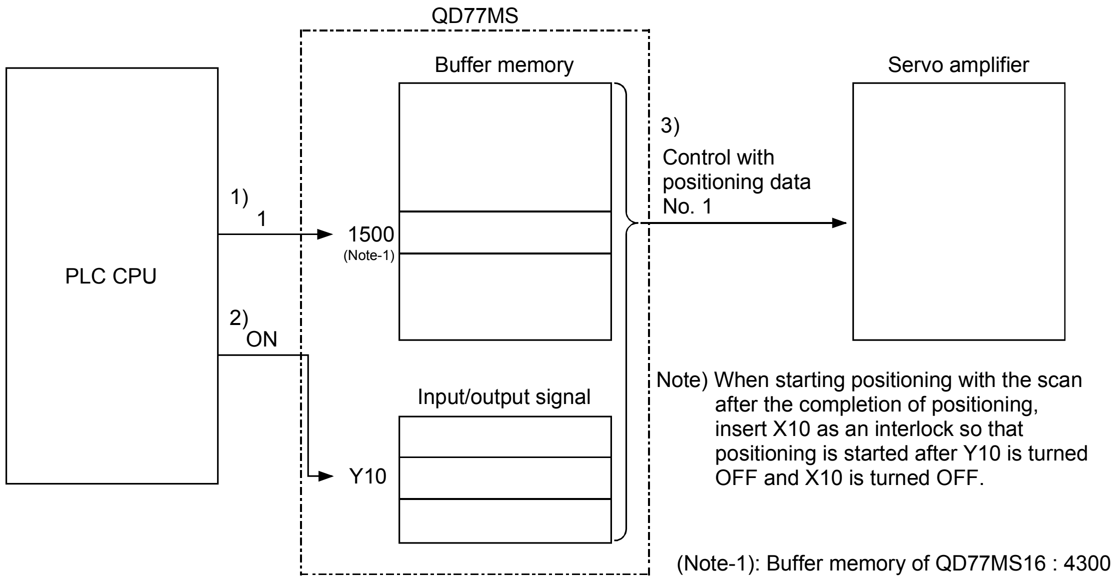
*: Refer to Section 5.7 "List of control data" for details on the setting details.

6.5.3 Start program

This program is used to start the control with start commands.
The control can be started with the following two methods.

[1] Starting by inputting positioning start signal
[2] Starting by inputting external command signal

[QD77MS4 operation example]



Note) When starting positioning with the scan after the completion of positioning, insert X10 as an interlock so that positioning is started after Y10 is turned OFF and X10 is turned OFF.

(Note-1): Buffer memory of QD77MS16 : 4300

1) Set the "positioning start No." in "Cd.3 Positioning start No." according to the control to be started.
(In the above example, set positioning data No. "1".)
2) Input the positioning start signal [Y10] or the external command signal.
3) The positioning data No. "1" will start.

Fig. 6.2 Procedures for starting control (for axis 1)

■ Servo ON conditions

Setting of servo parameter
↓
PLC READY signal Y0 ON
↓
All axis servo ON Y1 ON

■ Starting conditions

To start the control, the following conditions must be satisfied.
The necessary start conditions must be incorporated in the sequence program so that the control is not started when the conditions are not satisfied.

(1) Operation state

Monitor item		Operation state	Buffer memory address	
			QD77MS2 QD77MS4	QD77MS16
Md.26	Axis operation status	"0: Standby" or "1: Stopped"	809+100n	2409+100n

n: Axis No.-1

(2) Signal state

Signal name		Signal state		Device	
				QD77MS2 QD77MS4	QD77MS16
Interface signal	PLC READY signal	ON	PLC CPU preparation completed	Y0	
	READY signal	ON	QD77MS preparation completed	X0	
	All axis servo ON	ON	All axis servo ON	Y1	
	Synchronization flag ∗	ON	QD77MS buffer memory Accessible	X1	
	Axis stop signal	OFF	Axis stop signal is OFF	Y4 to Y7	Cd.180 Axis stop
	M code ON signal	OFF	M code ON signal is OFF	X4 to X7	Md.31 Status: b12
	Error detection signal	OFF	There is no error	X8 to XB	Md.31 Status: b13
	BUSY signal	OFF	BUSY signal is OFF	XC to XF	X10 to X1F
	Start complete signal	OFF	Start complete signal is OFF	X10 to X13	Md.31 Status: b14
External signal	Forced stop input signal	ON	There is no forced stop input	–	
	Stop signal	OFF	Stop signal is OFF	–	
	Upper limit (FLS)	ON	Within limit range	–	
	Lower limit (RLS)	ON	Within limit range	–	

∗: When the synchronous setting of the PLC CPU is made in the nonsynchronous mode, this must be provided as an interlock.
When it is made in the synchronous mode, no interlock must be provided in the program because the flag is turned ON when calculation is run on the PLC CPU.

[1] Starting by inputting positioning start signal

■ Operation when starting

(1) When the positioning start signal turns ON, the start complete signal and BUSY signal turn ON, and the positioning operation starts.
It can be seen that the axis is operating when the BUSY signal is ON.

(2) When the positioning start signal turns OFF, the start complete signal also turns OFF.
If the positioning start signal is ON even after positioning is completed, the start complete signal will remain ON.

(3) If the positioning start signal turns ON again while the BUSY signal is ON, the warning "operating start (warning code: 100)" will occur.

(4) The process taken when positioning is completed will differ according to case (a) and (b) below.

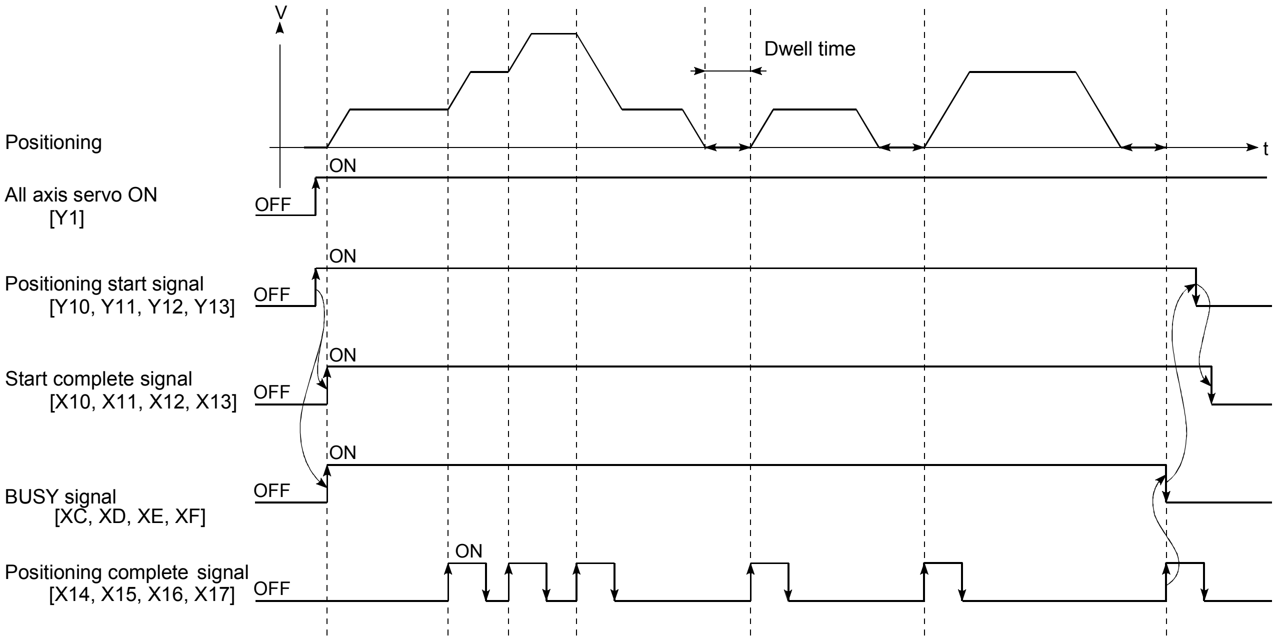
(a) When next positioning is not to be carried out

- If a dwell time is set, the system will wait for the set time to pass, and then positioning will be completed.
- When positioning is completed, the BUSY signal will turn OFF and the positioning complete signal will turn ON. However, when using speed control or when the positioning complete signal ON time is "0", the signal will not turn ON.
- When the positioning complete signal ON time is passed, the positioning complete signal will turn OFF.

(b) When next positioning is to be carried out

- If a dwell time is set, the system will wait for the set time to pass.
- When the set dwell time is passed, the next positioning will start.

[QD77MS4 operation example]



(Note): Refer to Section 3.3 for input/output signal of QD77MS16.

Fig. 6.3 ON/OFF timing of each signal at start of positioning

POINT

The BUSY signal turns ON even when position control of movement amount 0 is executed. However, since the ON time is short, the ON status may not be detected in the sequence program.
(The ON status of the start complete signal, positioning complete signal and M code ON signal can be detected in the sequence program.)

■ Starting time chart

The time chart for starting each control is shown below.

(1) Time chart for starting "machine OPR"

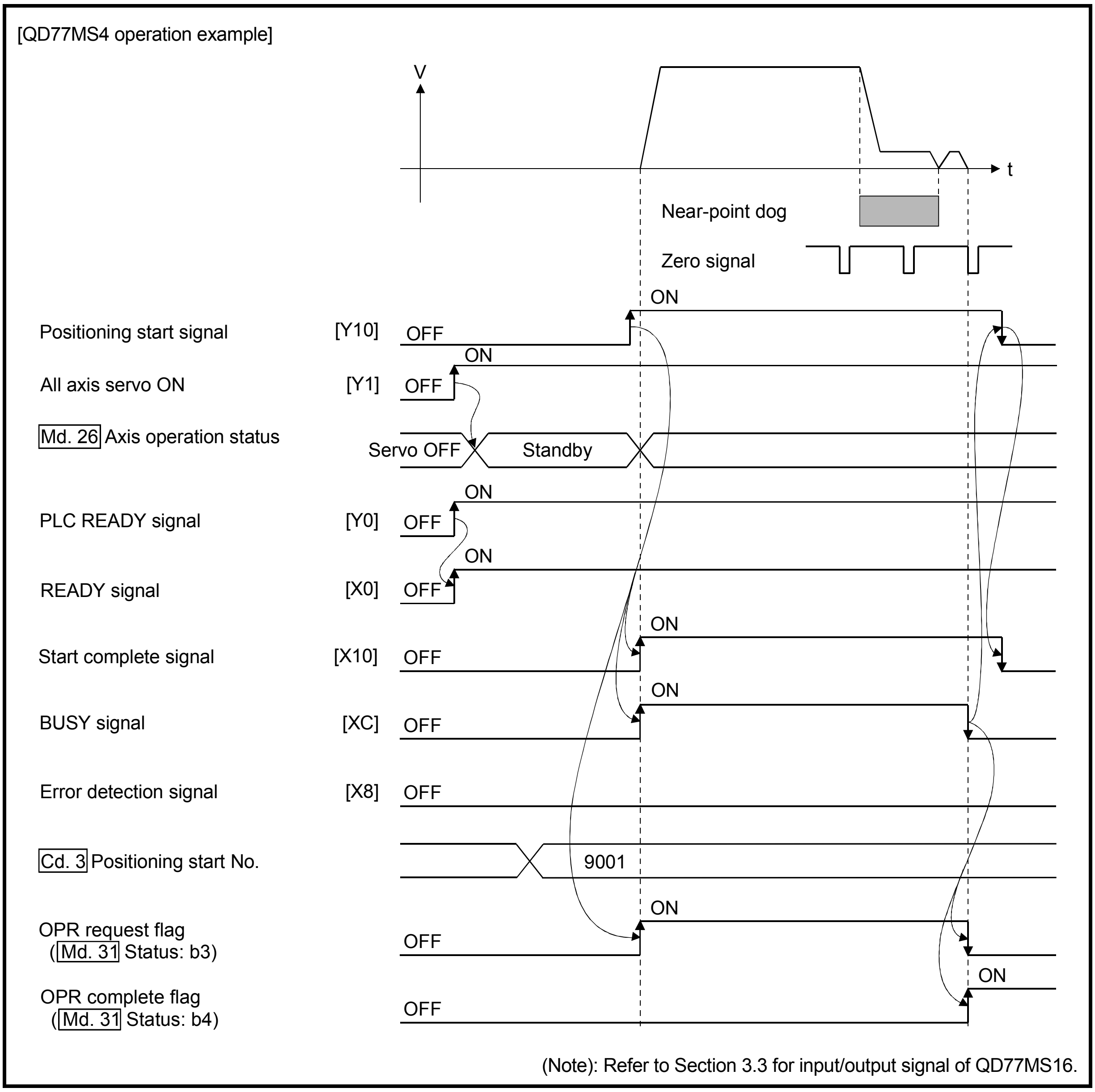
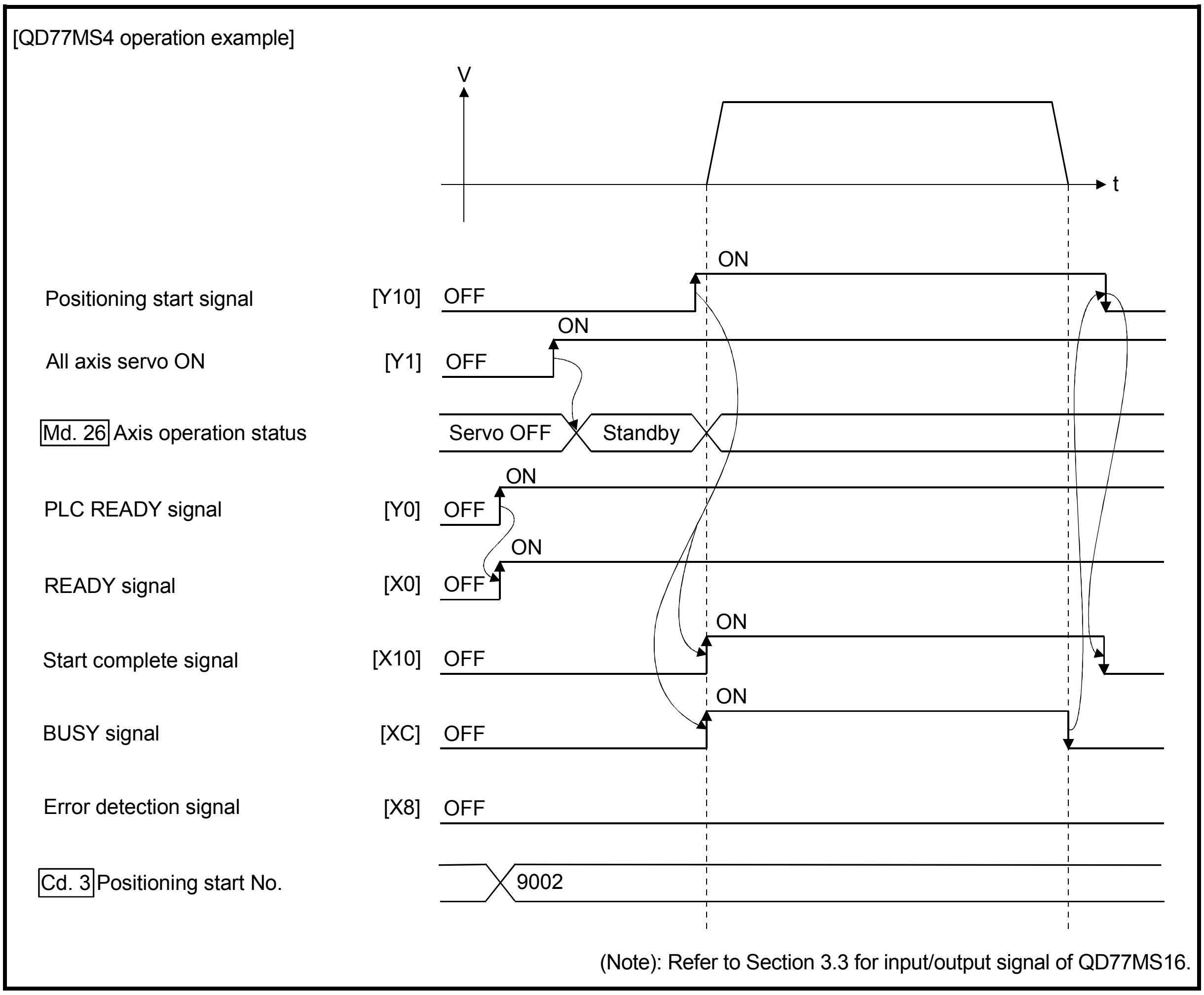


Fig. 6.4 Time chart for starting "machine OPR"

(2) Time chart for starting "fast OPR"



(Note): Refer to Section 3.3 for input/output signal of QD77MS16.

Fig. 6.5 Time chart for starting "fast OPR"

(3) Time chart for starting "major positioning control"

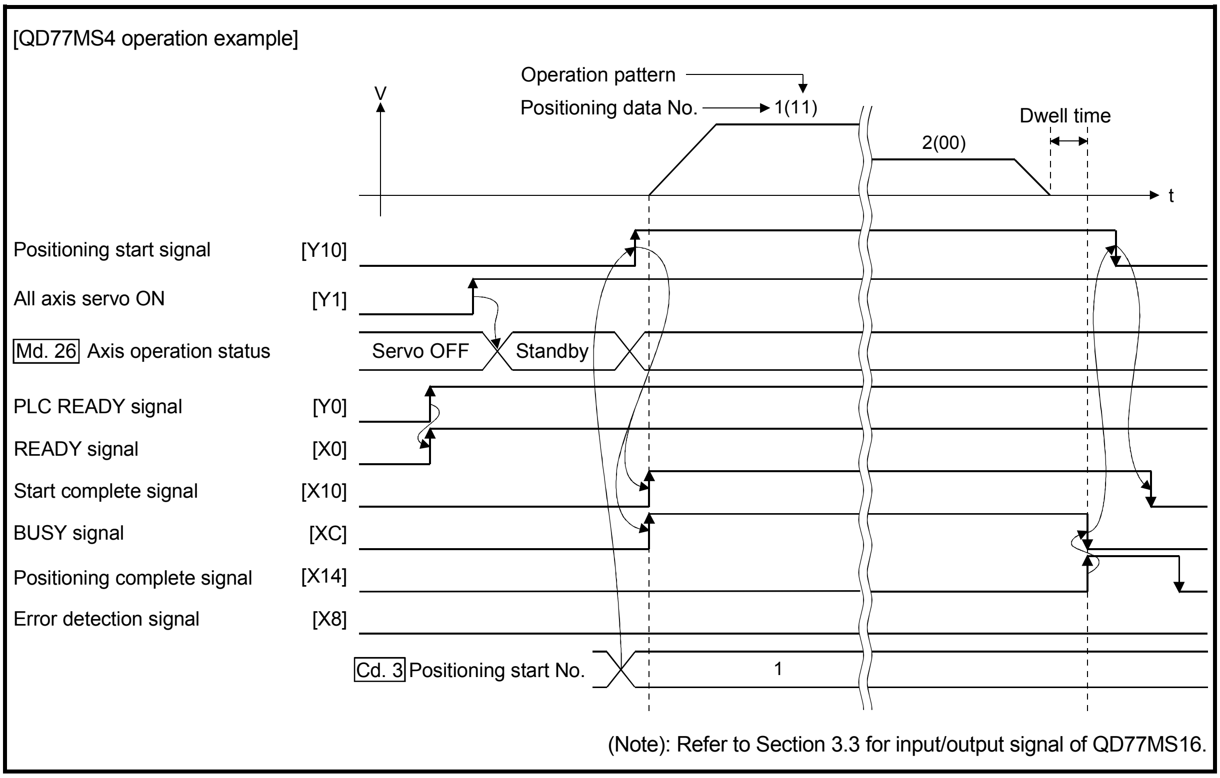


Fig. 6.6 Time chart for starting "major positioning control"

(4) Time chart for starting "speed-position switching control"

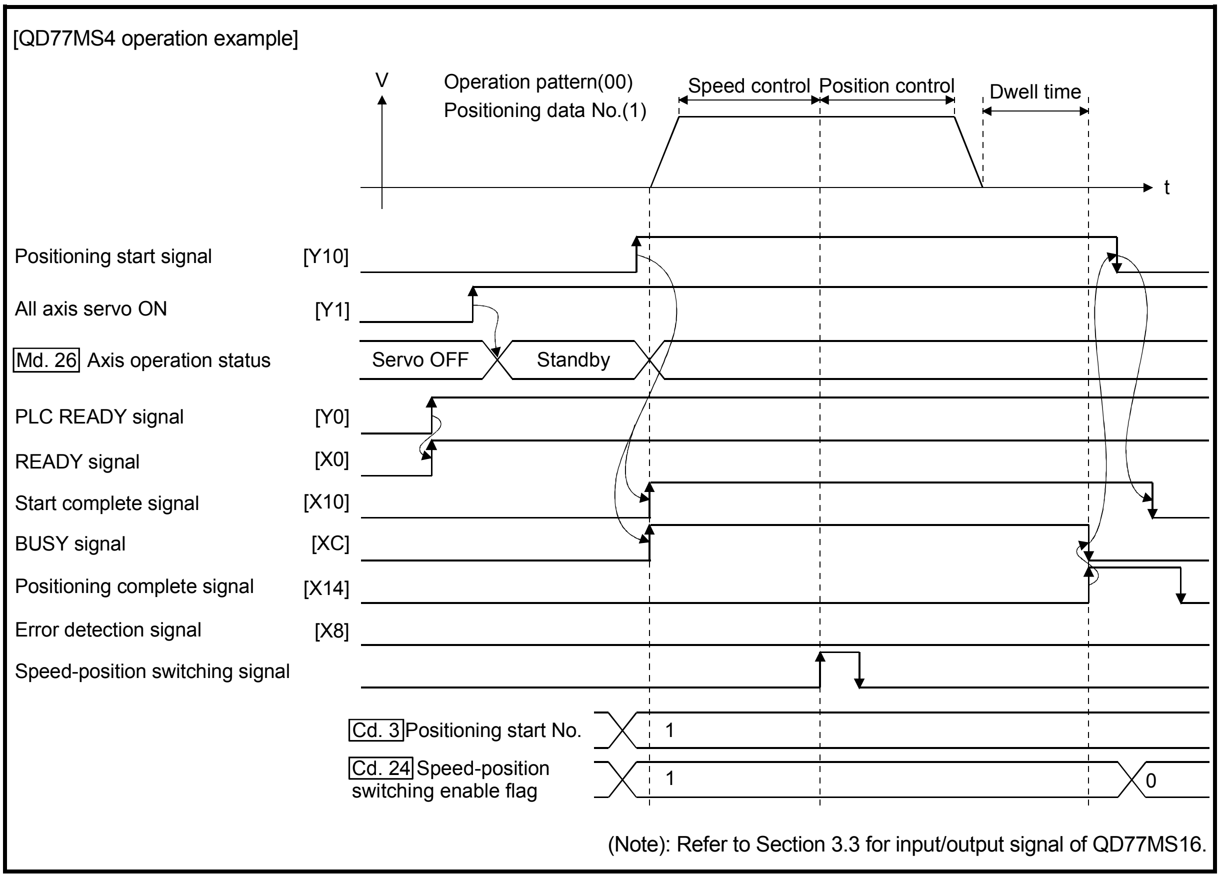


Fig. 6.7 Time chart for starting "speed-position switching control"

(5) Time chart for starting "position-speed switching control"

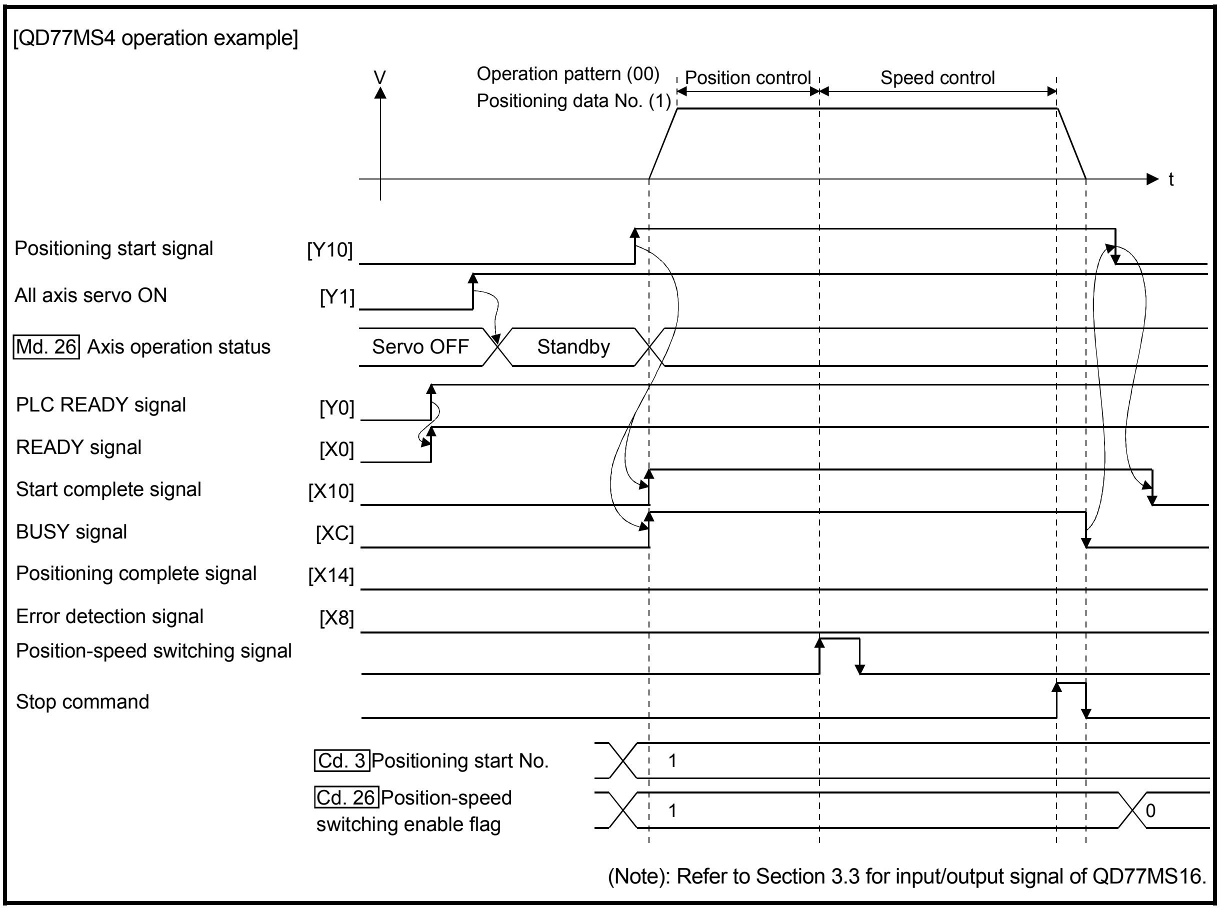
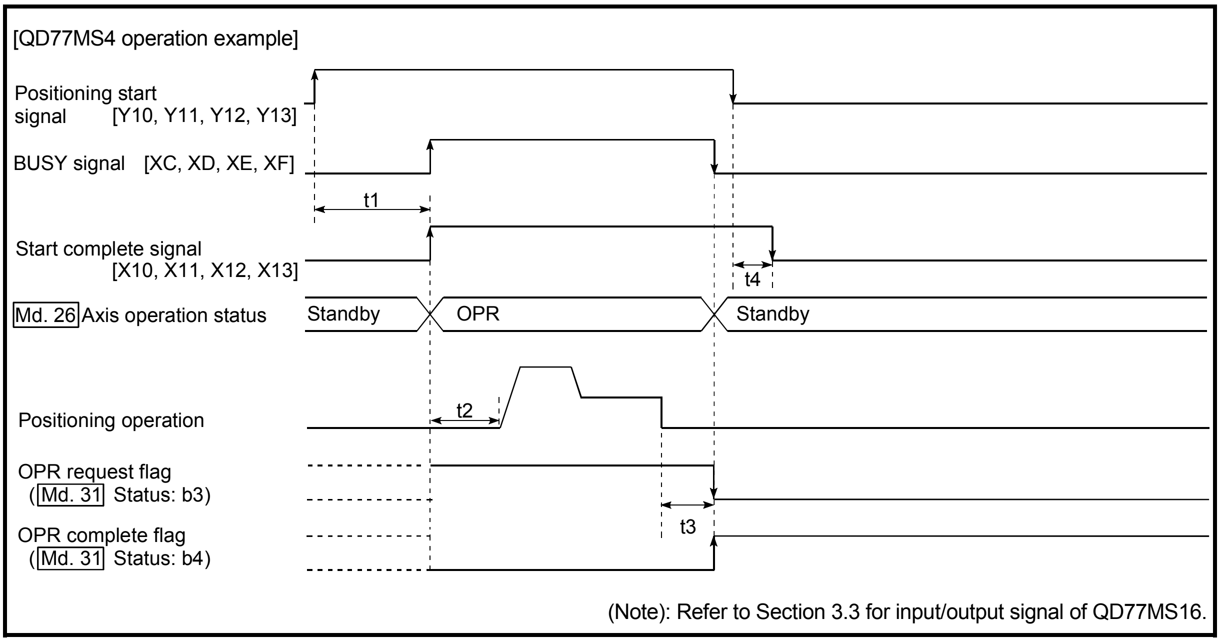


Fig. 6.8 Time chart for starting "position-speed switching control"

■ Machine OPR operation timing and process time



(Note): Refer to Section 3.3 for input/output signal of QD77MS16.

Fig. 6.9 Machine OPR operation timing and process time

Normal timing time Unit: [ms]

	Operation cycle	t1	t2	t3	t4
QD77MS2	0.88	0.2 to 0.3	1.8 to 2.7	0 to 0.9	0 to 0.9
	1.77	0.2 to 0.3	2.7 to 3.9	0 to 1.8	0 to 0.9
QD77MS4	0.88	0.2 to 0.3	1.8 to 2.7	0 to 0.9	0 to 0.9
	1.77	0.2 to 0.3	2.7 to 3.9	0 to 1.8	0 to 0.9
QD77MS16	0.88	0.3 to 1.4	1.8 to 2.7	0 to 0.9	0 to 0.9
	1.77	0.3 to 1.4	3.2 to 3.9	0 to 1.8	0 to 1.8

- The t1 timing time could be delayed depending on the operating conditions of the other axis.

■ Position control operation timing and process time

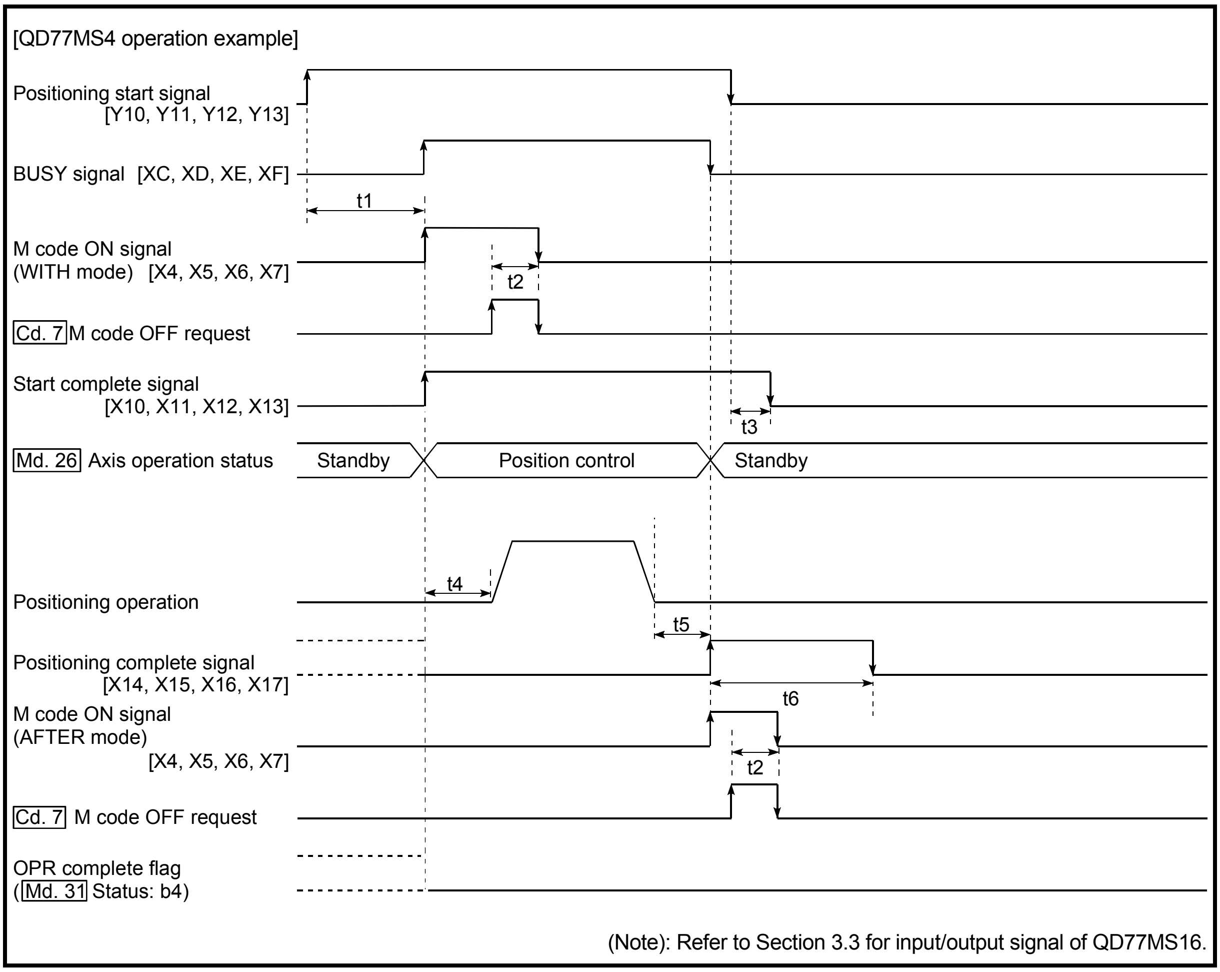


Fig. 6.10 Position control operation timing and process time

When the positioning start signal turns ON, if the "positioning complete signal" or "OPR complete flag" are already ON, the "positioning complete signal" or "OPR complete flag" will turn OFF when the positioning start signal turns ON.

Normal timing time Unit: [ms]

	Operation cycle	t1	t2	t3	t4	t5	t6
QD77MS2	0.88	0.2 to 0.3	0 to 0.9	0 to 0.9	1.8 to 2.7	0 to 0.9	Follows parameters
	1.77	0.2 to 0.3	0 to 1.8	0 to 1.8	2.5 to 3.9	0 to 1.8	Follows parameters
QD77MS4	0.88	0.2 to 0.3	0 to 0.9	0 to 0.9	1.8 to 2.7	0 to 0.9	Follows parameters
	1.77	0.2 to 0.3	0 to 1.8	0 to 1.8	2.5 to 3.9	0 to 1.8	Follows parameters
QD77MS16	0.88	0.3 to 1.4	0 to 0.9	0 to 0.9	1.8 to 2.7	0 to 0.9	Follows parameters
	1.77	0.3 to 1.4	0 to 1.8	0 to 1.8	3.2 to 3.9	0 to 1.8	Follows parameters

- The t1 timing time could be delayed depending on the operating conditions of the other axis.

[2] Starting by inputting external command signal

When starting positioning control by inputting the external command signal, the start command can be directly input into the Simple Motion module. This allows the variation time equivalent to one scan time of the PLC CPU to be eliminated. This is an effective procedure when operation is to be started as quickly as possible with the start command or when the starting variation time is to be suppressed. To start positioning control by inputting the external command signal, set the "data required to be set" and then turn ON the external command signal.

■ Restrictions

When starting by inputting the external command signal, the start complete signal will not turn ON.

■ Data required to be set

To execute positioning start with the external command signal, set parameter (Pr.42) beforehand, and validate the "external command signal" with the "external command signal validity setting program (program No.5).

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Pr.42	External command function selection	0	Set to "0: External positioning start".	62+150n	
Cd.8	External command valid	1	Set to "1: Validate external command".	1505+100n	4305+100n

n: Axis No.-1

＊: Set the external command signal (DI) in "Pr.95 External command signal selection" at QD77MS16 use.
Refer to Chapter 5 "Data Used for Positioning Control" for details on the setting details.

■ Starting time chart

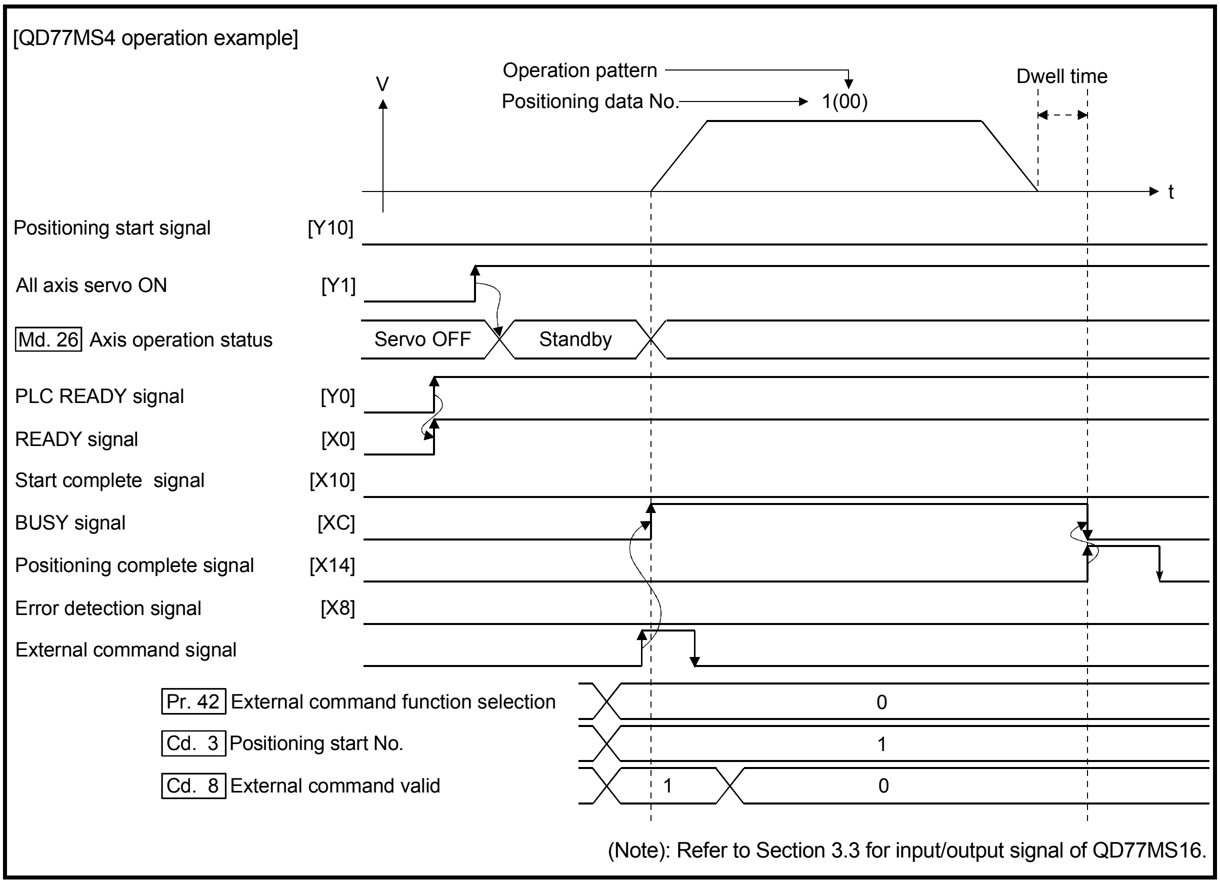


Fig. 6.11 Time chart for starting with external start signal

6.5.4 Continuous operation interrupt program

During positioning control, the control can be interrupted during continuous positioning control and continuous path control (continuous operation interrupt function). When "continuous operation interruption" is execution, the control will stop when the operation of the positioning data being executed ends. To execute continuous operation interruption, set "1: Continuous operation interrupt request" for "Cd.18 Interrupt request during continuous operation".

[1] Operation during continuous operation interruption

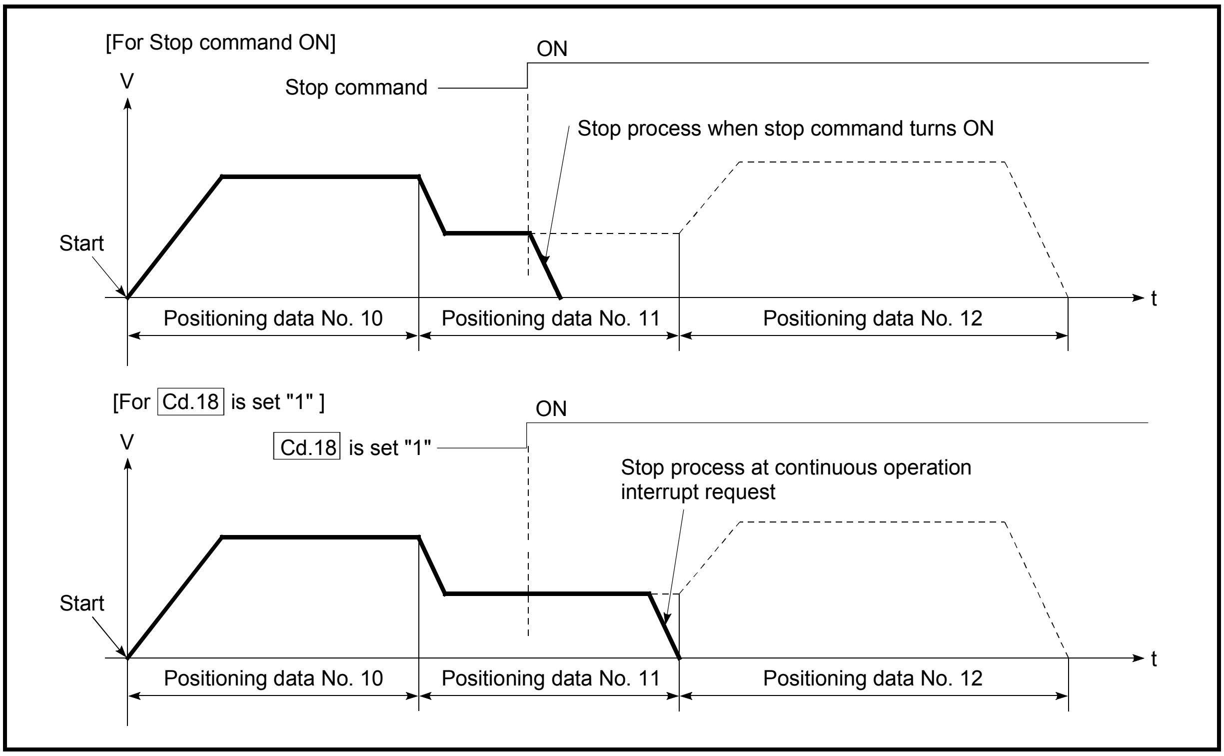
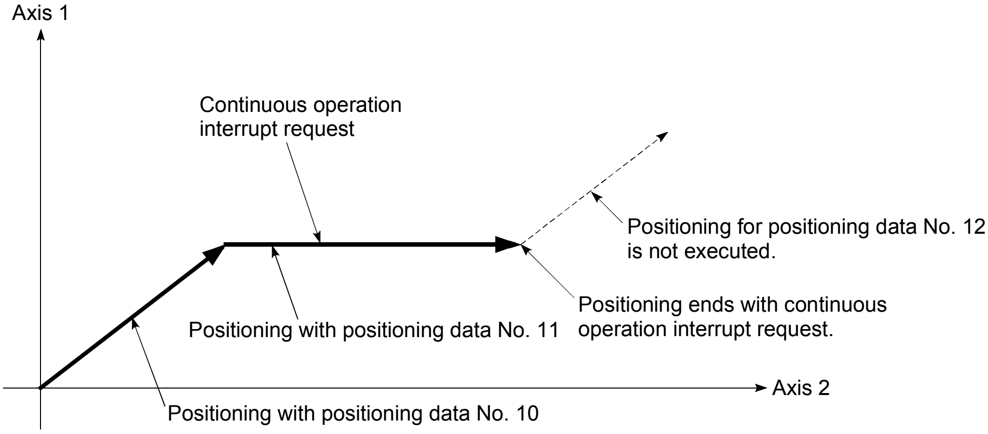


Fig. 6.12 Operation during continuous operation interruption

[2] Restrictions

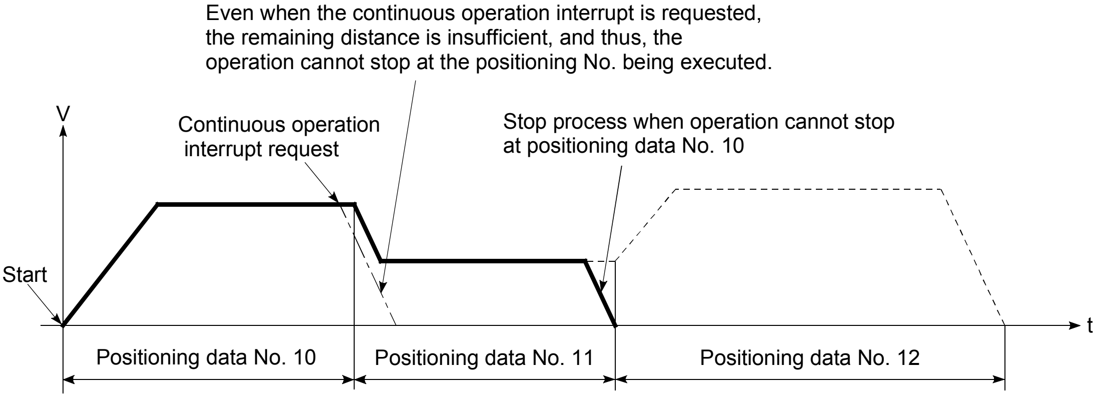
(1) When the "continuous operation interrupt request" is executed, the positioning will end.
Thus, after stopping, the operation cannot be "restarted".
When "Cd.6 Restart command" is issued, a warning "Restart not possible" (warning code: 104) will occur.

(2) Even if the stop command is turned ON after executing the "continuous operation interrupt request", the "continuous operation interrupt request" cannot be canceled.
Thus, if "restart" is executed after stopping by turning the stop command ON, the operation will stop when the positioning data No. where "continuous operation interrupt request" was executed is completed.



(3) If the operation cannot be decelerated to a stop because the remaining distance is insufficient when "continuous operation interrupt request" is executed with continuous path control, the interruption of the continuous operation will be postponed until the positioning data shown below.

- Positioning data No. have sufficient remaining distance
- Positioning data No. for positioning complete (pattern: 00)
- Positioning data No. for continuous positioning control (pattern: 01)



(4) When operation is not performed (BUSY signal is OFF), the interrupt request during continuous operation is not accepted. It is cleared to 0 at a start or restart.

[3] Control data requiring settings

Set the following data to interrupt continuous operation.

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Cd.18	Interrupt request during continuous operation	1	Set "1: Interrupt request during continuous operation".	1520+100n	4320+100n

n: Axis No.-1

∗: Refer to Section 5.7 "List of control data" for details on the setting details.

6.5.5 Restart program

When a stop factor occurs during position control and the operation stops, the positioning can be restarted from the stopped position to the position control end point by using the "restart command" (Cd.6 Restart command).

("Restarting" is not possible when "continuous operation is interrupted.")
This instruction is efficient when performing the remaining positioning from the stopped position in the positioning control of incremental method such as INC linear 1. (Calculation of remaining distance is not required.)

[1] Restart operation

After a deceleration stop by the stop command is completed, write "1" to the "Cd.6 Restart command" with "Md.26 Axis operation status" is "stopped" and the positioning restarts.

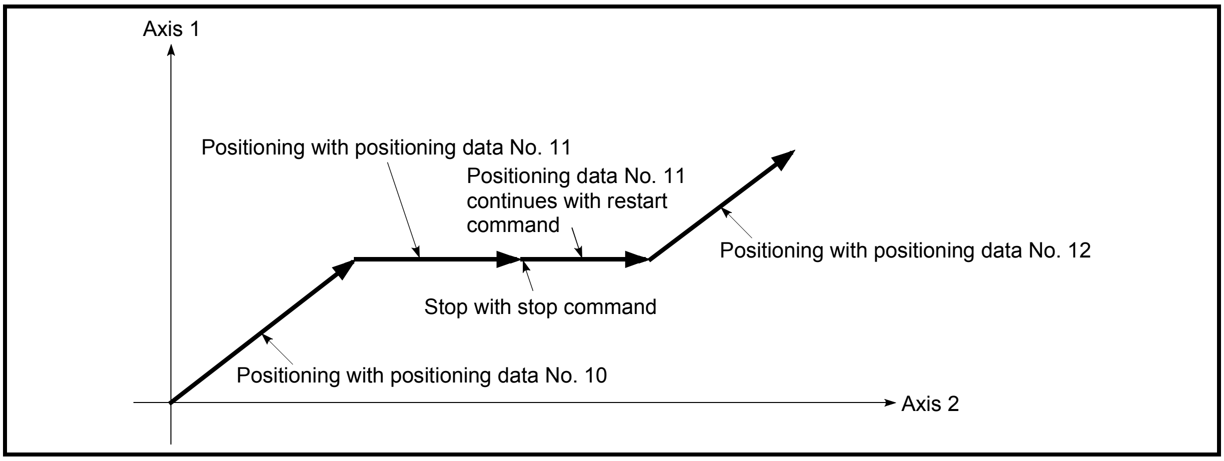


Fig. 6.13 Restart operation

[2] Restrictions

(1) Restarting can be executed only when the "Md.26 Axis operation status" is "stopped (the deceleration stop by stop command is completed)".
If the axis operation is not "stopped", restarting is not possible.
In this case, a warning "Restart not possible" (warning code: 104) will occur, and the process at that time will be continued.

(2) Do not execute restart while the stop command is ON.
If restart is executed while stopped, an error "Stop signal ON at start" (error code: 106) will occur, and the "Md.26 Axis operation status" will change to "Error".
Thus, even if the error is reset, the operation cannot be restarted.

(3) Restarting can be executed even while the positioning start signal is ON.
However, make sure that the positioning start signal does not change from OFF to ON while stopped.

(4) If the positioning start signal is changed from OFF to ON while "Md.26 Axis operation status" is "stopped", the normal positioning (the positioning data set in "Cd.3 Positioning start No.") is started.

(5) If positioning is ended with the continuous operation interrupt request, the operation cannot be restarted.
If restart is requested, a warning "Restart not possible" (warning code: 104) will occur.

(6) When stopped with interpolation operation, write "1: Restarts" into "Cd.6 Restart command" for the reference axis, and then restart.

(7) If the PLC READY signal is changed from OFF to ON while stopped, restarting is not possible.
If restart is requested, a warning "Restart not possible" (warning code: 104) will occur.

(8) When the machine OPR and fast OPR is stopped, an error "OPR restart not possible" (error code: 209) will occur and the positioning cannot restarts.

(9) If any of reference partner axes executes the positioning operation once after interpolation operation stop, a warning "Restart not possible" (warning code: 104) will occur, and the positioning cannot restarts.

[3] Control data requiring setting

Set the following data to execute restart.

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Cd.6	Restart command	1	Set "1: Restarts".	1503+100n	4303+100n

n: Axis No.-1

*: Refer to Section 5.7 "List of control data" for details on the setting details.

[4] Starting conditions

The following conditions must be satisfied when restarting. (Assemble the required conditions into the sequence program as an interlock.)

(1) Operation state

- "Md.26 Axis operation status" is "1: Stopped".

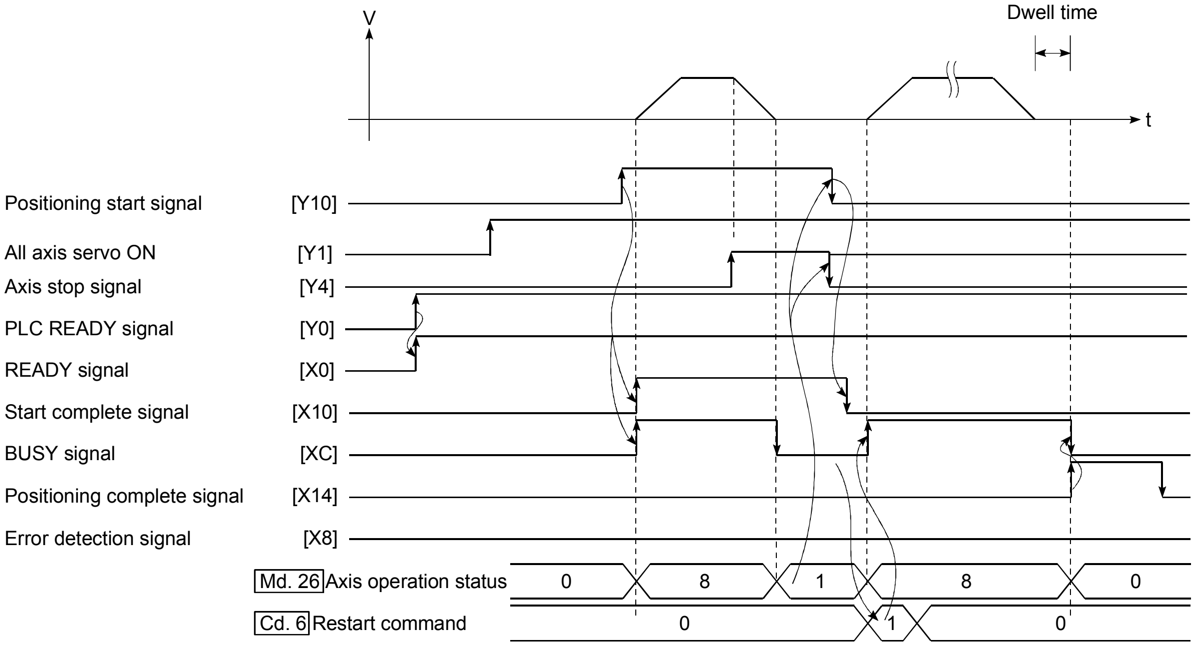
(2) Signal state

Signal name		Signal state		Device	
				QD77MS2 QD77MS4	QD77MS16
Interface signal	PLC READY signal	ON	PLC CPU preparation completed	Y0	
	READY signal	ON	QD77MS preparation completed	X0	
	All axis servo ON	ON	All axis servo ON	Y1	
	Synchronization flag ∗	ON	QD77MS buffer memory Accessible	X1	
	Axis stop signal	OFF	Axis stop signal is OFF	Y4 to Y7	Cd.180 Axis stop
	M code ON signal	OFF	M code ON signal is OFF	X4 to X7	Md.31 Status: b12
	Error detection signal	OFF	There is no error	X8 to XB	Md.31 Status: b13
	BUSY signal	OFF	BUSY signal is OFF	XC to XF	X10 to X1F
	Start complete signal	OFF	Start complete signal is OFF	X10 to X13	Md.31 Status: b14
External signal	Forced stop input signal	ON	There is no forced stop input	–	
	Stop signal	OFF	Stop signal is OFF	–	
	Upper limit (FLS)	ON	Within limit range	–	
	Lower limit (RLS)	ON	Within limit range	–	

∗: When the synchronous setting of the PLC CPU is made in the nonsynchronous mode, this must be provided as an interlock.
When it is made in the synchronous mode, no interlock must be provided in the program because the flag is turned ON when calculation is run on the PLC CPU.

[5] Time chart for restarting

[QD77MS4 operation example]



(Note): Refer to Section 3.3 for input/output signal of QD77MS16.

Fig. 6.14 Time chart for restarting

6.5.6 Stop program

The axis stop signal or stop signal from external input signal is used to stop the control.
Create a program to turn ON the axis stop signal as the stop program.

Signal	QD77MS2	QD77MS4	QD77MS16
Axis stop signal	Y4, Y5	Y4, Y5, Y6, Y7	Cd.180 Axis stop

The process for stopping control is explained below.
Each control is stopped in the following cases.

(1) When each control is completed normally.
(2) When the Servo READY signal is turned OFF.
(3) When a PLC CPU error occurs.
(4) When the PLC READY signal is turned OFF.
(5) When an error occurs in Simple Motion module.
(6) When control is intentionally stopped
(Stop signal from PLC CPU turned ON, "Stop signal" of external input signal turned ON, etc.)

The stop process for the above cases is shown below.
(Excluding item (1) above "When each control is completed normally".)

[1] Stop process

Stop cause		Stop axis	M code ON signal after stop	Axis operation status after stopping (Md.26)	Stop process					
					OPR control		Major positioning control	High-level positioning control	Manual control	
					Machine OPR control	Fast OPR control			JOG/ Inching operation	Manual pulse generator operation
Forced stop	"Forced stop input signal" OFF from an external device	All axes	No change	Servo OFF	Servo OFF or free run (The operation stops with dynamic brake)					—
	Servo READY OFF • Servo amplifier power supply OFF	Each axis	No change	Servo amplifier has not been connected						
	• Servo alarm			Error						
	• Forced stop input to servo amplifier			Servo OFF						
Fatal stop (Stop group 1)	Hardware stroke limit upper/lower limit error occurrence	Each axis	No change	Error	Deceleration stop/sudden stop (Select with "Pr.37 Stop group 1 sudden stop selection".)					Deceleration stop
Emergency stop (Stop group 2)	Error occurs in PLC CPU	All axes	No change	Error	Delegation stop/sudden stop (Select with "Pr.38 Stop group 2 sudden stop selection".)					Deceleration stop
	PLC READY signal OFF		Turns OFF							
	Error in test mode		No change							
Relatively safe stop (Stop group 3)	Axis error detection (Error other than stop group 1 or 2)	Each axis	No change	Error	Deceleration stop/sudden stop (Select with "Pr.39 Stop group 3 sudden stop selection".)					Deceleration stop
	"Stop" input from GX Works2									
Intentional stop (Stop group 3)	"Axis stop signal" ON from PLC CPU	Each axis	No change	Stopped (Standby)						
	"Stop signal" of external input signal ON									

[2] Types of stop processes

The operation can be stopped with deceleration stop, sudden stop or immediate stop.

(1) Deceleration stop ∗1

The operation stops with "deceleration time 0 to 3" (Pr.10, Pr.28, Pr.29, Pr.30).
Which time from "deceleration time 0 to 3" to use for control is set in positioning data (Da.4).

(2) Sudden stop

The operation stops with "Pr.36 Sudden stop deceleration time".

(3) Servo OFF or free run (The operation stops with dynamic brake or electromagnetic brake.)

The operation does not decelerate.
The Simple Motion module immediately stops the command, but the operation will coast for the droop pulses accumulated in the servo amplifier deviation counter.

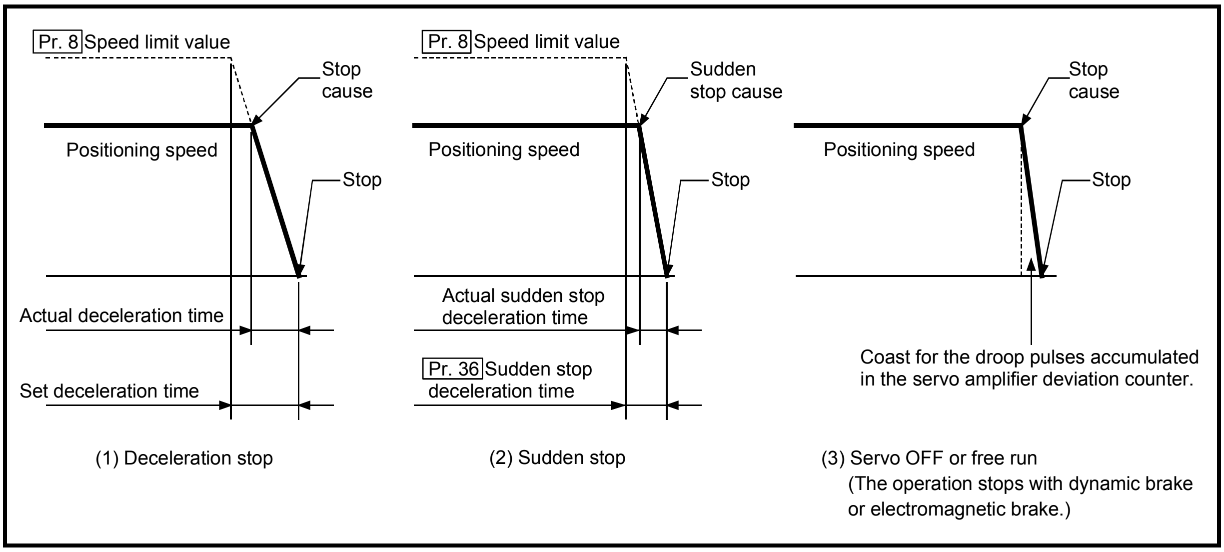


Fig. 6.15 Types of stop processes

REMARK

∗1 "Deceleration stop" and "sudden stop" are selected with the detailed parameter 2 "stop group 1 to 3 sudden stop selection". (The default setting is "deceleration stop".)

[3] Order of priority for stop process

The order of priority for the Simple Motion module stop process is as follows.

Deceleration stop < Sudden stop < Servo OFF

(1) If the deceleration stop command ON (stop signal ON) or deceleration stop cause occurs during deceleration to speed 0 (including automatic deceleration), operation changes depending on the setting of " Cd.42 Stop command processing for deceleration stop selection".

(a) Manual control

Independently of the Cd.42 setting, a deceleration curve is re-processed from the speed at stop cause occurrence.

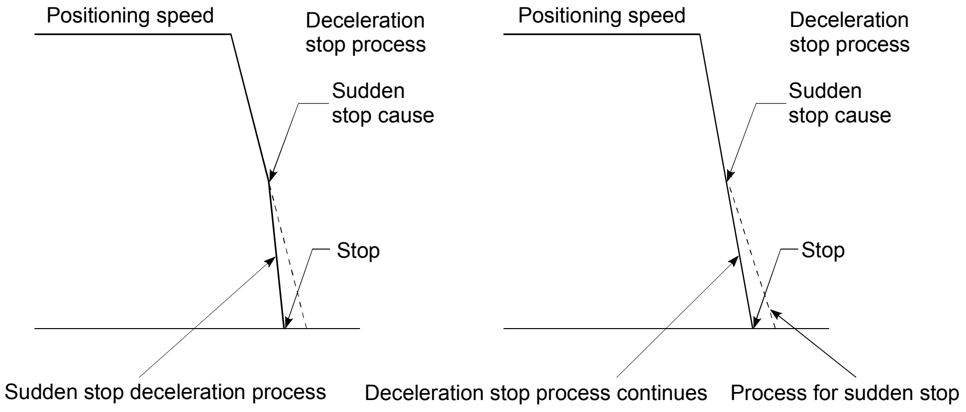
(b) OPR control, positioning control

- When Cd.42 = 0 (deceleration curve re-processing):
  A deceleration curve is re-processed from the speed at stop cause occurrence.
- When Cd.42 = 1 (deceleration curve continuation):
  The current deceleration curve is continued after stop cause occurrence. (For details, refer to Section 13.7.9 "Stop command processing for deceleration stop function".)

(2) If the stop signal designated for sudden stop turns ON or a stop cause occurs during deceleration, the sudden stop process will start from that point. However, if the sudden stop deceleration time is longer than the deceleration time, the deceleration stop process will be continued even if a sudden stop cause occurs during the deceleration stop process.

Example

The process when a sudden stop cause occurs during deceleration stop is shown below.



a) When deceleration stop time > sudden stop deceleration time (b) When deceleration stop time < sudden stop deceleration time

[4] Inputting the stop signal during deceleration

(1) Even if stop is input during deceleration (including automatic deceleration), the operation will stop at that deceleration speed.
(2) If stop is input during deceleration for OPR, the operation will stop at that deceleration speed. If input at the creep speed, the operation will stop immediately.
(3) If a stop cause, designated for sudden stop, occurs during deceleration, the sudden stop process will start from that point.
The sudden stop process during deceleration is carried out only when the sudden stop time is shorter than the deceleration stop time.

Chapter 7 Memory Configuration and Data Process

The memory configuration and data transmission of Simple Motion module are explained in this chapter.

The Simple Motion module is configured of four memories. By understanding the configuration and roles of two memories, the internal data transmission process of Simple Motion module, such as "when the power is turned ON" or "when the PLC READY signal changes from OFF to ON", can be easily understood. This also allows the transmission process to be carried out correctly when saving or changing the data.

7.1 Configuration and roles of QD77MS memory

7.1.1 Configuration and roles of QD77MS memory

The Simple Motion module is configured of the following four memories.

Model	Memory configuration	Role	Area configuration												Backup
						Positioning data area		Block start data area			Servo parameter area				
			Parameter area	Monitor data area	Control data area	(No. 1 to 100)	(No. 101 to 600)	(No.7000 to 7001)	(No.7002 to 7004)	PLC CPU memo area	(Pr.100, PA, PB, PC)	(PA19, PD, PE, PS, PF, Po, PL)	Synchronous control area	Cam area	
QD77MS2 QD77MS4	Buffer memory	Area that can be directly accessed with sequence program with PLC CPU.	○	○	○	○	○	○	○	○	○	○	○	–	Not possible
	Internal memory	Area that can be set only with GX Works2.	–	–	–	–	–	–	–	–	–	–	–	–	Not possible
		Area that can be set only using buffer memory.	–	–	–	–	–	–	–	–	–	–	–	○	Not possible
	Flash ROM	Area for backing up data required for positioning.	○	–	–	○	○	○	○	–	–	–	○ *	–	Possible
	Internal memory (nonvolatile)	Area for backing up servo parameter or cam data.	–	–	–	–	–	–	–	–	○	○	–	○	Possible
QD77MS16	Buffer memory	Area that can be directly accessed with sequence program with PLC CPU.	○	○	○	○	–	○	–	○	○	–	○	–	Not possible
	Internal memory	Area that can be set only with GX Works2.	–	–	–	–	○	–	○	–	–	○	–	–	Not possible
		Area that can be set only using buffer memory.	–	–	–	–	–	–	–	–	–	–	–	○	Not possible
	Flash ROM	Area for backing up data required for positioning.	○	–	–	○	○	○	○	–	–	–	○ *	–	Possible
	Internal memory (nonvolatile)	Area for backing up servo parameter or cam data.	–	–	–	–	–	–	–	–	○	○	–	○	Possible

○: Setting and storage area provided
–: Setting and storage area not provided
*: Parameter only
Possible : Data is held even when power is turned OFF.
Not possible: Data is lost when power is turned OFF.

■ Details of areas

- Parameter area
  Area where parameters, such as positioning parameters and OPR parameters, required for positioning control are set and stored.

- Monitor data area
  Area where the operation status of positioning system is stored.

- Control data area
  Area where data for operating and controlling positioning system is set and stored.

- Positioning data area (No.1 to 600)
  Area where positioning data No.1 to 600 is set and stored.

- Block start data area (No.7000 to 7004)
  Area where information required only when carrying out block No. 7000 to 7004 high-level positioning is set and stored.

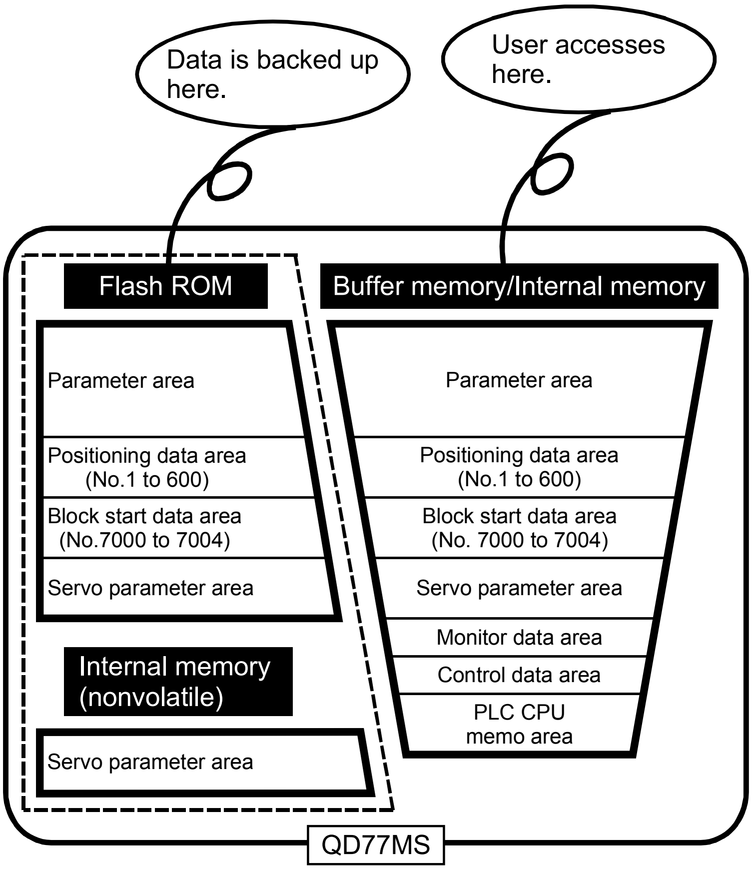
- PLC CPU memo area
  Area where condition judgment values required for special positioning, etc., are set and stored.

- Servo parameter area
  Area where parameters, such as servo parameters, required for positioning control on servo amplifier are set and stored.

- Synchronous control area (Note-1)
  Area where parameters and control data required for synchronous control are set and stored. Also, the operation status of synchronous control is stored.

- Cam area (Note-1)
  Area where cam data, etc., are set and stored. There are cam storage area and cam open area.

(Note-1): Refer to "MELSEC-Q/L QD77MS/QD77GF/LD77MS/LD77MH Simple Motion Module User's Manual (Synchronous Control)" for details of synchronous control area and cam area.


Data is backed up here.
User accesses here.
Flash ROM
Parameter area
Positioning data area (No.1 to 600)
Block start data area (No.7000 to 7004)
Servo parameter area
Internal memory (nonvolatile)
Servo parameter area
Buffer memory/Internal memory
Parameter area
Positioning data area (No.1 to 600)
Block start data area (No. 7000 to 7004)
Servo parameter area
Monitor data area
Control data area
PLC CPU memo area
QD77MS

7.1.2 Buffer memory area configuration

The buffer memory of Simple Motion module is configured of the following types of areas.

Buffer memory area configuration		Buffer memory address		Writing possibility
		QD77MS2/QD77MS4	QD77MS16	
Parameter area	Basic parameter area	0+150n to 15+150n		Possible
	Detailed parameter area	17+150n to 69+150n		
	OPR basic parameter area	70+150n to 78+150n		
	OPR detailed parameter area	79+150n to 91+150n		
	Expansion parameter area	100+150n to 149+150n		
	Mark detection setting parameter area	54000+20k to 54019+20k		
Monitor data area	System monitor area	1200 to 1499 31300 to 31549	4000 to 4299 31300 to 31549	Not possible
	Axis monitor area	800+100n to 899+100n	2400+100n to 2499+100n	
	Mark detection monitor data area	54960+80k to 55039+80k		
Control data area	System control data area	1900 to 1999	5900 to 5999	Possible
	Axis control data area	1500+100n to 1599+100n	4300+100n to 4399+100n	
	Expansion axis control data area		30100+10n to 30109+10n	
	Mark detection control data area	54640+10k to 54649+10k		
Positioning data area (No.1 to 100)	Positioning data area	2000+6000n to 2999+6000n	6000+1000n to 6999+1000n	
Positioning data area (No.101 to 600)		3000+6000n to 7999+6000n	Set with GX Works2	
Block start data area (No.7000)	Block start data area	26000+1000n to 26049+1000n	22000+400n to 22049+400n	
		26050+1000n to 26099+1000n	22050+400n to 22099+400n	
	Condition data area	26100+1000n to 26199+1000n	22100+400n to 22199+400n	
Block start data area (No.7001)	Block start data area	26200+1000n to 26249+1000n	22200+400n to 22249+400n	
		26250+1000n to 26299+1000n	22250+400n to 22299+400n	
	Condition data area	26300+1000n to 26399+1000n	22300+400n to 22399+400n	
Block start data area (No.7002)	Block start data area	26400+1000n to 26449+1000n	Set with GX Works2	
		26450+1000n to 26499+1000n		
	Condition data area	26500+1000n to 26599+1000n		
Block start data area (No.7003)	Block start data area	26600+1000n to 26649+1000n		
		26650+1000n to 26699+1000n		
	Condition data area	26700+1000n to 26799+1000n		
Block start data area (No.7004)	Block start data area	26800+1000n to 26849+1000n		
		26850+1000n to 26899+1000n		
	Condition data area	26900+1000n to 26999+1000n		
PLC CPU memo area	PLC CPU memo area	30000 to 30099		

Buffer memory area configuration			Buffer memory address		Writing possibility
			QD77MS2/QD77MS4	QD77MS16	
Servo parameter area	Servo series		30100+200n	28400+100n	Possible
	PA group	PA01 to PA18	30101+200n to 30118+200n	28401+100n to 28418+100n	
		PA19	30932+50n	Set with GX Works2	
		PA20 to PA32	64400+250n to 64412+250n	64400+70n to 64412+70n	
	PB group		30119+200n to 30163+200n	28419+100n to 28463+100n	
			64413+250n to 64431+250n	64413+70n to 64431+70n	
	PC group		30164+200n to 30195+200n	28464+100n to 28495+100n	
			64432+250n to 64463+250n	64432+70n to 64463+70n	
	PD group		30196+200n to 30227+200n	Set with GX Works2	
			64464+250n to 64479+250n		
	PE group		30228+200n to 30267+200n		
			64480+250n to 64503+250n		
	PS group		30268+200n to 30299+200n		
	PF group		30900+50n to 30915+50n		
			64504+250n to 64535+250n		
	Po group		30916+50n to 30931+50n		
			64536+250n to 64551+250n		
	PL group		64552+250n to 64599+250n		
Synchronous control area	Servo input axis parameter		32800+10n to 32805+10n		Possible
	Servo input axis monitor data		33120+10n to 33127+10n		Not possible
	Synchronous encoder axis parameter		34720+20j to 34735+20j		Possible
	Synchronous encoder axis control data		35040+10j to 35047+10j		Possible
	Synchronous encoder axis monitor data		35200+20j to 35212+20j		Not possible
	Synchronous control system control data		36320, 36322		Possible
	Synchronous parameter		36400+200n to 36513+200n		Possible
	Synchronous control monitor data		42800+40n to 42835+40n		Not possible
	Control data for synchronous control		44080+20n to 44090+20n		Possible
	Cam operation control data		45000 to 53791		Possible
	Cam operation monitor data		53800 to 53801		Not possible

n: Axis No.-1
k: Mark detection setting No.-1
j: Synchronous encoder axis No.-1

＊: Use of address Nos. skipped above is prohibited. If used, the system may not operate correctly.

POINT

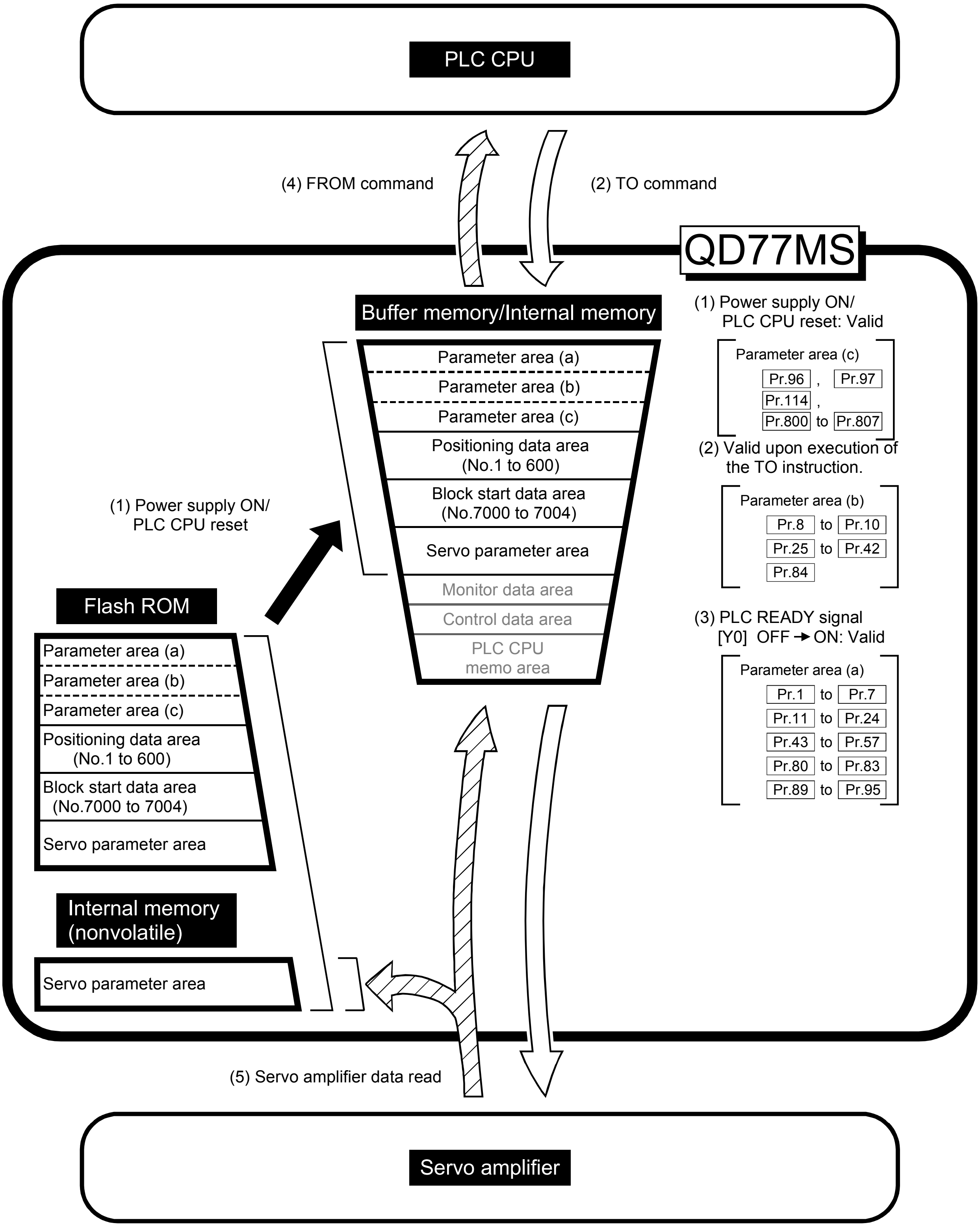
When the parameter of the servo amplifier side is changed by the following method, the Simple Motion module reads parameters automatically, and the data is transmitted to the servo parameter area in the buffer memory/internal memory and internal memory (nonvolatile).

(1) When changing the servo parameters by the auto tuning.
(2) When the servo parameter is changing after the MR Configurator2 is connected directly with the servo amplifier.

7.2 Data transmission process

The data is transmitted between the memories of Simple Motion module with steps (1) to (10) shown below.

＊: The data transmission patterns correspond to the numbers (1) to (10) in the following drawings.



(1) Transmitting data when power is turned ON or PLC CPU is reset (➡)

When the power is turned ON or the PLC CPU is reset, the "parameters area (c)＊1", "positioning data", "block start data" and "servo parameter" stored (backed up) in the flash ROM/internal memory (nonvolatile) are transmitted to the buffer memory and internal memory.

The value stored in the flash ROM is valid for "Pr.96 Operation cycle setting".

＊1: Parameter area (c)...... Parameters validated with power supply ON/ PLC CPU reset.
(Pr.96, Pr.97, Pr.114, Pr.800 to Pr.807)

(2) Transmitting data with TO command from PLC CPU (⇨)

The parameters or data is written from the PLC CPU to the buffer memory using the TO command＊2. At this time, when the "parameter area (b)＊3", "positioning data", "block start data", "control data" and "PLC CPU memo area" are written into the buffer memory with the TO command, it is simultaneously valid.

＊2: "Servo parameter (PA19, PD, PE, PS, PF, Po, PL)", "Positioning data (No.101 to 600)" and "Block start data (No.7002 to 7004)" can be set with only GX Works2 in QD77MS16.

＊3: Parameter area (b) ..... Parameters validated with next each positioning control is started.
(Pr.8 to Pr.10, Pr.25 to Pr.42, Pr.84)

POINT

When a value other than "0" has been set to the servo parameter "Pr.100 Servo series" inside the internal memory (nonvolatile), the power is turned ON or PLC CPU is reset to transmit the servo parameter inside the internal memory (nonvolatile) to the servo amplifier (servo amplifier LED indicates "b□").

After that, the TO instruction writes the servo parameter from the PLC CPU to the buffer memory so that the servo parameter in the buffer memory is not transmitted to the servo amplifier even if the PLC READY signal [Y0] is turned OFF then ON.

Change the servo parameter with the above method, after setting the servo parameter "Pr.100 Servo series" inside the internal memory (nonvolatile), to "0".

(3) Validate parameters when PLC READY signal [Y0] changes from OFF to ON

When the PLC READY signal [Y0] changes from OFF to ON, the data stored in the buffer memory's "parameter area (a)＊4" is validated.

＊4: Parameter area (a) .... Parameters validated when PLC READY signal [Y0] changes from OFF to ON.
(Pr.1 to Pr.7, Pr.11 to Pr.24, Pr.43 to Pr.57, Pr.80 to Pr.83, Pr.89 to Pr.95)

POINT

The setting values of the parameters that correspond to parameter area (b) are valid when written into the buffer memory with the TO command.
However, the setting values of the parameters that correspond to parameter area (a) are not validated until the PLC READY signal [Y0] changes from OFF to ON.

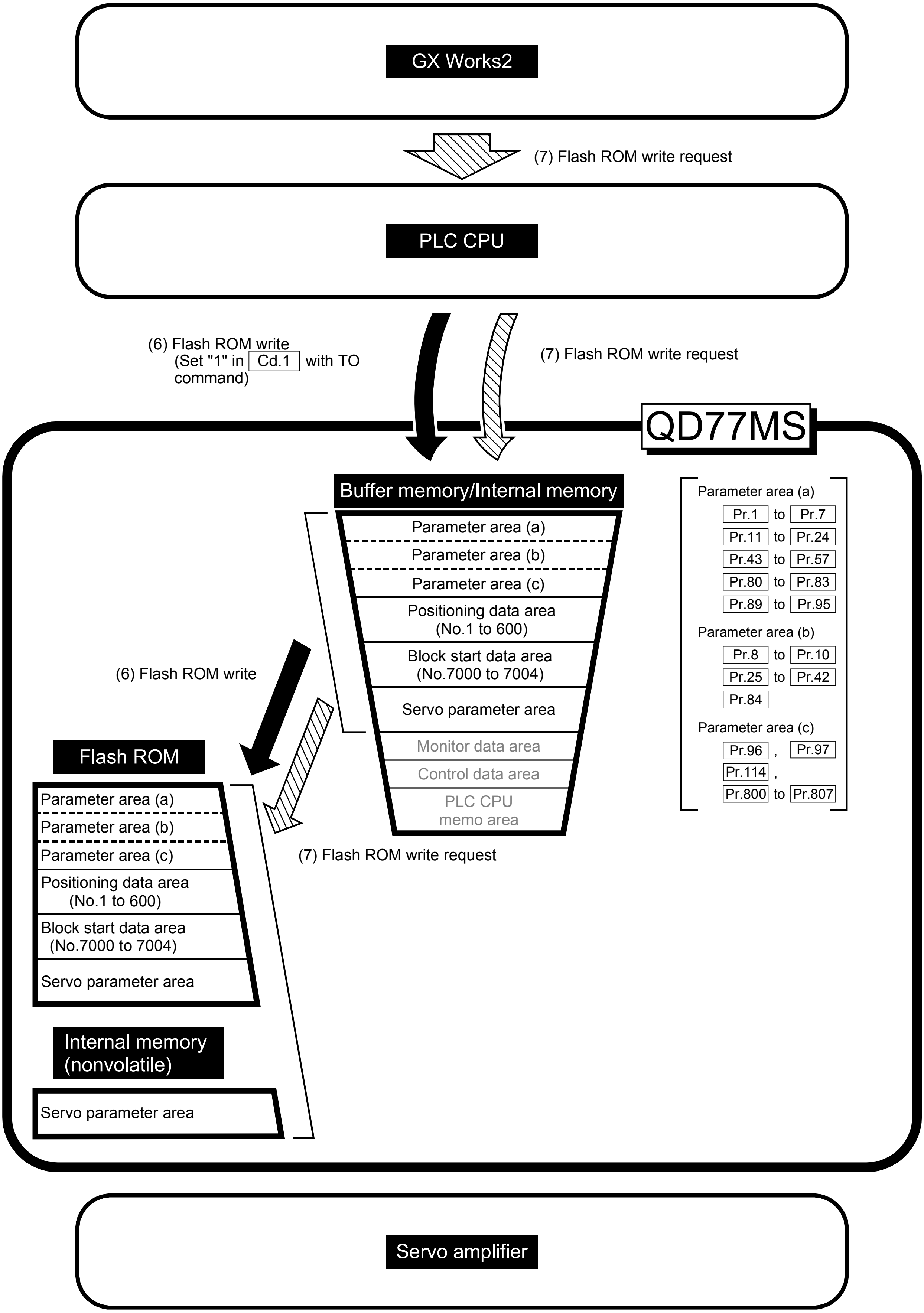
(4) Accessing with FROM command from PLC CPU (⇨)

The data is read from the buffer memory to the PLC CPU using the FROM command[*5].

＊5: "Servo parameter (PA19, PD, PE, PS, PF, Po, PL)", "Positioning data (No.101 to 600)" and "Block start data (No.7002 to 7004)" can be read with only GX Works2 in QD77MS16.

(5) Reading the servo parameter from the servo amplifier (⇨)

When the parameter of the servo amplifier side is changed, the servo parameter is read automatically from the servo amplifier to the buffer memory/internal memory and internal memory (nonvolatile).


GX Works2
(7) Flash ROM write request
PLC CPU
(6) Flash ROM write
(Set "1" in Cd.1 with TO command)
(7) Flash ROM write request
QD77MS
Buffer memory/Internal memory
Parameter area (a)
Parameter area (b)
Parameter area (c)
Positioning data area (No.1 to 600)
Block start data area (No.7000 to 7004)
Servo parameter area
Monitor data area
Control data area
PLC CPU memo area
Parameter area (a)
Pr.1 to Pr.7
Pr.11 to Pr.24
Pr.43 to Pr.57
Pr.80 to Pr.83
Pr.89 to Pr.95
Parameter area (b)
Pr.8 to Pr.10
Pr.25 to Pr.42
Pr.84
Parameter area (c)
Pr.96 , Pr.97
Pr.114 ,
Pr.800 to Pr.807
(6) Flash ROM write
(7) Flash ROM write request
Flash ROM
Parameter area (a)
Parameter area (b)
Parameter area (c)
Positioning data area (No.1 to 600)
Block start data area (No.7000 to 7004)
Servo parameter area
Internal memory (nonvolatile)
Servo parameter area
Servo amplifier

(6) Writing the flash ROM by a PLC CPU request (➡)

The following transmission process is carried out by setting "1" in "Cd.1 Flash ROM write request".

1) The "parameters", "positioning data (No. 1 to 600)", "block start data (No. 7000 to 7004)" and "servo parameter" in the buffer memory/internal memory area are transmitted to the flash ROM/internal memory (nonvolatile).

The writing to the flash ROM may also be carried out using a dedicated instruction "ZP.PFWRT". (Refer to Chapter 15 "Dedicated Instructions" for details.)

(7) Writing the flash ROM by a GX Works2 request (⇨)

The following transmission processes are carried out with the [flash ROM write request] from the GX Works2.

1) The "parameters", "positioning data (No. 1 to 600)", "block start data (No. 7000 to 7004)" and "servo parameter" in the buffer memory/internal memory area are transmitted to the flash ROM/internal memory (nonvolatile).

Note) This transmission process is the same as (6) above.

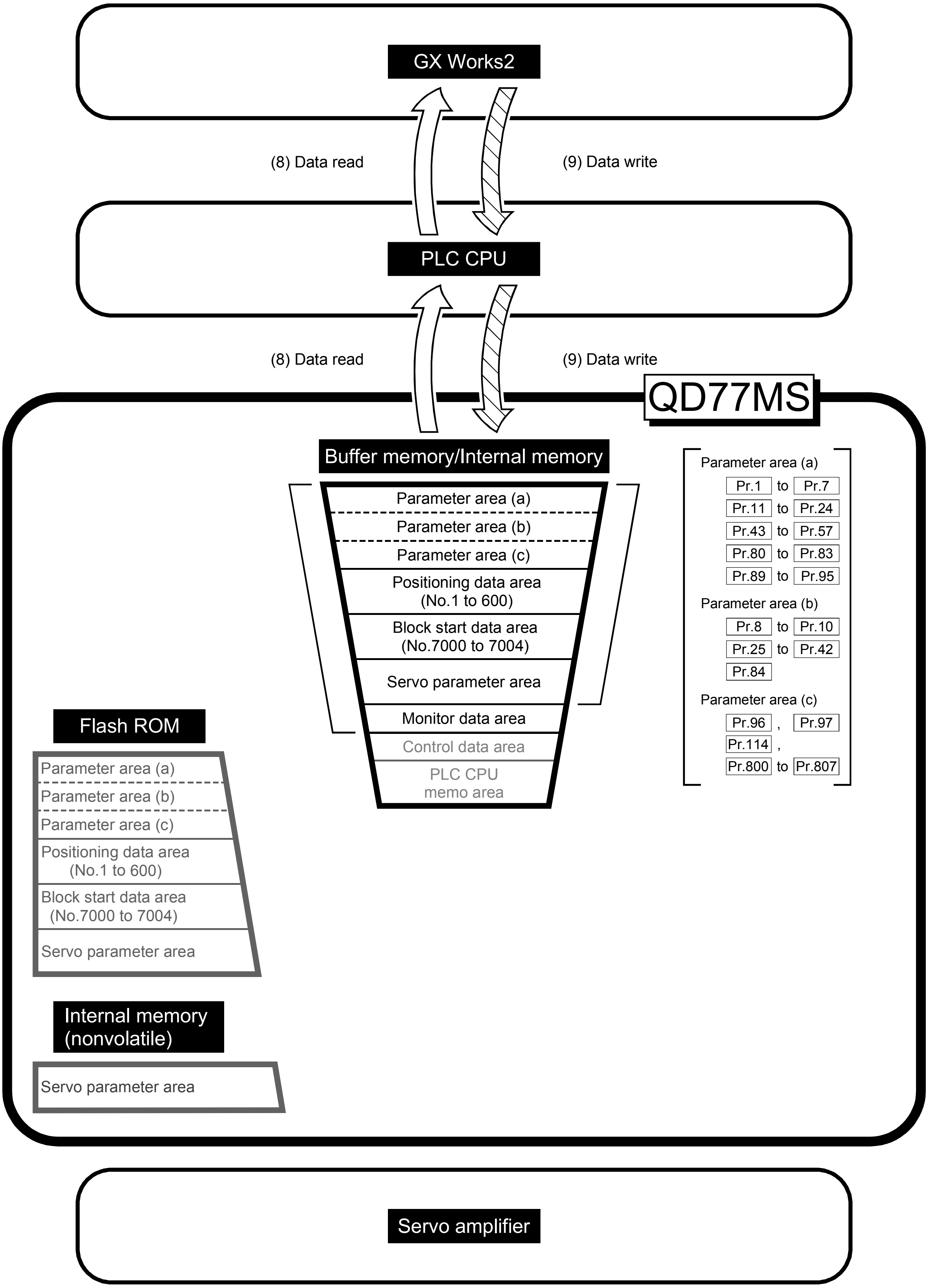
IMPORTANT

(1) Do not turn the power OFF or reset the PLC CPU while writing to the flash ROM. If the power is turned OFF or the PLC CPU is reset to forcibly end the process, the data backed up in the flash ROM/internal memory (nonvolatile) will be lost.

(2) Do not write the data to the buffer memory/internal memory before writing to the flash ROM is completed.

(3) The number of writes to the flash ROM with the sequence program is 25 max. while the power is turned ON.
Writing to the flash ROM beyond 25 times will cause an error (error code: 805).
Refer to Section 16.5 "List of errors" for details.

(4) Monitoring is the number of writes to the flash ROM after power supply ON by the "Md.19 Number of write accesses to flash ROM".


GX Works2
(8) Data read
(9) Data write
PLC CPU
(8) Data read
(9) Data write
QD77MS
Buffer memory/Internal memory
Parameter area (a)
Parameter area (b)
Parameter area (c)
Positioning data area (No.1 to 600)
Block start data area (No.7000 to 7004)
Servo parameter area
Monitor data area
Control data area
PLC CPU memo area
Parameter area (a)
Pr.1 to Pr.7
Pr.11 to Pr.24
Pr.43 to Pr.57
Pr.80 to Pr.83
Pr.89 to Pr.95
Parameter area (b)
Pr.8 to Pr.10
Pr.25 to Pr.42
Pr.84
Parameter area (c)
Pr.96 , Pr.97
Pr.114 ,
Pr.800 to Pr.807
Flash ROM
Parameter area (a)
Parameter area (b)
Parameter area (c)
Positioning data area (No.1 to 600)
Block start data area (No.7000 to 7004)
Servo parameter area
Internal memory (nonvolatile)
Servo parameter area
Servo amplifier

(8) Reading data from buffer memory/internal memory to GX Works2 (⇨)

The following transmission processes are carried out with the [Read from module (Read from QD77MS)] from the GX Works2.

1) The "parameters", "positioning data (No. 1 to 600)", "block start data (No. 7000 to 7004)" and "servo parameter" in the buffer memory/internal memory area are transmitted to the GX Works2 via the PLC CPU.

The following transmission processes are carried out with the [monitor] from the GX Works2.

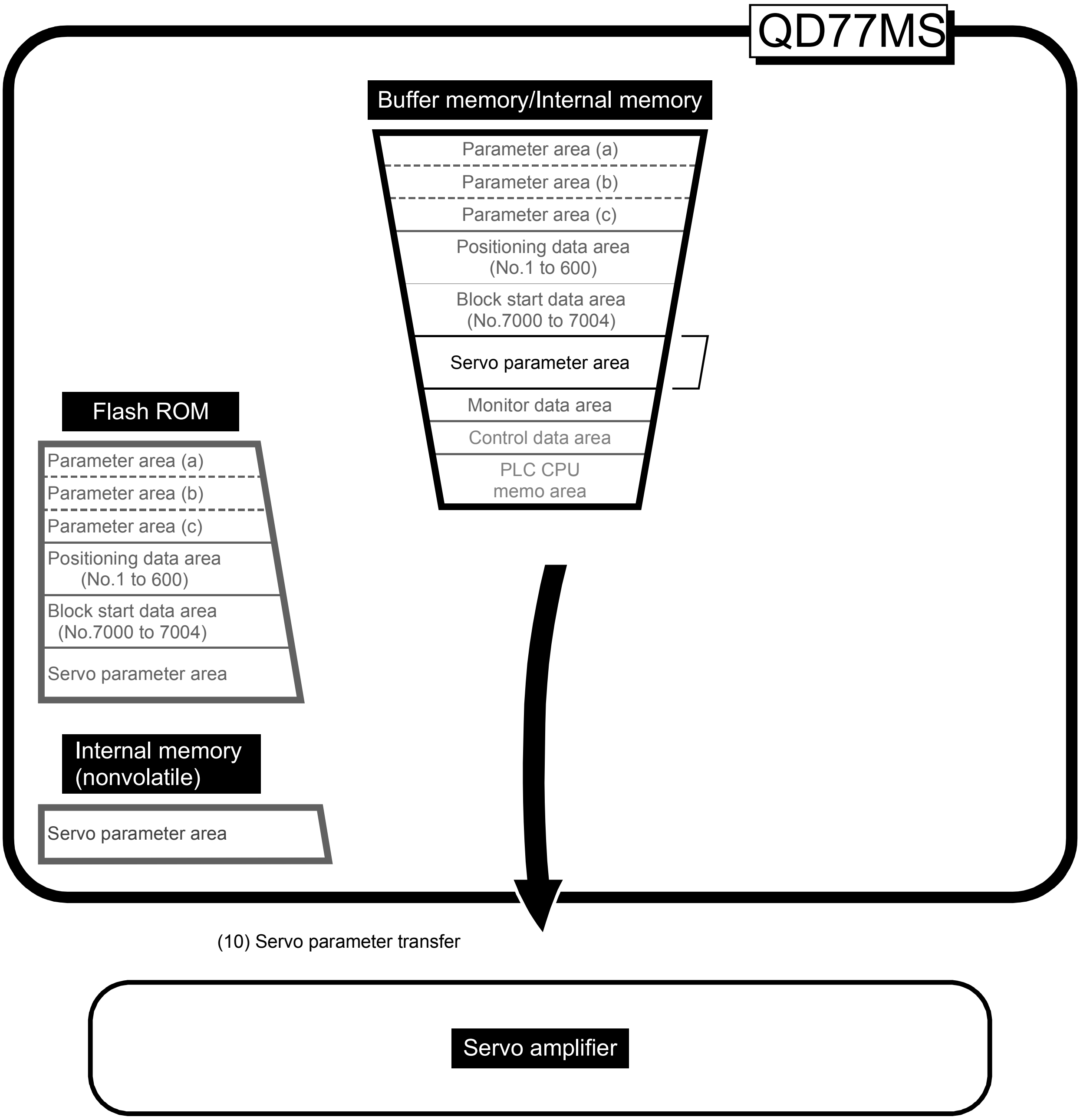
2) The "monitor data" in the buffer memory area is transmitted to the GX Works2 via the PLC CPU.

(9) Writing data from GX Works2 to buffer memory/internal memory (➩)

The following transmission processes are carried out with the [Write to module (Write to QD77MS)] from the GX Works2.

1) The "parameters", "positioning data (No. 1 to 600)", "block start data (No. 7000 to 7004)" and "servo parameter" in the GX Works2 are transmitted to the buffer memory/internal memory via the PLC CPU.

At this time, when [Flash ROM automatic write] is set with the GX Works2, the transmission processes indicated with "(7) Flash ROM write" are carried out.


QD77MS
Buffer memory/Internal memory
Parameter area (a)
Parameter area (b)
Parameter area (c)
Positioning data area (No.1 to 600)
Block start data area (No.7000 to 7004)
Servo parameter area
Monitor data area
Control data area
PLC CPU memo area
Flash ROM
Parameter area (a)
Parameter area (b)
Parameter area (c)
Positioning data area (No.1 to 600)
Block start data area (No.7000 to 7004)
Servo parameter area
Internal memory (nonvolatile)
Servo parameter area
(10) Servo parameter transfer
Servo amplifier

(10) Transmitting servo parameter from the buffer memory/internal memory area to servo amplifier (➡)

The servo parameter in the buffer memory/internal memory area is transmitted to the servo amplifier by the following timing.

1) The servo parameter is transmitted to the servo amplifier when communications with servo amplifier start.
   The "expansion parameter" and "servo parameter" in the buffer memory area is transmitted to the servo amplifier.

2) The following servo parameter in the buffer memory area are transmitted to the internal memory (nonvolatile) and servo amplifier when the PLC READY signal [Y0] turns from OFF to ON.
   - "Auto tuning mode (PA08)"
   - "Auto tuning response (PA09)"
   - "Feed forward gain (PB04)"
   - "Load to motor inertia ratio/load to motor mass ratio (PB06)"
   - "Model loop gain (PB07)"
   - "Position loop gain (PB08)"
   - "Speed loop gain (PB09)"
   - "Speed integral compensation (PB10)"
   - "Speed differential compensation (PB11)"

POINT

When the PLC READY signal [Y0] is turned ON, an error (error code: 1205) occurs, "Rotation direction selection/travel direction selection (PA14)" is changed by sequence program or the GX Works2 after the servo parameter is transmitted to servo amplifier (LED of the servo amplifier is indicated b□, C□, or d□).
When "Rotation direction selection/travel direction selection (PA14)" is changed, transmit the servo parameter to servo amplifier.

■ About the communication start with servo amplifier

Communication with servo amplifier is valid when following condition is realized together.

1) The power of Simple Motion module and servo amplifier is turned ON.

2) When the servo parameter "Pr.100 Servo series" inside the buffer memory area is set to the value other than "0" in Simple Motion module.

When the power is turned ON or the PLC CPU is reset, the data stored in the flash ROM/internal memory (nonvolatile) is transmitted to the buffer memory/internal memory.
Therefore the servo parameter "Pr.100 Servo series" inside the internal memory (nonvolatile) is stored to the value other than "0", and communication with servo amplifier is started when the power is turn ON in order of the servo amplifier, Simple Motion module.
After the servo parameter stored in the internal memory (nonvolatile) is transmitted to the servo amplifier.

■ How to transfer the servo parameter setup from sequence program/GX Works2 to the servo amplifier

The servo series of servo parameter "Pr.100 Servo series" inside the internal memory (nonvolatile) set to "0". (Initial value: "0")
The setting value of the parameters that correspond to the servo parameter "Pr.100 Servo series" inside the internal memory (nonvolatile) becomes valid when the power is turned ON or the PLC CPU is reset, after the communication with servo amplifier is not started.
However, the PLC READY signal [Y0] is changed from OFF to ON after setting the servo parameters ("Pr.100 Servo series": except for 0) with sequence program/GX Woroks2 the communication with servo amplifier starts.

■ How to transfer the servo parameter which wrote it in the internal memory (nonvolatile) to servo amplifier

Flash ROM writing carried out after the servo parameter is set up in the buffer memory/internal memory.
After that, when the power is turned ON or the PLC CPU is reset, the servo parameters stored in the internal memory (nonvolatile) is transmitted to the buffer memory/internal memory.
When the servo parameter is written in the internal memory (nonvolatile), it is unnecessary to use a setup from the sequence program/GX Works2.

■ Servo parameter of the buffer memory/internal memory

The followings show details about the operation timing and details at transmitting the servo parameter of the buffer memory/internal memory.

POINT

(1) When the servo parameter is written in the internal memory (nonvolatile), it is unnecessary to use a setup from the sequence program/GX Works2.
(2) Axis connection time varies depending on the number of axes and the servo amplifier's power supply ON timing. And, time when "20: Servo amplifier has not been connected/servo amplifier power OFF" is set in "Md.26 Axis operation status" is also varies.

(1) When the servo amplifier's power supply is turned ON before the system's power supply ON.

(a) When the servo parameter "Pr.100 Servo series" ≠ "0" is stored in the internal memory (nonvolatile).

Communication start timing to the servo amplifier: Initialization completion (Fig. 7.1 (A))

Transfer the servo parameter : The data stored (backed up) in the internal memory (nonvolatile).

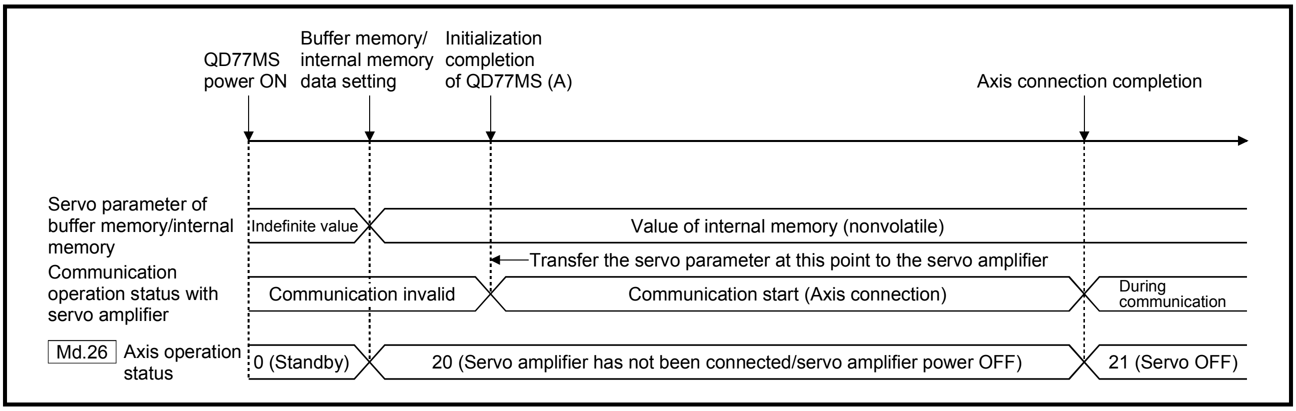


Fig. 7.1 When the servo amplifier had started before the system's power supply ON (The servo series of internal memory (nonvolatile) is set.)

(b) When the servo parameter "Pr.100 Servo series" = "0" is stored in the internal memory (nonvolatile).

Communication start timing to the servo amplifier: The data written from sequence program before the PLC READY signal [Y0] ON (Fig. 7.2 (B)).

Transfer the servo parameter : The data written from sequence program/ GX Works2 before the PLC READY signal [Y0] ON (Fig. 7.2 (A)).

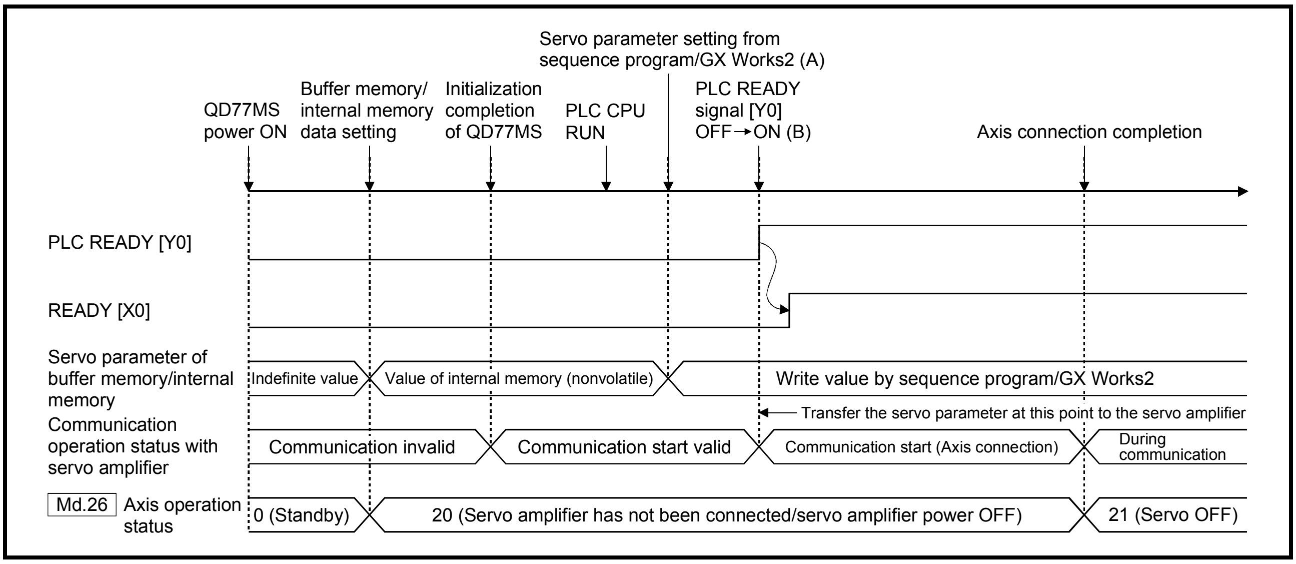


Fig. 7.2 When the servo amplifier had started before the system's power supply ON
(The servo series of internal memory (nonvolatile) is not set.)

(2) When the servo amplifier's power supply is turned ON after the PLC READY signal [Y0] is turned OFF to ON (Fig. 7.3 (C)).

Communication start timing to the servo amplifier: When the servo amplifier had started (Fig. 7.3 (B)).

Transfer the servo parameter : The data written from sequence program/ GX Works2 before the PLC READY signal [Y0] ON (Fig. 7.3 (A)).

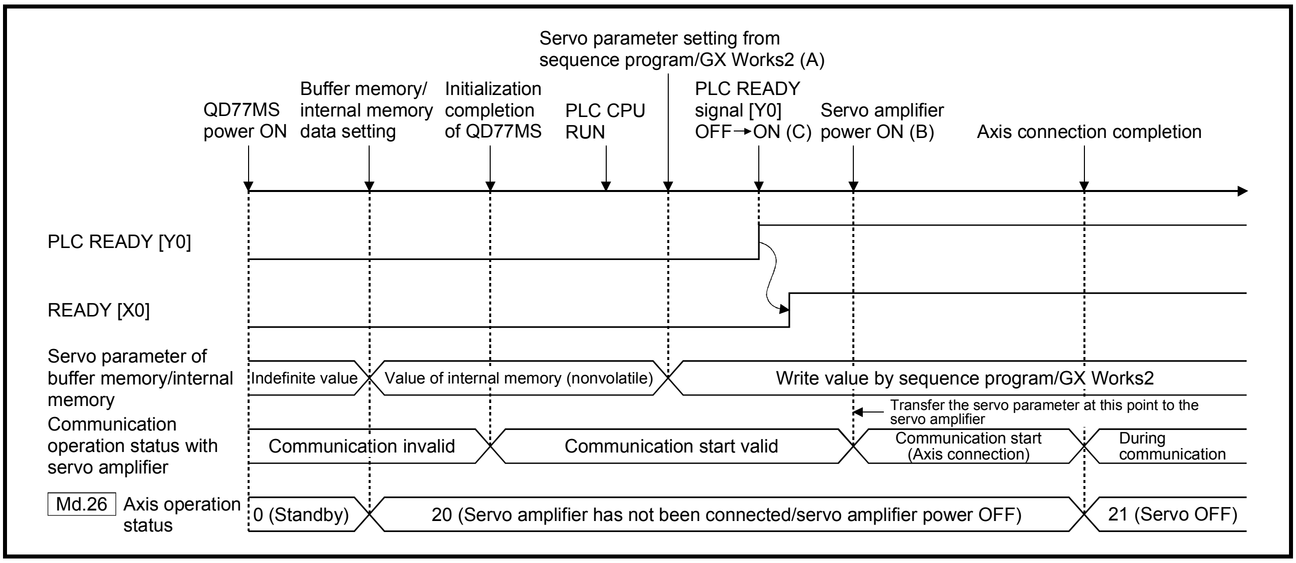


Fig. 7.3 When the servo amplifier had started after the PLC READY signal [Y0] is turned OFF to ON

■ How to change individually the servo parameter after transfer of servo parameter

The servo parameters can be individually changed from Simple Motion module with the following axis control data.

Setting item		Setting details	Buffer memory address	
			QD77MS2 QD77MS4	QD77MS16
Cd.130	Parameter write request	Set the write request of servo parameter. Set "1" or "2" after setting "Cd.131 Parameter No." and "Cd.132 Change data". 1 : 1 word write request 2 : 2 words write request Other than 1 and 2 : Not request	1554+100n	4354+100n
Cd.131	Parameter No.	Set the servo parameter to be changed.	1555+100n	4355+100n
Cd.132	Change data	Set the change value of servo parameter set in "Cd.131 Parameter No.".	1556+100n 1557+100n	4356+100n 4357+100n

n: Axis No.-1

POINT

(1) Both of the servo parameter area (internal memory (nonvolatile) and buffer memory/internal memory) of Simple Motion module and the parameter of servo amplifier are changed.

(2) When the servo parameters that become valid by turning ON the servo amplifier's power supply are changed, be sure to turn ON (Note) twice the servo amplifier's power supply after change.

(Note): The servo amplifier's RAM data are changed by parameter setting, but the servo amplifier's EEPROM data are not changed. The EEPROM data before the change are overwritten to RAM by the servo amplifier's power supply ON again, and then the servo amplifier starts.
After that, the changed data are written to the servo amplifier's EEPROM in an initial communication with Simple Motion module.
Therefore, the changed data are overwritten to the RAM data by turning the servo amplifier's power supply ON again.

MEMO

Section 2 Control Details and Setting

Section 2 is configured for the following purposes shown in (1) to (3).

(1) Understanding of the operation and restrictions of each control.
(2) Carrying out the required settings in each control
(3) Dealing with errors

The required settings in each control include parameter setting, positioning data setting, control data setting by a sequence program, etc.
Carry out these settings while referring to "Chapter 5 Data Used for Positioning Control".
Also refer to "Chapter 6 Sequence Program Used for Positioning Control" when creating the sequence programs required in each control, and consider the entire control program configuration when creating each program.

MEMO

Chapter 8 OPR Control

The details and usage of "OPR control" are explained in this chapter.

OPR control includes "machine OPR" that establish a machine OP without using address data, and "fast OPR" that store the coordinates established by the machine OPR, and carry out positioning to that position.
OPR carried out by sequence programs from the PLC CPU are explained in this chapter.
Refer to the "Simple Motion Module Setting Tool Help" of GX Works2 for details on OPR using the GX Works2.

8.1 Outline of OPR control

8.1.1 Two types of OPR control

In "OPR control" a position is established as the starting point (or "OP") when carrying out positioning control, and positioning is carried out toward that starting point.
It is used to return a machine system at any position other than the OP to the OP when the Simple Motion module issues an "OPR request" (Note-1) with the power turned ON or others, or after a positioning stop.

In the Simple Motion module, the two types of controls shown below are defined as "OPR control", following the flow of the OPR work.
These two types of OPR control can be executed by setting the "OPR parameters", setting "Positioning start No. 9001" and "positioning start No. 9002" prepared beforehand in the Simple Motion module to " Cd.3 Positioning start No.", and turning ON the positioning start signal.
The ZP.PSTRT□ start numbers of the dedicated instruction can also be set to 9001 or 9002 to execute the OPR control. (For details, refer to Chapter 15 "Dedicated Instructions".)

(1) Establish a positioning control OP
    – "Machine OPR" (positioning start No. 9001)
(2) Carry out positioning toward the OP
    – "Fast OPR" (positioning start No. 9002).

The "machine OPR" above must always be carried out before executing the "fast OPR".

⚠CAUTION

- When using the absolute position system function, on starting up, and when the controller or absolute value motor has been replaced, always perform an OPR.
  In the case of the absolute position system, use the sequence program to check the OPR request before performing the positioning control.
  Failure to observe this could lead to an accident such as a collision.

REMARK

OPR request (Note-1)

The "OPR request flag" (Md.31 Status: b3) must be turned ON in the Simple Motion module, and a machine OPR must be executed in the following cases.

(1) When not using an absolute position system
  (a) This flag turns on in the following cases:
    - System's power supply on or reset
    - Servo amplifier power supply on
    - Machine OPR start
      (Unless a machine OPR is completed normally, the OPR request flag does not turn off.)

  (b) This flag turns off by the completion of machine OPR.

(2) When using an absolute position system
  (a) This flag turns on in the following cases:
    - When not executing a machine OPR once after system start.
    - Machine OPR start
      (Unless a machine OPR is completed normally, the OPR request flag does not turn off.)
    - Erase of an absolute position data in the Simple Motion module according to causes, such as battery error (error [1201] occurrence)
    - Error [2025] (absolute position erase) occurrence
      (Md.108 Servo status (high-order buffer memory address) b14 ON)
    - Warning [2143] (absolute position counter warning) occurrence
      (Md.108 Servo status (high-order buffer memory address) b14 ON)

	Buffer memory address (high-order)	
	QD77MS2/QD77MS4	QD77MS16
Md.108 Servo status: b14	877+100n	2477+100n

n: Axis No.-1

    - When the "Rotation direction selection/travel direction selection (PA14)" of servo parameter is changed.
  (b) This flag turns off by the completion of the machine OPR.

The address information stored in the Simple Motion module cannot be guaranteed while the "OPR request flag" is ON.
The "OPR request flag" turns OFF and the "OPR complete flag" (Md.31 Status: b4) turns ON if the machine OPR is executed and is completed normally.

■ Wiring the near-point dog

The "external input signal of QD77MS", "external input signal of the servo amplifier" or "buffer memory of QD77MS" can be selected by "Pr.80 External input signal selection" as the near-point dog.
When the "buffer memory of QD77MS" is selected, the wiring differs according to the Input module used. As for the 24VDC power supply, the direction of current can be switched.

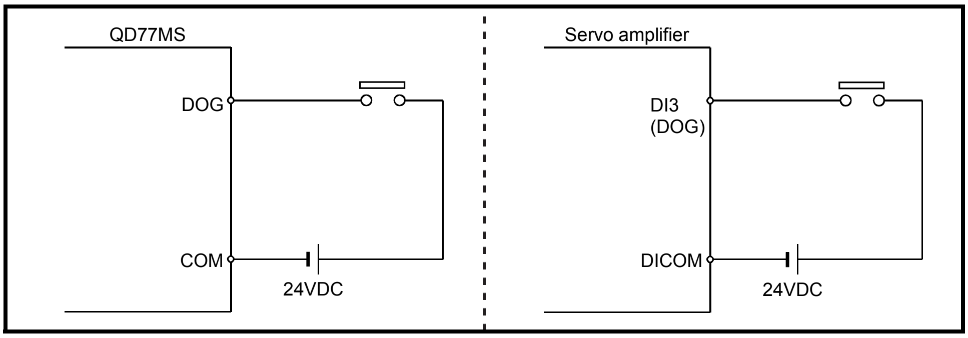


Fig. 8.1 Wiring when using the near-point dog

■ OPR sub functions

Refer to Section 3.2.5 "Combination of QD77MS main functions and sub functions" for details on "sub functions" that can be combined with OPR control. Also refer to Chapter 13 "Control Sub Functions" for details on each sub function.

[Remarks]

The following two sub functions are only related to machine OPR.

Sub function name	Machine OPR	Fast OPR	Reference
OPR retry function	△	×	Section 13.2.1
OP shift function	○	×	Section 13.2.2

○ : Combination possible, △: Restricted, ×: Combination not possible

■ When an OPR is not required

Control can be carried out ignoring the "OPR request flag" (Md.31 Status: b3) in systems that do not require an OPR.
In this case, the "OPR parameters (Pr.43 to Pr.57)" must all be set to their initial values or a value at which an error does not occur.

■ OPR from GX Works2

"Machine OPR" and "fast OPR" can be executed from the test function of the GX Works2.
Refer to the "Simple Motion Module Setting Tool Help" of GX Works2 for details on OPR from the GX Works2.

8.2 Machine OPR

8.2.1 Outline of the machine OPR operation

Important

Use the OPR retry function when the OP position is not always in the same direction from the workpiece operation area (when the OP is not set near the upper or lower limit of the machine).
The machine OPR may not complete unless the OPR retry function is used.

■ Machine OPR operation

In a machine OPR, OP is established.
None of the address information stored in the Simple Motion module, PLC CPU, or servo amplifier is used at this time. The position mechanically established after the machine OPR is regarded as the "OP" to be the starting point for positioning control.
The method for establishing an "OP" by a machine OPR differs according to the method set in "Pr.43 OPR method".
The following shows the operation when starting a machine OPR.

1)	The "machine OPR" is started.
2)	The operation starts according to the speed and direction set in the OPR parameters (Pr.43 to Pr.57).
3)	The "OP" is established by the method set in "Pr.43 OPR method", and the machine stops. (Refer to Sections 8.2.2 to 8.2.7)
4)	If "a" is set as "Pr.45 OP address", "a" will be stored as the current position in the "Md.20 Current feed value" and "Md.21 Machine feed value" which are monitoring the position.
5)	The machine OPR is completed.

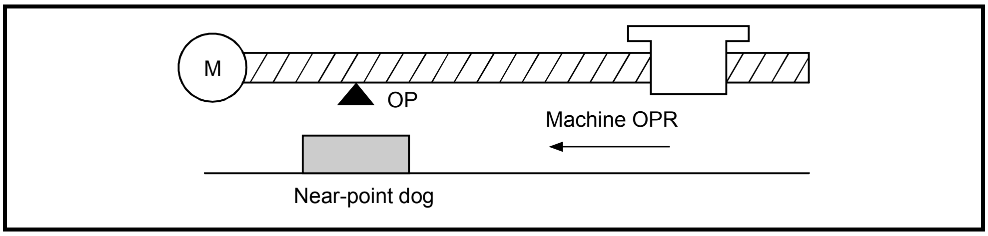


Fig. 8.2 Example of a machine OPR

8.2.2 Machine OPR method

The method by which the machine OP is established (method for judging the OP position and machine OPR completion) is designated in the machine OPR according to the configuration and application of the positioning method.
The following table shows the methods that can be used for this OPR method.
(The OPR method is one of the items set in the OPR parameters. It is set in "Pr.43 OPR method" of the basic parameters for OPR.)

Pr.43 OPR method	Operation details
Near-point dog method	Deceleration starts by the OFF → ON of the near-point dog. (Speed is reduced to "Pr.47 Creep speed".) The operation stops once after the near-point dog turns ON and then OFF. Later the operation restarts and then stops at the first zero signal to complete the OPR.
Count method 1)	The deceleration starts by the OFF → ON of the near-point dog, and the machine moves at the "Pr.47 Creep speed". The machine stops once after moving the distance set in the "Pr.50 Setting for the movement amount after near-point dog ON" from the OFF → ON position. Later the operation restarts and then stops at the first zero point to complete the machine OPR.
Count method 2)	The deceleration starts by the OFF → ON of the near-point dog, and the machine moves at the "Pr.47 Creep speed. The machine moves the distance set in the "Pr.50 Setting for the movement amount after near-point dog ON" from the near-point dog OFF → ON position, and stops at that position. The machine OPR is then regarded as completed.
Data set method	The position where the machine OPR has been performed becomes an OP. The current feed value and feed machine value are overwritten to the OP address.
Scale origin signal detection method	The machine moves in the opposite direction against of "Pr.44 OPR direction" at the "Pr.46 OPR speed" by the OFF → ON of the near-point dog, and a deceleration stop is carried out once at the first zero signal. Later the operation moves in direction of "Pr.44 OPR direction" at the "Pr.47 Creep speed", and then stops at the detected nearest zero point to complete the machine OPR.

REMARK

Creep speed
The stopping accuracy is poor when the machine suddenly stops from fast speeds. To improve the machine's stopping accuracy, its must change over to a slow speed before stopping. This speed is set in the "Pr.47 Creep speed".

The following shows the signals as required for machine OPR.

Pr.43 OPR method	Signals required for control		
	Near-point dog	Zero signal	Upper/lower limit
Near-point dog method	◎	◎	○
Count method 1)	◎	◎	○
Count method 2)	◎	−	○
Data set method	−	−	−
Scale origin signal detection method	◎	◎	−

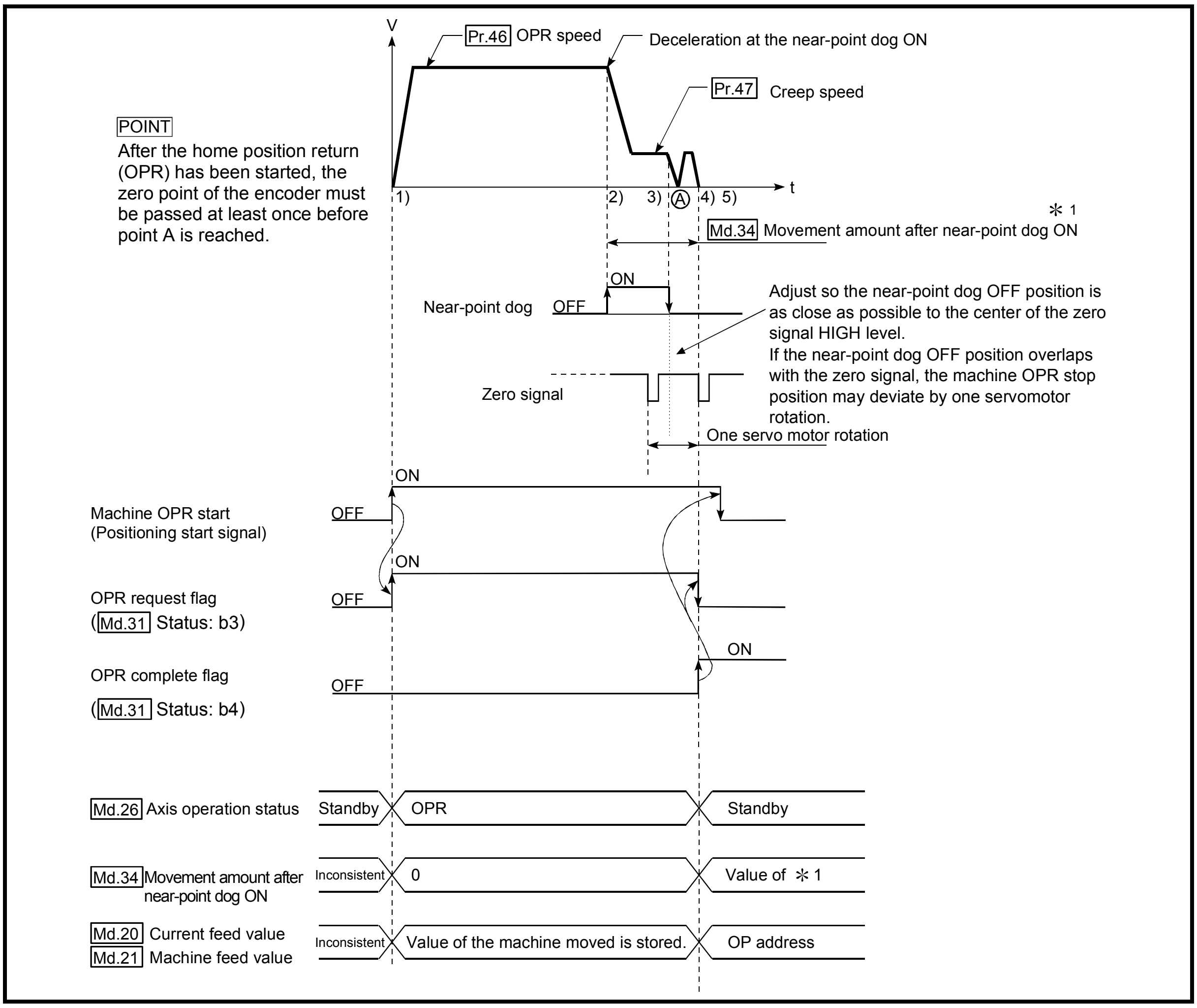
◎: Necessary, ○: Necessary as required, −: Unnecessary

8.2.3 OPR method (1): Near-point dog method

The following shows an operation outline of the "near-point dog method" OPR method.

■ Operation chart

1)	The machine OPR is started. (The machine begins the acceleration designated in "Pr.51 OPR acceleration time selection", in the direction designated in "Pr.44 OPR direction". It then moves at the "Pr.46 OPR speed" when the acceleration is completed.)
2)	The machine begins decelerating when the near-point dog ON is detected.
3)	The machine decelerates to the "Pr.47 Creep speed", and subsequently moves at that speed. (At this time, the near-point dog must be ON. The workpiece will continue decelerating and stop if the near-point dog is OFF.)
4)	After the near-point dog turns OFF, the machine stops. It then restarts and stops at the first zero point.
5)	The OPR complete flag (Md.31 Status: b4) turns from OFF to ON and the OPR request flag (Md.31 Status: b3) turns from ON to OFF.



POINT
After the home position return (OPR) has been started, the zero point of the encoder must be passed at least once before point A is reached.

Adjust so the near-point dog OFF position is as close as possible to the center of the zero signal HIGH level.
If the near-point dog OFF position overlaps with the zero signal, the machine OPR stop position may deviate by one servomotor rotation.

Fig. 8.3 Near-point dog method machine OPR

■ Precautions during operation

(1) An error "Start at home position (OP) fault (error code: 201)" will occur if another machine OPR is attempted after a machine OPR completion when the OPR retry function is not set ("0" is set in "Pr.48 OPR retry").

(2) Machine OPR carried out from the near-point dog ON position will start at the "Pr.47 Creep speed".

(3) The near-point dog must be ON during deceleration from the OPR speed "Pr.47 Creep speed".

(4) When the stop signal stops the machine OPR, carry out the machine OPR again. When restart command is turned ON after the stop signal stops the OPR, the error "OPR restart impossible (error code: 209)" will occur.

(5) After the home position return (OPR) has been started, the zero point of the encoder must be passed at least once before point A is reached.
However, if selecting "1: Not need to pass servo motor Z-phase after power on" with "Function selection C-4 (PC17)", it is possible to carry out the home position return (OPR) without passing the zero point.
The workpiece will continue decelerating and stop if the near-point dog is turned OFF before it has decelerated to the creep speed, thus causing an error "Dog detection timing fault (error code: 203)".

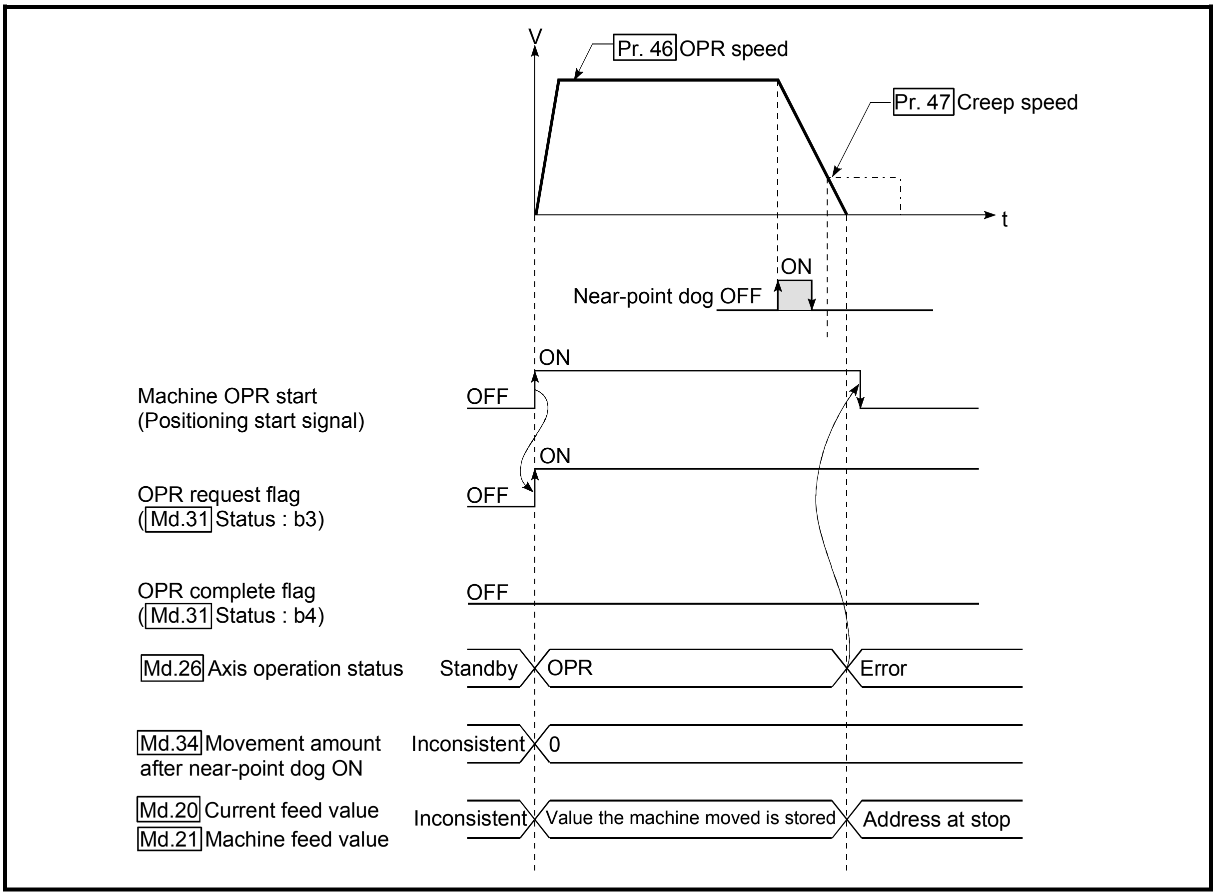


Fig. 8.4 Operation when the near-point dog is turned OFF before the creep speed is reached

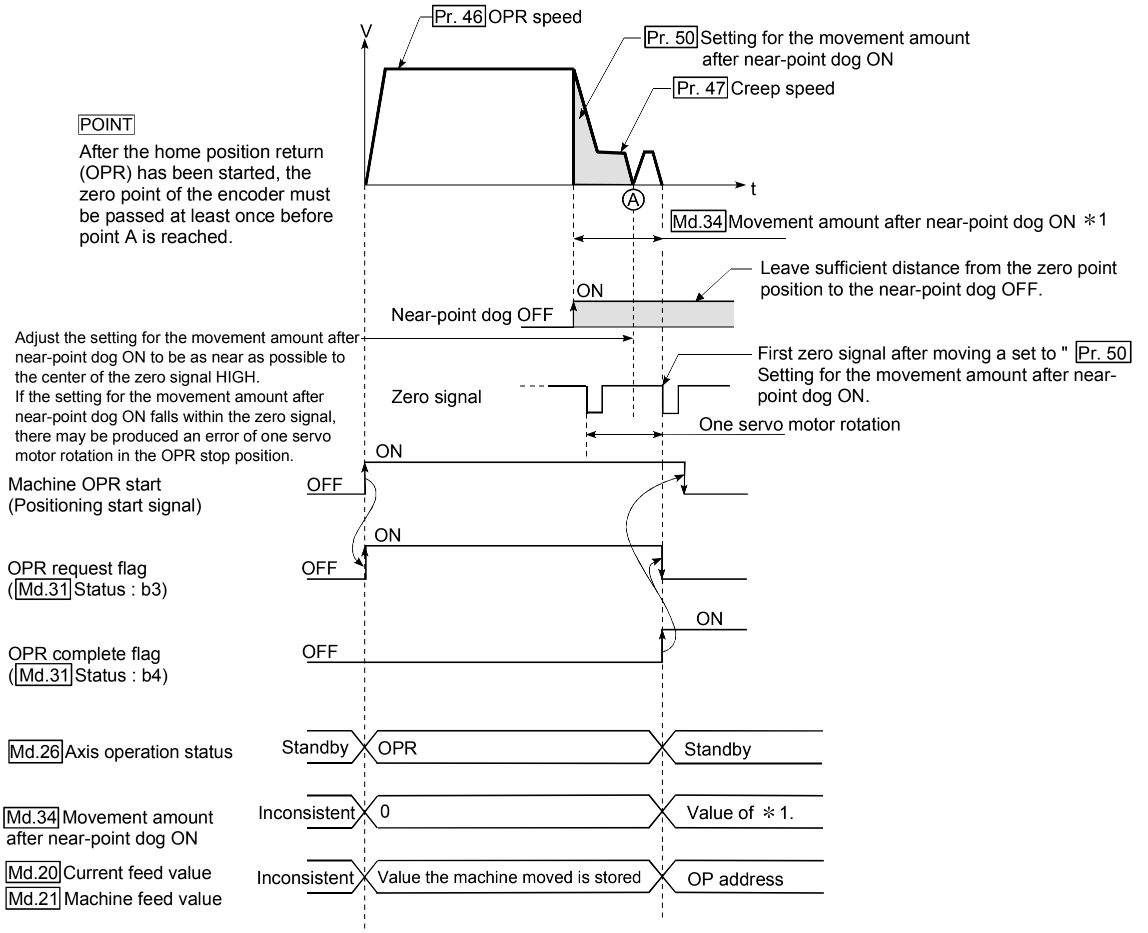
8.2.4 OPR method (2): Count method 1)

The following shows an operation outline of the "count method 1)" OPR method.
In the "count method 1)" OPR, the following can be performed:

- Machine OPR on near-point dog
- Second machine OPR after completion of first machine OPR

■ Operation chart

1)	The machine OPR is started. (The machine begins the acceleration designated in "Pr.51 OPR acceleration time selection", in the direction designated in "Pr.44 OPR direction". It then moves at the "Pr.46 OPR speed" when the acceleration is completed.)
2)	The machine begins decelerating when the near-point dog ON is detected.
3)	The machine decelerates to the "Pr.47 Creep speed", and subsequently moves at that speed.
4)	The machine stops after the workpiece has been moved the amount set in the "Pr.50 Setting for the movement amount after near-point dog ON" after the near-point dog turned ON. It then restarts and stops at the first zero point.
5)	The OPR complete flag (Md.31 Status: b4) turns from OFF to ON, and the OPR request flag (Md.31 Status: b3) turns from ON to OFF.



POINT
After the home position return (OPR) has been started, the zero point of the encoder must be passed at least once before point A is reached.

Adjust the setting for the movement amount after near-point dog ON to be as near as possible to the center of the zero signal HIGH.
If the setting for the movement amount after near-point dog ON falls within the zero signal, there may be produced an error of one servo motor rotation in the OPR stop position.

Fig. 8.5 Count method1) machine OPR

■ Precautions during operation

(1) An error "Count method movement amount fault (error code: 206)" will occur if the "Pr.50 Setting for the movement amount after near-point dog ON" is smaller than the deceleration distance from the "Pr.46 OPR speed" to "Pr.47 Creep speed".

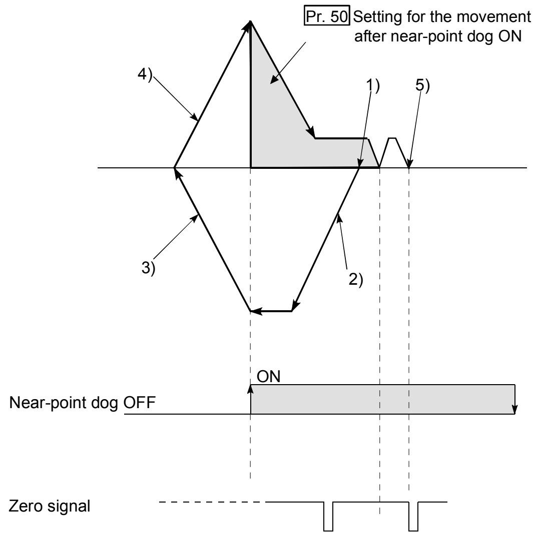
(2) If the speed is changed to a speed faster than "Pr.46 OPR speed" by the speed change function (refer to "13.5.1 Speed change function".) during a machine OPR, the distance to decelerate to "Pr.47 Creep speed" may not be ensured, depending on the setting value of "Pr.50 Setting for the movement amount after near-point dog ON". In this case, the error "Count method movement amount fault" (error code: 206) occurs and the machine OPR is stopped.

(3) The following shows the operation when a machine OPR is started while the near-point dog is ON.

(4) Turn OFF the near-point dog at a sufficient distance from the OP.
Although there is no harm in operation if the near-point dog is turned OFF during a machine OPR, it is recommended to leave a sufficient distance from the OP when the near-point dog is turned OFF for the following reason.
If machine OPRs are performed consecutively after the near-point dog is turned OFF at the time of machine OPR completion, operation will be performed at the OPR speed until the hardware stroke limit (upper/lower limit) is reached.
If a sufficient distance cannot be kept, consider the use of the OPR retry function.

(5) When the stop signal stops the machine OPR, carry out the machine OPR again. When restart command is turned ON after the stop signal stops the OPR, the error "OPR restart impossible (error code: 209)" will occur.

(6) After the home position return (OPR) has been started, the zero point of the encoder must be passed at least once before point A is reached.
However, if selecting "1: Not need to pass servo motor Z-phase after power on" with "Function selection C-4 (PC17)", it is possible to carry out the home position return (OPR) without passing the zero point.



[Operation when a machine OPR is started at the near-point dog ON position]

1) A machine OPR is started.
2) The machine moves at the OPR speed in the opposite direction of an OPR.
3) Deceleration processing is carried out when the near-point dog OFF is detected.
4) After the machine stops, a machine OPR is carried out in the OPR direction.
5) The machine OPR is completed on detection of the first zero signal after the travel of the movement amount set to "Pr.50 Setting for the movement amount after near-point dog ON" on detection of the near-point dog signal ON.

Fig. 8.6 Count method 1) machine OPR on the near-point dog ON position

8.2.5 OPR method (3): Count method 2)

The following shows an operation outline of the "method 2)" OPR method.
The "count method 2)" method is effective when a "zero signal" cannot be received. (Note that compared to the "count method 1)" method, using this method will result in more deviation in the stop position during machine OPR.)

■ Operation chart

1)	The machine OPR is started. (The machine begins the acceleration designated in "Pr.51 OPR acceleration time selection", in the direction designated in "Pr.44 OPR direction". It then moves at the "Pr.46 OPR speed" when the acceleration is completed.)
2)	The machine begins decelerating when the near-point dog ON is detected.
3)	The machine decelerates to the "Pr.47 Creep speed", and subsequently moves at that speed.
4)	The command from the Simple Motion module will stop and the machine OPR will be completed when the machine moves the movement amount set in "Pr.50 Setting for the movement amount after near-point dog ON" from the near-point dog ON position.

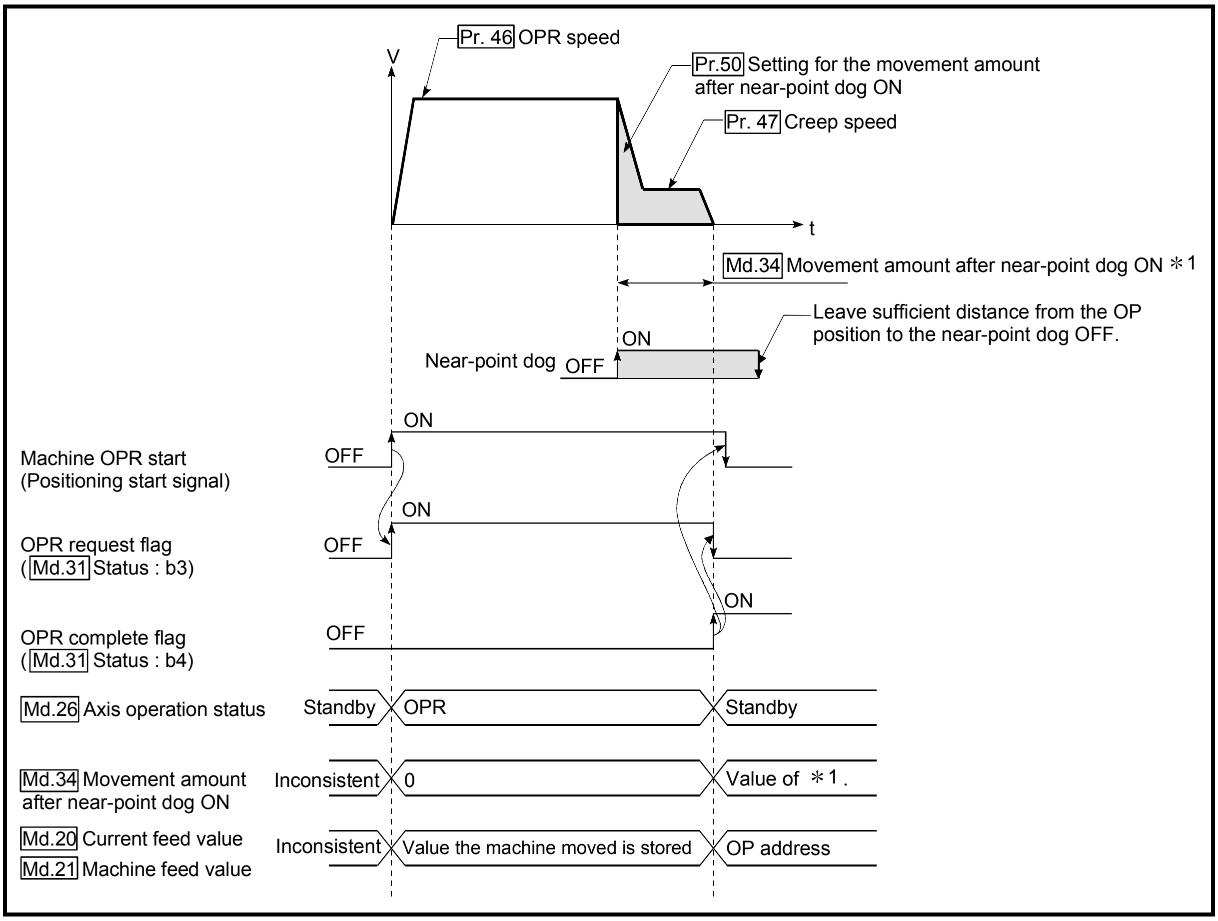


Fig. 8.7 Count method 2) machine OPR

■ Restrictions

When this method is used, a deviation will occur in the stop position (OP) compared to other OPR methods because an error of about 1 ms occurs in taking in the near-point dog ON.

■ Precautions during operation

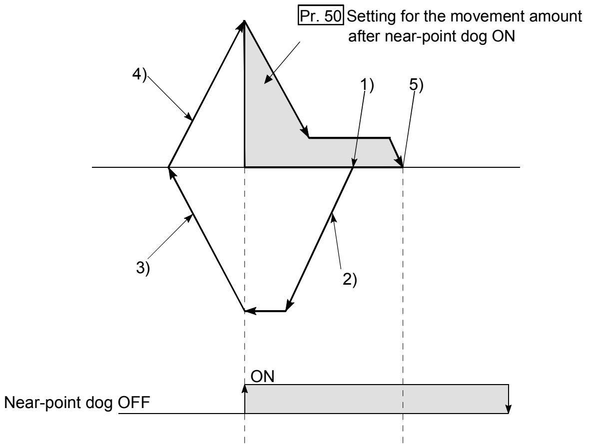
(1) An error "Count method movement amount fault (error code: 206)" will occur and the operation will not start if the "Pr.50 Setting for the movement amount after near-point dog ON" is smaller than the deceleration distance from the "Pr.46 OPR speed" to "Pr.47 Creep speed".

(2) If the speed is changed to a speed faster than "Pr.46 OPR speed" by the speed change function (refer to "13.5.1 Speed change function".) during a machine OPR, the distance to decelerate to "Pr.47 Creep speed" may not be ensured, depending on the setting value of "Pr.50 Setting for the movement amount after near-point dog ON". In this case, the error "Count method movement amount fault" (error code: 206) occurs and the machine OPR is stopped.

(3) The following shows the operation when a machine OPR is started while the near-point dog is ON.

(4) Turn OFF the near-point dog at a sufficient distance from the OP.
Although there is no harm in operation if the near-point dog is turned OFF during a machine OPR, it is recommended to leave a sufficient distance from the OP when the near-point dog is turned OFF for the following reason.
If machine OPRs are performed consecutively after the near-point dog is turned OFF at the time of machine OPR completion, operation will be performed at the OPR speed until the hardware stroke limit (upper/lower limit) is reached.
If a sufficient distance cannot be kept, consider the use of the OPR retry function.

(5) When the stop signal stops the machine OPR, carry out the machine OPR again. When restart command is turned ON after the stop signal stops the OPR, the error "OPR restart impossible" (error code: 209) will occur.



[Operation when an OPR is started at the near-point dog ON position]

1) A machine OPR is started.
2) The machine moves at the OPR speed in the opposite direction of an OPR.
3) Deceleration processing is carried out when the near-point dog OFF is detected.
4) After the machine stops, a machine OPR is carried out in the OPR direction.
5) The machine OPR is completed after moving the movement amount set in the "Pr.50 Setting for the movement amount after near-point dog ON".

Fig. 8.8 Count method 2) machine OPR on the near-point dog ON position

8.2.6 OPR method (4): Data set method

The following shows an operation outline of the "data set method" OPR method.
The "Data set method" method is effective when a "Near-point dog" is not used.
It can be used with absolute position system.
With the data set method OPR, the position where the machine OPR has been carried out, is registered into the Simple Motion module as the OP, and the current feed value and feed machine value is overwritten to an OP address.
Use the JOG or manual pulse generator operation to move the OP.

■ Operation chart

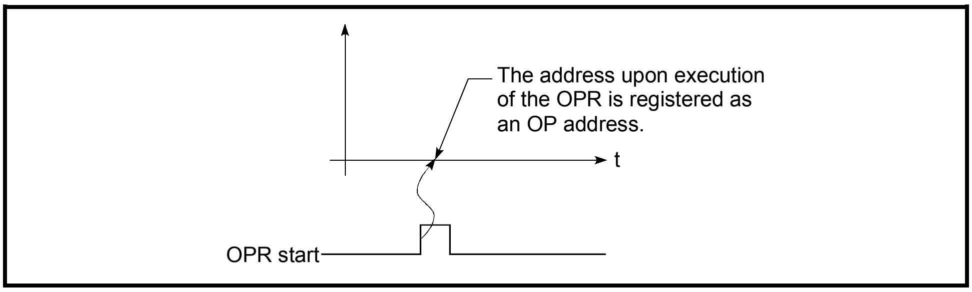


Fig. 8.9 Data set method OPR

■ Precautions during operation

(1) The zero point must have been passed before the OPR is carried out after the power supply is turned ON. If the OPR is carried out without passing the zero point even once, the "OPR restart zero point not passed error" will occur.
When the "Home positioning return (OPR) restart zero point not passed error" occurs, perform the JOG or similar operation so that the servomotor makes more than one revolution after an error reset, before carrying out the machine OPR again.
However, if selecting "1: Not need to pass servo motor Z-phase after power on" with "Function selection C-4 (PC17)", it is possible to carry out the home position return (OPR) without passing the zero point.

(2) The OPR data used for the data set method is the "OPR direction" and "OP address".
The OPR data other than that for the OPR direction and OP address is not used for the data set method OPR method, but if a value is set the outside the setting range, an error will occur when the PLC READY signal [Y0] is turned ON so that the READY signal [X0] is not turned OFF.
With the OPR data other than that for the OPR direction and OP address, set an arbitrary value (default value can be allowed) within each data setting range so that an error will not occur upon receiving the PLC READY signal [Y0] ON.

8.2.7 OPR method (5): Scale origin signal detection method

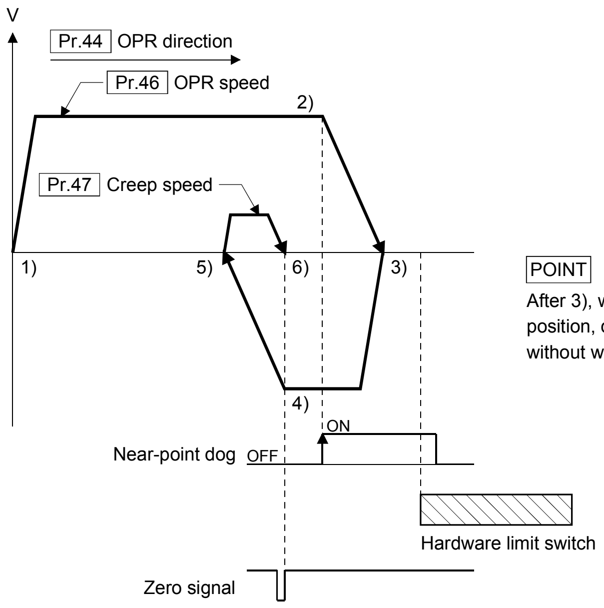
The following shows an operation outline of the "scale origin signal detection method" OPR method.

POINT

Set "0: Need to pass servo motor Z-phase after power on" in "Function selection C-4 (PC17)". If "1: Not need to pass servo motor Z-phase after power on" is set, the error "Z-phase passing parameter invalid" (error code: 231) will occur at the start of scale origin signal detection method OPR.

■ Operation chart

1)	The machine OPR is started. (The machine begins the acceleration designated in "Pr.51 OPR acceleration time selection", in the direction designated in "Pr.44 OPR direction". It then moves at the "Pr.46 OPR speed" when the acceleration is completed.)
2)	The machine begins decelerating when the near-point dog ON is detected.
3)	After deceleration stop, the machine moves in the opposite direction against of OPR at the "Pr.46 OPR speed".
4)	During movement, the machine begins decelerating when the first zero signal is detected.
5)	After deceleration stop, the operation moves in direction of OPR at the "Pr.47 Creep speed", and then stops at the detected nearest zero signal.
6)	The OPR complete flag (Md.31 Status: b4) turns from OFF to ON, and the OPR request flag (Md.31 Status: b3) turns from ON to OFF.



POINT

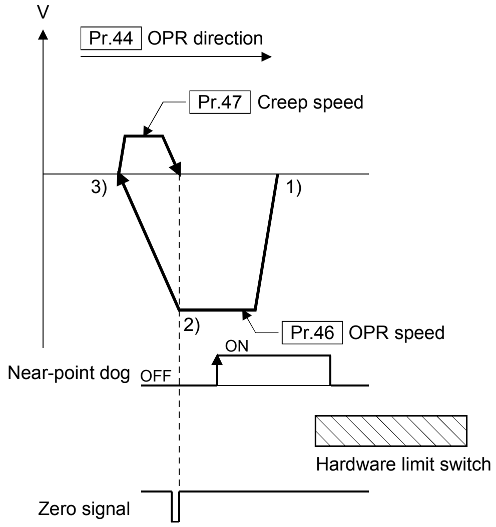
After 3), when the zero signal is in the near-point dog position, deceleration stop (4)) is started at the zero signal without waiting for the near-point dog OFF.

Fig. 8.10 Scale origin signal detection method machine OPR

■ Precautions during operation

(1) An error "Start at OP (error code: 201)" will occur if another machine OPR is attempted immediately after a machine OPR completion when the OP is in the near-point dog ON position.

(2) The following shows the operation when a machine OPR is started from the near-point dog ON position.



[Operation when a machine OPR is started from the near-point dog ON position]

1) The machine moves in the opposite direction against of OPR at the OPR speed.
2) The machine begins decelerating when the first zero signal is detected.
3) After deceleration stop, the operation moves in direction of OPR at the creep speed, and then stops at the zero signal to complete the machine OPR.

POINT

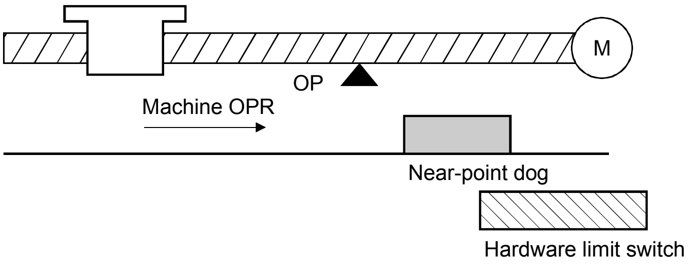
After 1), when the zero signal is in the near-point dog ON position, deceleration stop (2)) is started at the zero signal without waiting for the near-point dog OFF.

Fig. 8.11 Operation when a machine OPR is started from the near-point dog ON position

(3) When the stop signal stops the machine OPR, carry out the machine OPR again. When restart command is turned ON after the stop signal stops the OPR, the error "OPR restart not possible (error code: 209)" will occur.

(4) The OPR retry will not be performed regardless of setting set in "Pr.48 OPR retry" in the scale origin signal detection method. When a hardware limit switch is detected during machine OPR, the error "Hardware stroke limit (+) (error code: 104)" or "Hardware stroke limit (-) (error code: 105)" will occur.

(5) Position the near-point dog forward to overlaps with the hardware limit switch in direction of OPR. When the near-point dog is in the opposite direction against of OPR from the machine OPR start position, the error "Hardware stroke limit (+) (error code: 104)" or "Hardware stroke limit (-) (error code: 105)" will occur.



(6) When the zero signal is detected again during deceleration (4) of Fig. 8.12) with detection of zero signal, the operation stops at the zero signal detected lastly to complete the OPR.

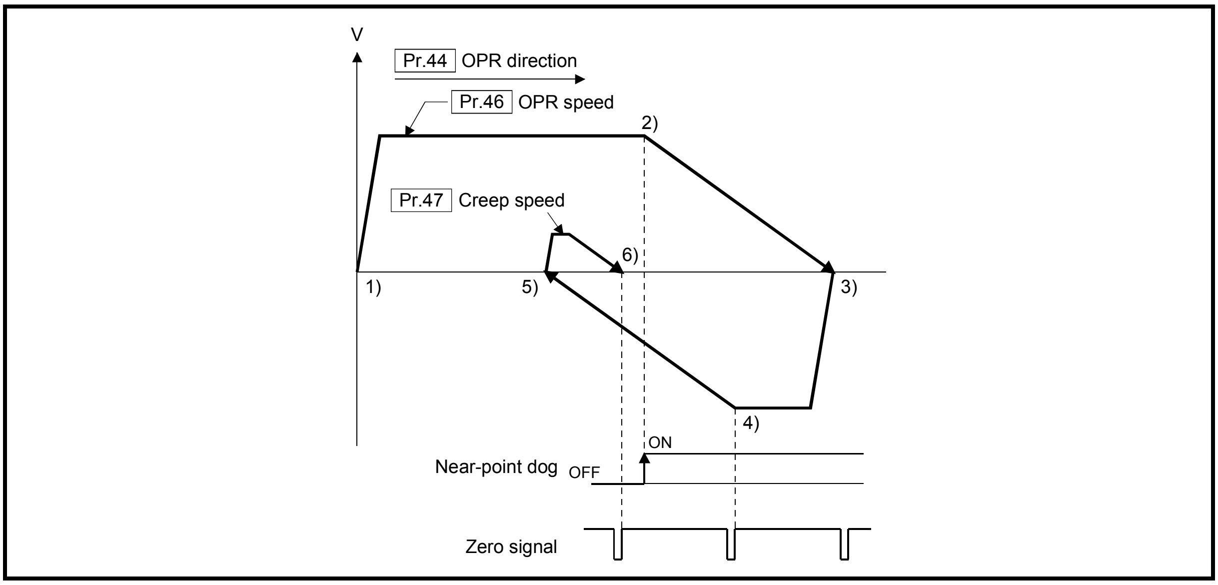


Fig. 8.12 Operation when the zero signal is detected again during deceleration with detection of zero signal

(7) Do not use the scale origin signal detection method OPR for the machine with the backlash.

(8) When using the direct drive motor, make it passed the Z phase once before reaching 3) of Fig. 8.10.

8.3 Fast OPR

8.3.1 Outline of the fast OPR operation

■ Fast OPR operation

After establishing OP position by a machine OPR, positioning control to the OP position is executed without using a near-point dog or a zero signal.
The following shows the operation during a basic fast OPR start.

1) The fast OPR is started.
2) Positioning control to the OP position established by a machine OPR begins at speed set in the OPR parameters (Pr.43 to Pr.57).
3) The fast OPR is completed.

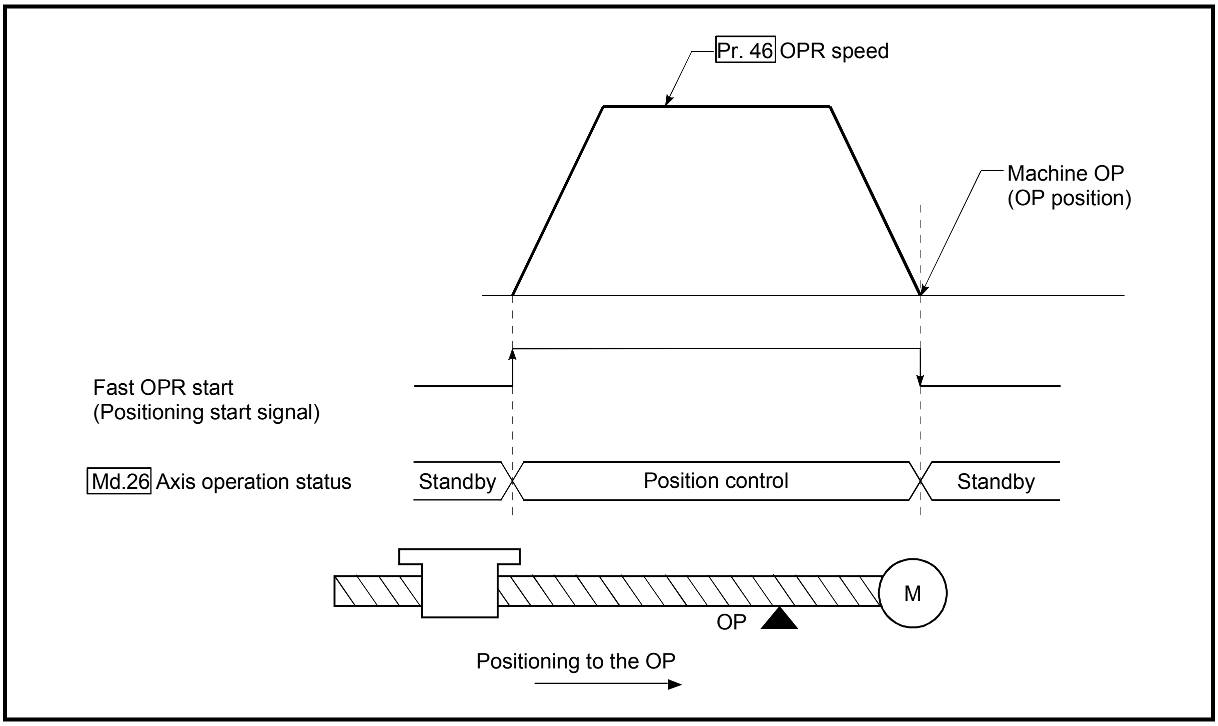


Fig. 8.13 Fast OPR

■ Operation timing and processing time of fast OPR

The following shows details about the operation timing and time during fast OPR.

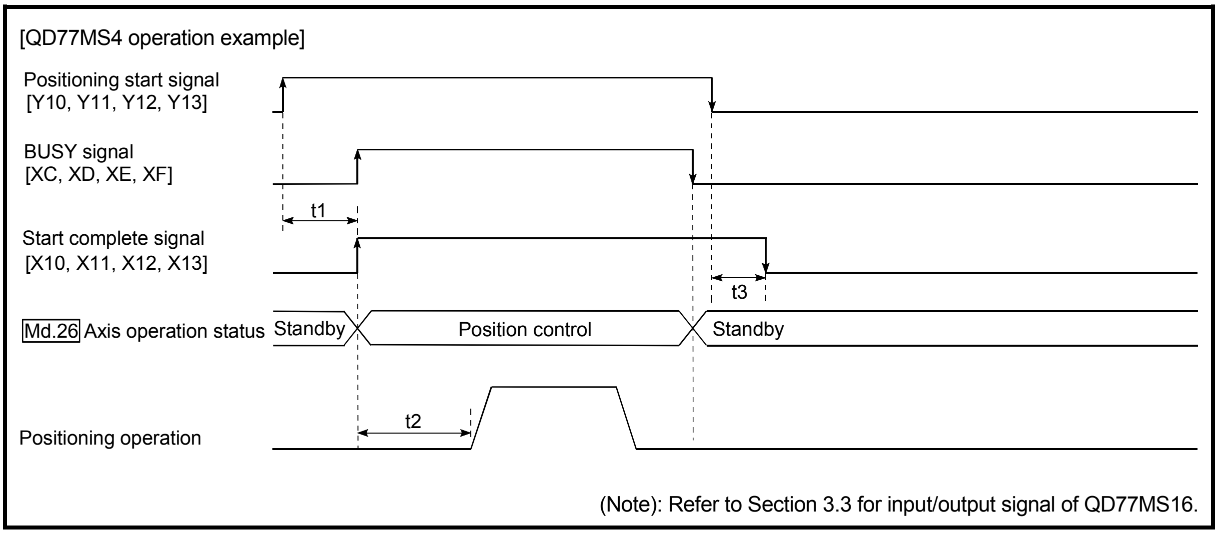


Fig. 8.14 Operation timing and processing time of fast OPR

Normal timing time Unit: [ms]

	Operation cycle	t1	t2	t3
QD77MS2	0.88	0.2 to 0.3	1.8 to 2.7	0 to 0.9
	1.77	0.2 to 0.3	2.5 to 3.9	0 to 1.8
QD77MS4	0.88	0.2 to 0.3	1.8 to 2.7	0 to 0.9
	1.77	0.2 to 0.3	2.5 to 3.9	0 to 1.8
QD77MS16	0.88	0.3 to 1.4	1.8 to 2.7	0 to 0.9
	1.77	0.3 to 1.4	3.2 to 3.9	0 to 1.8

•The t1 timing time could be delayed by the operation state of other axes.

■ Operating restrictions

(1) The fast OPR can only be executed after the OP position is established by executing the Machine OPR.
If not, the error "OPR request ON" (error code: 207) will occur.
(OPR request flag (Md.31 Status: b3) must be turned OFF).

(2) If the fraction pulse is cleared to zero using current value changing or fixed-feed control, execute the fast OPR and an error will occur by a cleared amount.

(3) When unlimited length feed is executed by speed control and the machine feed value overflows or underflows once, the fast OPR cannot be executed normally.

(4) The OPR complete flag (Md.31 Status: b4) is not turned ON.

(5) The axis operation status during fast OPR is "in position control".

8.4 Selection of the OPR setting condition

8.4.1 Outline of the OPR setting condition

If executing the home position return (OPR), it is necessary to make sure that the servomotor has been rotated more than one revolution and passed the Z phase (Motor reference position signal) and that the zero point pass signal (Md.108 Servo status (low-order buffer memory address): b0) has turned ON.
However, if selecting "1: Not need to pass servo motor Z-phase after power on" with "Function selection C-4 (PC17)", it is possible to turn the zero point pass signal (Md.108 Servo status (low-order buffer memory address): b0) ON without passing the zero point.

	Buffer memory address (low-order)	
	QD77MS2/QD77MS4	QD77MS16
Md.108 Servo status: b0	876+100n	2476+100n

n: Axis No.-1

■ Data setting

To select the "OPR setting condition", set the "servo amplifier" shown in the following table.
Servo parameters are set for each axis.

The "OPR setting condition" is stored into the following buffer memory addresses.

Setting item	Setting value	Setting details	Buffer memory address	
			QD77MS2 QD77MS4	QD77MS16
Function selection C-4 (PC17)	0	0 : Need to pass servo motor Z-phase after power on 1 : Not need to pass servo motor Z-phase after power on	30180+200n	28480+100n

n: Axis No.-1

＊: Refer to Section 5.2.8 "Servo parameters" for information on the storage details.

■ Precautions during operation

(1) If setting the above servo parameter to "1: Not need to pass servo motor Z-phase after power on", the restriction, "If executing the home position return (OPR), it is necessary to execute OPR after rotating the servomotor more than one revolution and letting it pass through the Z phase (Motor reference position signal).", will be invalid.

(2) Set the parameter value and switch power off once (The parameter is transferred to servo amplifier from Simple Motion module), then switch it on again to make that parameter setting valid.

MEMO

Chapter 9 Major Positioning Control

The details and usage of the major positioning controls (control functions using the "positioning data") are explained in this chapter.

The major positioning controls include such controls as "positioning control" in which positioning is carried out to a designated position using the address information, "speed control" in which a rotating object is controlled at a constant speed, "speed-position switching control" in which the operation is shifted from "speed control" to "position control" and "position-speed switching control" in which the operation is shifted from "position control" to "speed control".

Execute the required settings to match each control.

9.1 Outline of major positioning controls

"Major positioning controls" are carried out using the "positioning data" stored in the Simple Motion module.

The basic controls such as position control and speed control are executed by setting the required items in this "positioning data", and then starting that positioning data.

The control system for the "major positioning controls" is set in setting item "Da.2 Control system" of the positioning data.

Control defined as a "major positioning control" carries out the following types of control according to the "Da.2 Control system" setting.

However, the position loop is included for commanding to servo amplifier in the speed control set in "Da.2 Control system".

Use the "speed-torque control" (Refer to Section 12.1 "Speed-torque control") to execute the speed control not including position loop.

Major positioning control			Da.2 Control system	Details
Position control	Linear control	1-axis linear control	ABS Linear 1 INC Linear 1	Positioning of the designated 1 axis is carried out from the start address (current stop position) to the designated position.
		2-axis linear interpolation control (Note-1)	ABS Linear 2 INC Linear 2	Using the designated 2 axes, linear interpolation control is carried out from the start address (current stop position) to the designated position.
		3-axis linear interpolation control (Note-1)	ABS Linear 3 INC Linear 3	Using the designated 3 axes, linear interpolation control is carried out from the start address (current stop position) to the designated position.
		4-axis linear interpolation control (Note-1)	ABS Linear 4 INC Linear 4	Using the designated 4 axes, linear interpolation control is carried out from the start address (current stop position) to the designated position.
	Fixed-feed control	1-axis fixed-feed control	Fixed-feed 1	Positioning of the designated 1 axis is carried out for a designated movement amount from the start address (current stop position). (The "Md.20 Current feed value" is set to "0" at the start.)
		2-axis fixed-feed control (Note-1)	Fixed-feed 2	Using the designated 2 axes, linear interpolation control is carried out for a designated movement amount from the start address (current stop position). (The "Md.20 Current feed value" is set to "0" at the start.)
		3-axis fixed-feed control (Note-1)	Fixed-feed 3	Using the designated 3 axes, linear interpolation control is carried out for a designated movement amount from the start address (current stop position). (The "Md.20 Current feed value" is set to "0" at the start.)
		4-axis fixed-feed control (Note-1)	Fixed-feed 4	Using the designated 4 axes, linear interpolation control is carried out for a designated movement amount from the start address (current stop position). (The "Md.20 Current feed value" is set to "0" at the start.)
	2-axis circular interpolation control (Note-1)	Sub point designation	ABS Circular sub INC Circular sub	Using the designated 2 axes, positioning is carried out in an arc path to a position designated from the start point address (current stop position).
		Center point designation	ABS Circular right ABS Circular left INC Circular right INC Circular left	

Major positioning control		Da.2 Control system	Details
Speed control	1-axis speed control	Forward run speed 1 Reverse run speed 1	The speed control of the designated 1 axis is carried out.
	2-axis speed control (Note-1)	Forward run speed 2 Reverse run speed 2	The speed control of the designated 2 axes is carried out.
	3-axis speed control (Note-1)	Forward run speed 3 Reverse run speed 3	The speed control of the designated 3 axes is carried out.
	4-axis speed control (Note-1)	Forward run speed 4 Reverse run speed 4	The speed control of the designated 4 axes is carried out.
Speed-position switching control		Forward run speed/position Reverse run speed/position	The control is continued as position control (positioning for the designated address or movement amount) by turning ON the "speed-position switching signal" after first carrying out speed control.
Position-speed switching control		Forward run position/speed Reverse run position/speed	The control is continued as speed control by turning ON the "position-speed switching signal" after first carrying out position control.
Other control	NOP instruction	NOP instruction	A nonexecutable control system. When this instruction is set, the operation is transferred to the next data operation, and the instruction is not executed.
	Current value changing	Current value changing	"Md.20 Current feed value" is changed to an address set in the positioning data. This can be carried out by either of the following 2 methods. ("Md.21 Machine feed value" cannot be changed.) • Current value changing using the control system • Current value changing using the current value changing start No. (No. 9003).
	JUMP instruction	JUMP instruction	An unconditional or conditional JUMP is carried out to a designated positioning data No.
	LOOP	LOOP	A repeat control is carried out by repeat LOOP to LEND.
	LEND	LEND	Control is returned to the top of the repeat control by repeat LOOP to LEND. After the repeat operation is completed specified times, the next positioning data is run.

(Note-1): Control is carried out so that linear and arc paths are drawn using a motor set in two or more axes directions. This kind of control is called "interpolation control". (Refer to Section 9.1.6 "Interpolation control" for details.)

(Note-2): In the QD77MS2, when 3- or 4-axis interpolation is carried out, or axis 3 or axis 4 is designated to the axis to be interpolated for 2-axis interpolation, an error "Illegal interpolation description command" (error code: 521) will occur and the positioning control does not start.

9.1.1 Data required for major positioning control

The following table shows an outline of the "positioning data" configuration and setting details required to carry out the "major positioning controls".

Setting item			Setting details
Positioning data No. 1	Da.1	Operation pattern	Set the method by which the continuous positioning data (Ex: positioning data No.1, No.2, No.3) will be controlled. (Refer to Section 9.1.2.)
	Da.2	Control system	Set the control system defined as a "major positioning control". (Refer to Section 9.1.)
	Da.3	Acceleration time No.	Select and set the acceleration time at control start. (Select one of the four values set in Pr.9, Pr.25, Pr.26, and Pr.27 for the acceleration time.)
	Da.4	Deceleration time No.	Select and set the deceleration time at control stop. (Select one of the four values set in Pr.10, Pr.28, Pr.29, and Pr.30 for the deceleration time.)
	Da.5	Axis to be interpolated QD77MS2 QD77MS4	Set an axis to be interpolated (partner axis) during the 2-axis interpolation operation (Refer to Section 9.1.6.).
	Da.6	Positioning address/ movement amount	Set the target value during position control. (Refer to Section 9.1.3.)
	Da.7	Arc address	Set the sub point or center point address during circular interpolation control.
	Da.8	Command speed	Set the speed during the control execution.
	Da.9	Dwell time	The time between the command pulse output is completed to the positioning completed signal is turned ON. Set it for absorbing the delay of the mechanical system to the instruction, such as the delay of the servo system (deviation).
	Da.10	M code	Set this item when carrying out sub work (clamp and drill stops, tool replacement, etc.) corresponding to the code No. related to the positioning data execution.
	Da.20	Axis to be interpolated No.1 QD77MS16	Set an axis to be interpolated during the 2- to 4-axis interpolation operation. (Refer to Section 9.1.6.)
	Da.21	Axis to be interpolated No.2 QD77MS16	
	Da.22	Axis to be interpolated No.3 QD77MS16	

(Note): The settings and setting requirement for the setting details of Da.1 to Da.10 and Da.20 to Da.22 differ according to the "Da.2 Control system". (Refer to Section 9.2 "Setting the positioning data".)

■ Major positioning control sub functions

Refer to Section 3.2.5 "Combination of QD77MS main functions and sub functions" for details on "sub functions" that can be combined with the major positioning control.
Also refer to Chapter 13 "Control Sub Functions" for details on each sub function.

■ Major positioning control from GX Works2

"Major positioning control" can be executed by test function of GX Works2.
Refer to "Simple Motion Module Setting Tool Help" of GX Works2 for details on carrying out major positioning control from the GX Works2.

REMARK

600 positioning data (positioning data No. 1 to 600) items can be set per axis.

9.1.2 Operation patterns of major positioning controls

In "major positioning control" (high-level positioning control), "Da.1 Operation pattern" can be set to designate whether to continue executing positioning data after the started positioning data. The "operation pattern" includes the following 3 types.

- Positioning complete ——— (1) Independent positioning control (operation pattern: 00)
- Positioning continue ——— (2) Continuous positioning control (operation pattern: 01)
  - (3) Continuous path control (operation pattern: 11)

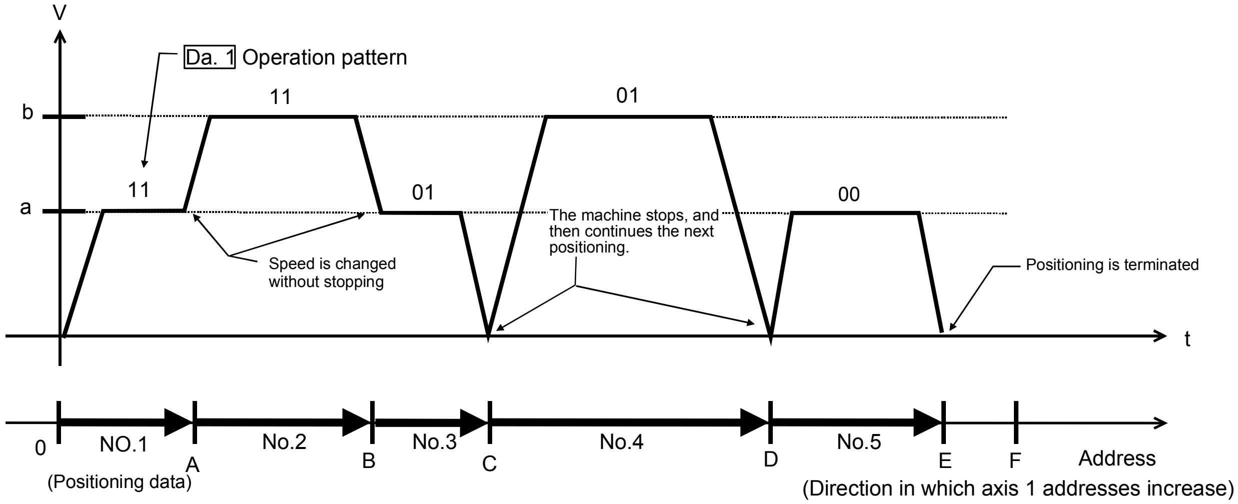
The following shows examples of operation patterns when "1-axis linear control (ABS linear 1)" is set in positioning data No. 1 to No. 6 of axis 1. Details of each operation pattern are shown on the following pages.

< Operation example when "1-axis linear positioning" is set in the positioning data of axis 1 >

No.1 Start

	(Setting details)	
Positioning data No.1	Positioning to address [A] at command speed [a]	Operation pattern = 11: Continuous path control
No.2	Positioning to address [B] at command speed [b]	Operation pattern = 11: Continuous path control
No.3	Positioning to address [C] at command speed [a]	Operation pattern = 01: Continuous positioning control
No.4	Positioning to address [D] at command speed [b]	Operation pattern = 01: Continuous positioning control
No.5	Positioning to address [E] at command speed [a]	Operation pattern = 00: Independent positioning control (Positioning complete)
No.6	Positioning to address [F] at command speed [a]	Operation pattern = 11: Continuous path control

Control stop



For 1-axis linear control

(One motor is driven, and positioning is carried out to an addresses designated in one direction.)

POINT

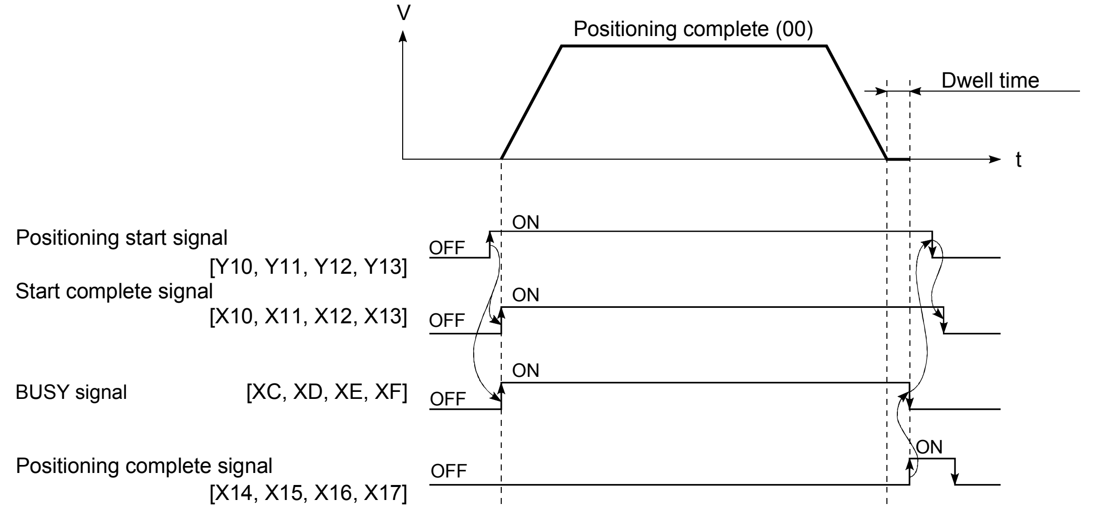
(1) When the operation pattern is continuous positioning control or continuous path control, the same address as the last value is specified in absolute system or the movement amount 0 is specified in incremental system, positioning control of movement amount 0 is executed.
(2) The BUSY signal turns ON even when position control of movement amount 0 is executed. However, since the ON time is short, the ON status may not be detected in the PLC program.
(3) The positioning complete signal turns ON even when position control of movement amount 0 is executed. ON time is determined by "Pr.40 Positioning complete signal output time".

[1] Independent positioning control (Positioning complete)

This control is set when executing only one designated data item of positioning. If a dwell time is designated, the positioning completes after the designated time elapses.

This data (operation pattern [00] data) becomes the end of block data when carrying out block positioning. (The positioning stops after this data is executed.)

[QD77MS4 operation example]



(Note): Refer to Section 3.3 for input/output signal of QD77MS16.

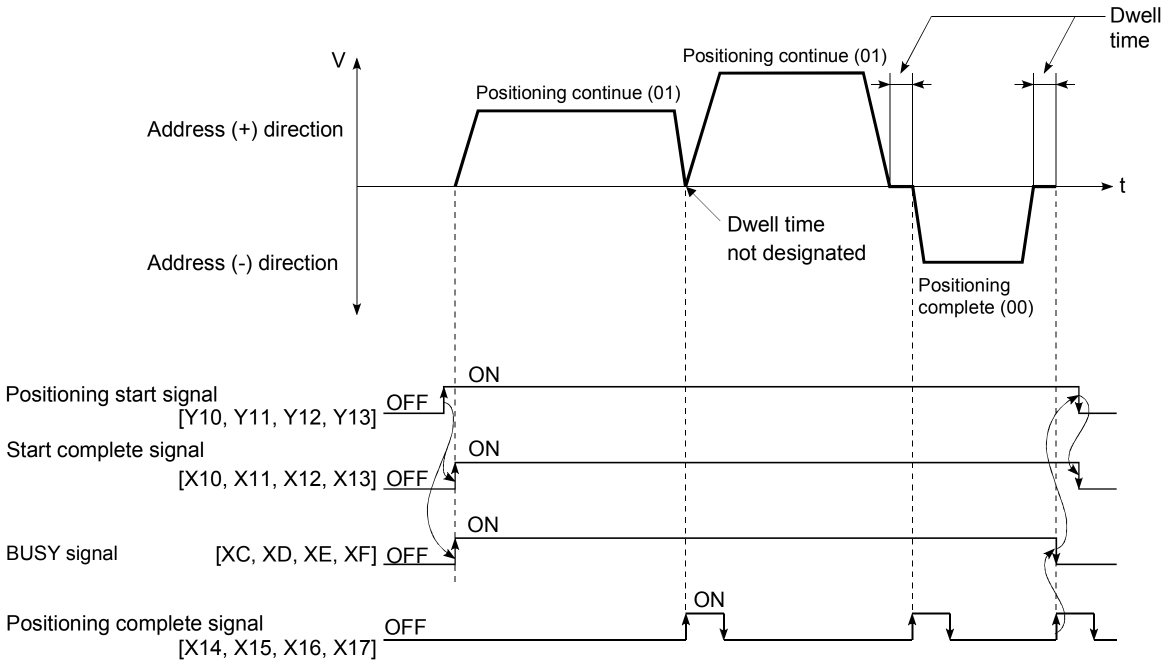
Fig. 9.1 Operation during independent positioning control

[2] Continuous positioning control

(1) The machine always automatically decelerates each time the positioning is completed. Acceleration is then carried out after the Simple Motion module command speed reaches 0 to carry out the next positioning data operation. If a dwell time is designated, the acceleration is carried out after the designated time elapses.

(2) In operation by continuous positioning control (operation pattern "01"), the next positioning No. is automatically executed. Always set operation pattern "00" in the last positioning data to complete the positioning.
If the operation pattern is set to positioning continue ("01" or "11"), the operation will continue until operation pattern "00" is found.
If the operation pattern "00" cannot be found, the operation may be carried out until the positioning data No. 600. If the operation pattern of the positioning data No. 600 is not completed, the operation will be started again from the positioning data No. 1.

[QD77MS4 operation example]



(Note): Refer to Section 3.3 for input/output signal of QD77MS16.

Fig. 9.2 Operation during continuous positioning control

[3] Continuous path control

(1) Continuous path control

(a) The speed is changed without deceleration stop between the command speed of the "positioning data No. currently being executed" and the speed of the "positioning data No. to carry out the next operation".
The speed is not changed if the current speed and the next speed are equal.

(b) The speed used in the previous positioning operation is continued when the command speed is set to "-1".

(c) Dwell time is ignored, even if it is set.

(d) The next positioning No. is executed automatically in operations by continuous path control (operation pattern "11"). Always complete the positioning by setting operation pattern "00" in the last positioning data.
If the operation pattern is set to positioning continue ("01" or "11"), the operation will continue until operation pattern "00" is found.
If the operation pattern "00" cannot be found, the operation may be carried out until the positioning data No. 600. If the operation pattern of the positioning data No. 600 is not complete, the operation will be started again from the positioning data No. 1.

(e) The speed switching patterns include the "front-loading speed switching pattern" in which the speed is changed at the end of the current positioning side, and the "standard speed switching pattern" in which the speed is at the start of the next positioning side. (Refer to "Pr.19 Speed switching mode".)

Continuous path control ─┬─ Standard speed switching mode
　　　　　　　　　　　　　└─ Front-loading speed switching mode

(f) In the continuous path control, the positioning may be completed before the set address/movement amount and the current data may be switched to the "positioning data that will be run next".
This is because a preference is given to the positioning at a command speed. In actuality, the positioning is completed before the set address/movement amount by an amount of remaining distance at speeds less than the command speed. The remaining distance ($\triangle \ell$) at speeds less than the command speed is $0 \leq \triangle \ell \leq$ (distance moved in operation cycle at a speed at the time of completion of the positioning).
The remaining distance ($\triangle \ell$) is output at the next positioning data No.

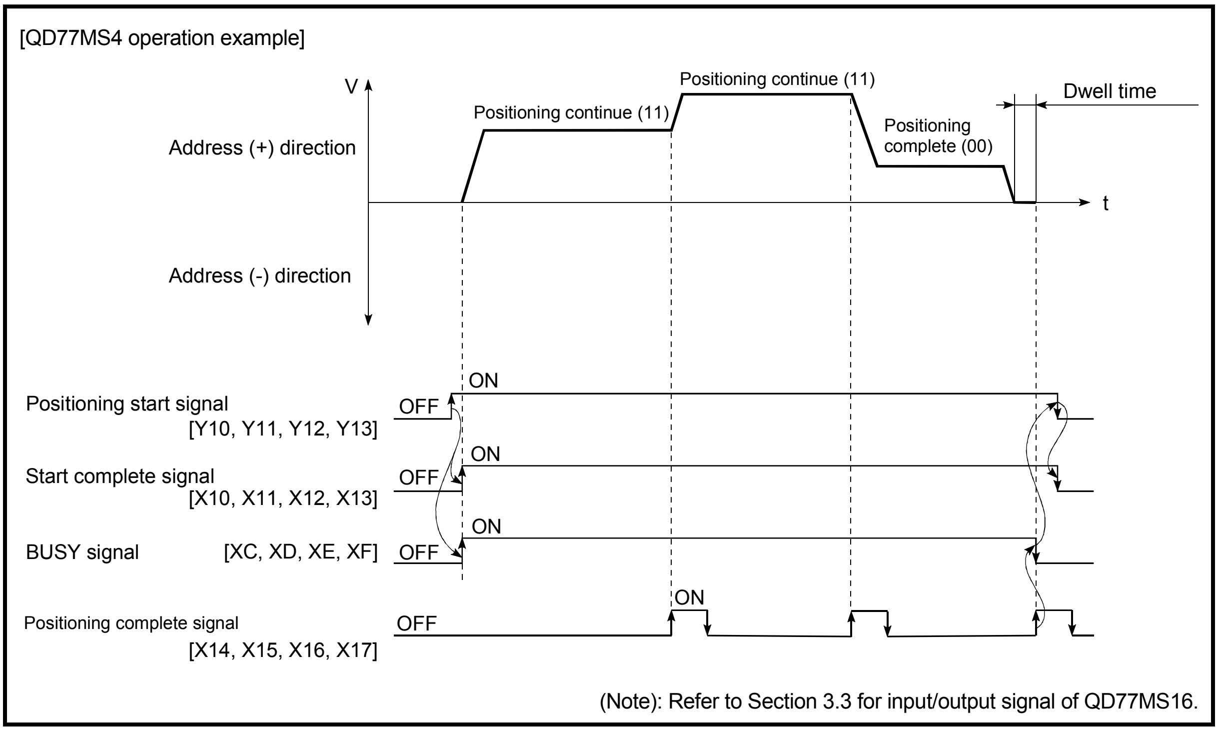


Fig. 9.3 Operation during continuous path control (Standard speed switching mode)

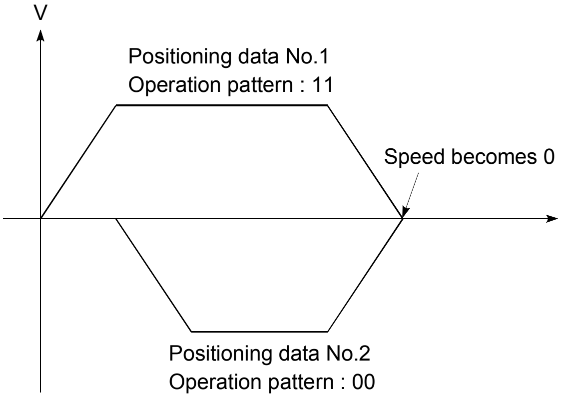
POINT

In the continuous path control, a speed variation will not occur using the near-pass function when the positioning data No. is switched (Refer to Section 13.3.3 "Near pass function").

(2) Deceleration stop conditions during continuous path control

Deceleration stops are not carried out in continuous path control, but the machine will carry out a deceleration stop to speed "0" in the following cases (a) to (c).

(a) When the operation pattern of the positioning data currently being executed is "continuous path control: 11", and the movement direction of the positioning data currently being executed differs from that of the next positioning data. (Only for 1-axis positioning control (Refer to the "Points" in the next page.))



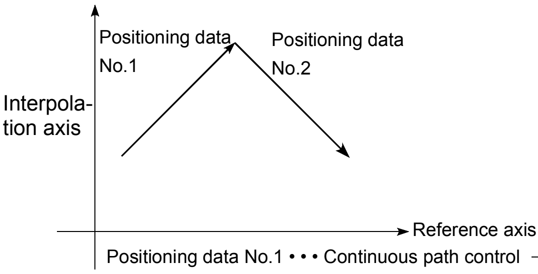
(b) During operation by step operation. (Refer to Section 13.7.1 "Step function".)

(c) When there is an error in the positioning data to carry out the next operation.

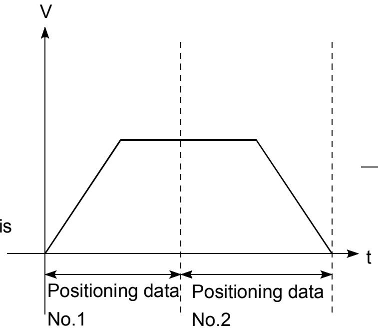
POINTS

(1) The movement direction is not checked during interpolation operations. Thus, automatic deceleration to a stop will not be carried out even if the movement direction is changed (See the figures below).
Because of this, the interpolation axis may suddenly reverse direction.
To avoid this sudden direction reversal in the interpolation axis, set the pass point to continuous positioning control "01" instead of setting it to continuous path control "11".

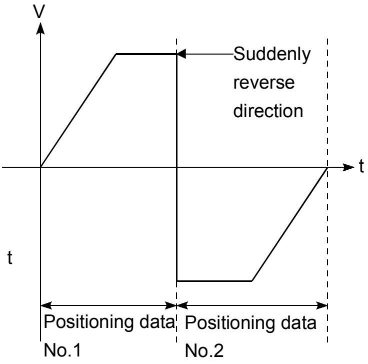
[Positioning by interpolation]



[Reference axis operation]



[Interpolation axis operation]



(2) When a "0" is set in the "Da.6 Positioning address/movement amount" of the continuous path control positioning data, the command speed of about 2 ms is reduced to 0.
When a "0" is set in the "Da.6 Positioning address/movement amount" to increase the number of speed change points in the future, change the "Da.2 Control system" to the "NOP instruction" to make the control nonexecutable.
(Refer to Section 9.2.20 "NOP instruction".)

(3) In the continuous path control positioning data, assure a movement distance so that the execution time with that data is 100 ms or longer, or lower the command speed.

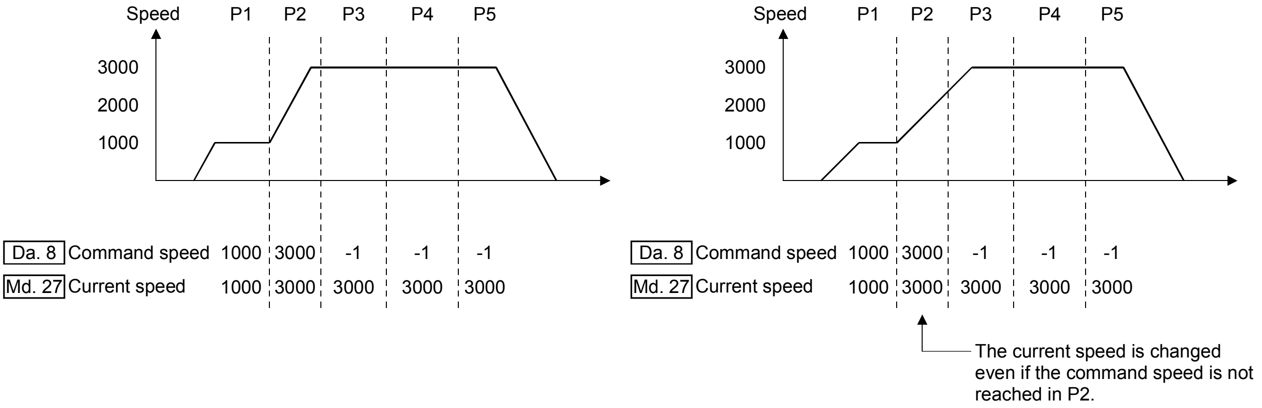
(3) Speed handling

(a) Continuous path control command speeds are set with each positioning data.
The Simple Motion module carries out the positioning at the speed designated with each positioning data.

(b) The command speed can be set to "–1" in continuous path control.
The control will be carried out at the speed used in the previous positioning data No. if the command speed is set to "–1".
(The "current speed" will be displayed in the command speed when the positioning data is set with a GX Works2. The current speed is the speed of the positioning control being executed currently.)

1) The speed does not need to be set in each positioning data when carrying out uniform speed control if "–1" is set beforehand in the command speed.
2) If the speed is changed or the override function is executed, in the previous positioning data when "–1" is set in the command speed, the operation can be continued at the new speed.
3) An error "no command speed error (error code: 503)" occurs and positioning cannot be started if "–1" is set in the command speed of the first positioning data at start.

[Relation between the command speed and current speed]



POINTS

(1) In the continuous path control, a speed variation will not occur using the near-pass function when the positioning data is switched (Refer to Section 13.3.3 "Near pass function").

(2) The Simple Motion module holds the command speed set with the positioning data, and the latest value of the speed set with the speed change request as the "Md.27 Current speed". It controls the operation at the "current speed" when "-1" is set in the command speed.
(Depending on the relation between the movement amount and the speed, the feedrate may not reach the command speed value, but even then the current speed will be updated.)

(3) When the address for speed change is identified beforehand, generate and execute the positioning data for speed change by the continuous path control to carry out the speed change without requesting the speed change with a sequence program.

(4) Speed switching

(Refer to "Pr.19 Speed switching mode".)

The two modes for changing the speed are shown below.

- Standard speed switching………Switch the speed when executing the next positioning data.
- Front-loading speed switching….The speed switches at the end of the positioning data currently being executed.

(a) Standard speed switching mode

1) If the respective command speeds differ in the "positioning data currently being executed" and the "positioning data to carry out the next operation", the machine will accelerate or decelerate after reaching the positioning point set in the "positioning data currently being executed" and the speed will change over to the speed set in the "positioning data to carry out the next operation".
2) The parameters used in acceleration/deceleration to the command speed set in the "positioning data to carry out the next operation" are those of the positioning data to carry out acceleration/deceleration.
   Speed switching will not be carried out if the command speeds are the same.

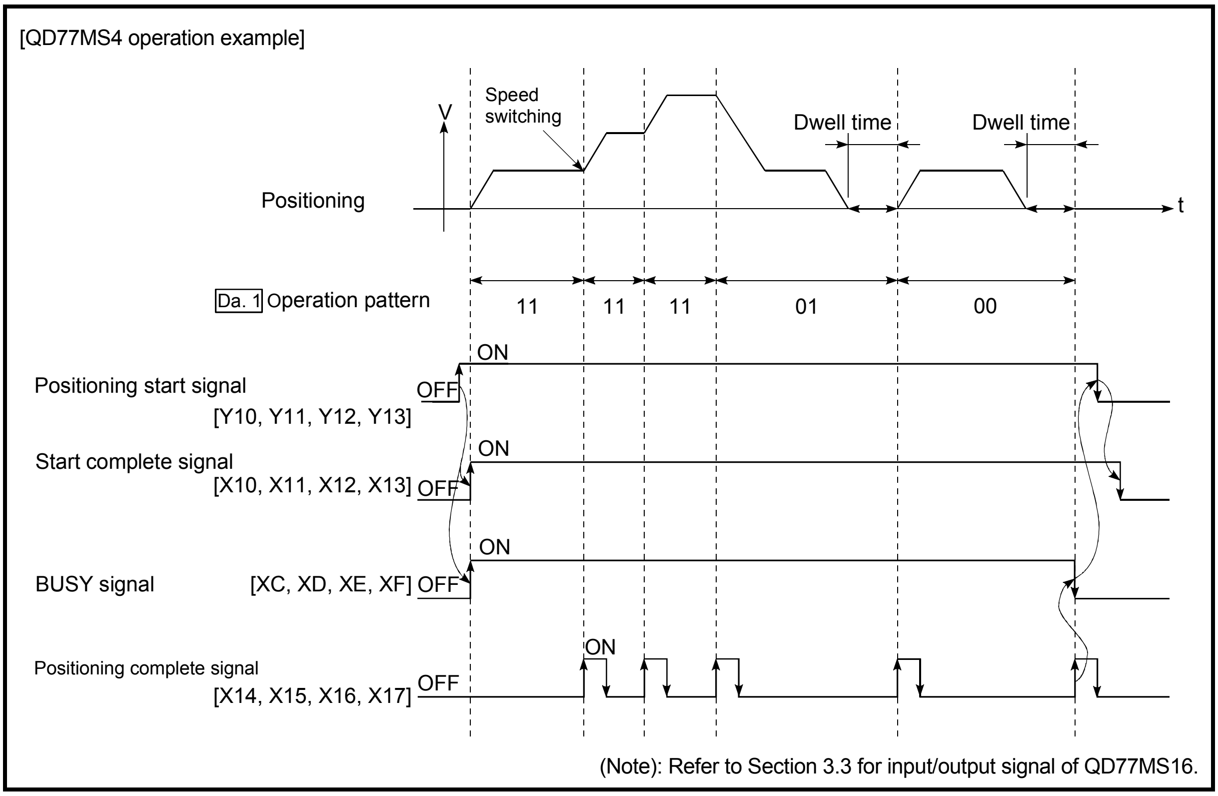
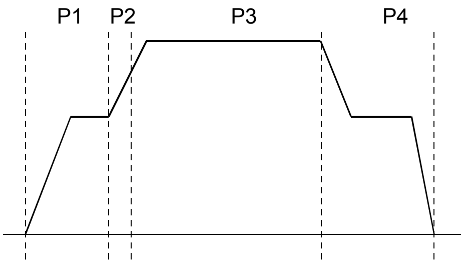


Fig. 9.4 Operation for the standard speed switching mode

3) Speed switching condition
If the movement amount is small in regard to the target speed, the current speed may not reach the target speed even if acceleration/deceleration is carried out. In this case, the machine is accelerated/decelerated so that it nears the target speed.
If the movement amount will be exceeded when automatic deceleration is required (Ex. Operation patterns "00", "01", etc.), the machine will immediately stop at the designated positioning address, and an "insufficient movement amount" (warning code: 513) will occur.

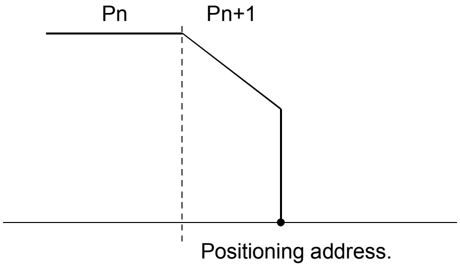
[When the speed cannot change over in P2]

For the following relation of the speed
P1 = P4, P2 = P3, P1 < P2



[When the movement amount is small during automatic deceleration]

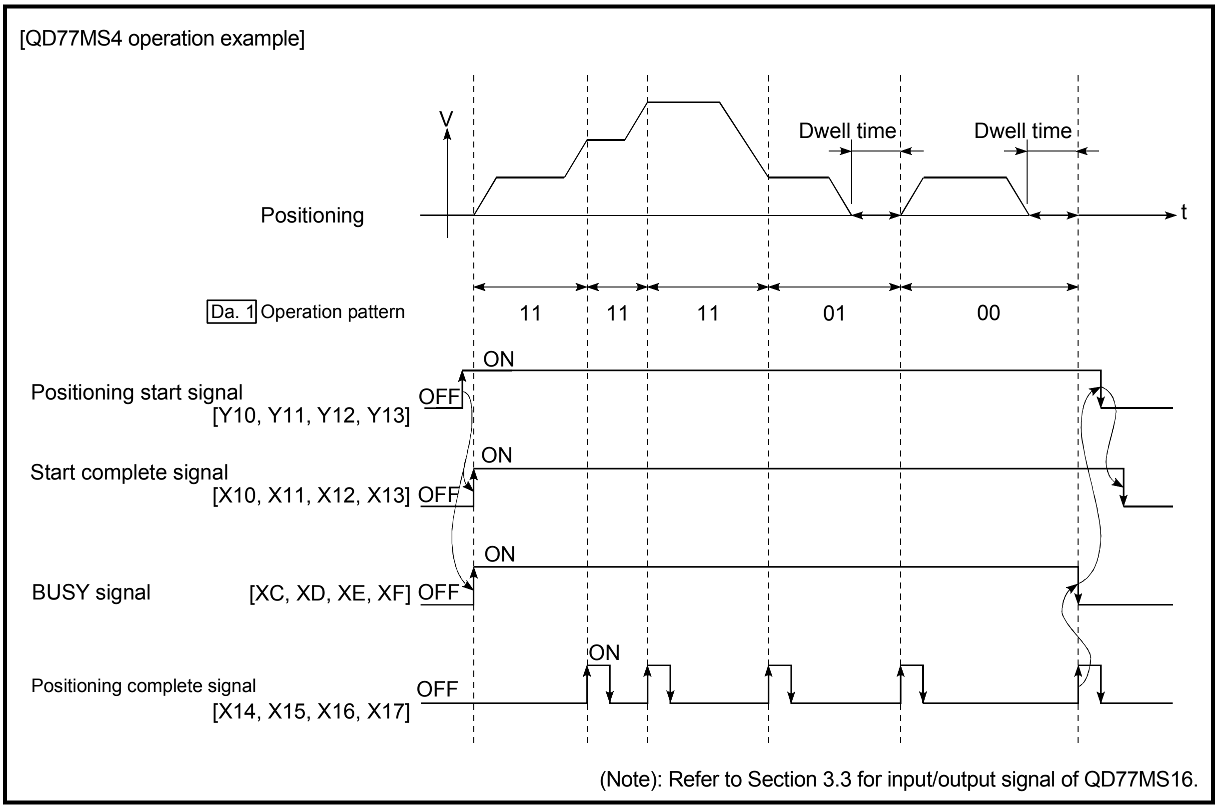
The movement amount required to carry out the automatic deceleration cannot be secured, so the machine immediately stops in a speed ≠ 0 status.



(b) Front-loading speed switching mode

1) If the respective command speeds differ in the "positioning data currently being executed" and the "positioning data to carry out the next operation", the speed will change over to the speed set in the "positioning data to carry out the next operation" at the end of the "positioning data currently being executed".

2) The parameters used in acceleration/deceleration to the command speed set in the "positioning data to carry out the next operation" are those of the positioning data to carry out acceleration/deceleration.
Speed switching will not be carried out if the command speeds are the same.



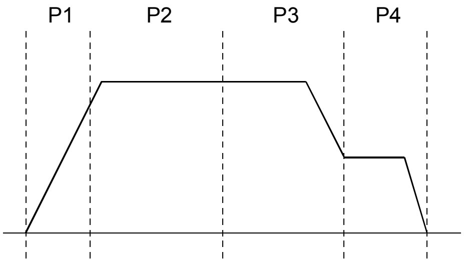
(Note): Refer to Section 3.3 for input/output signal of QD77MS16.

Fig. 9.5 Operation for the front-loading speed switching mode

3) Speed switching condition
If the movement amount is small in regard to the target speed, the current speed may not reach the target speed even if acceleration/deceleration is carried out. In this case, the machine is accelerated/decelerated so that it nears the target speed.
If the movement amount will be exceeded when automatic deceleration is required (Ex. Operation patterns "00", "01", etc.), the machine will immediately stop at the designated positioning address, and an "insufficient movement amount" (warning code: 513) will occur.

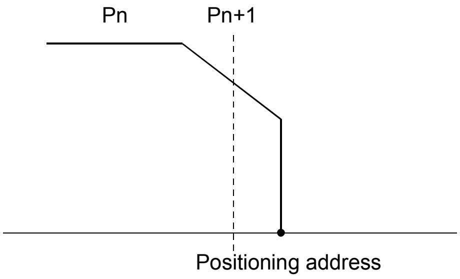
[When the speed cannot change over to the P2 speed in P1]

For the following relation of the speed
P1 = P4, P2 = P3, P1 < P2



[When the movement amount is small during automatic deceleration]

The movement amount required to carry out the automatic deceleration cannot be secured, so the machine immediately stops in a speed ≠ 0 status.



9.1.3 Designating the positioning address

The following shows the two methods for commanding the position in control using positioning data.

■ Absolute system

Positioning is carried out to a designated position (absolute address) having the OP as a reference. This address is regarded as the positioning address. (The start point can be anywhere.)

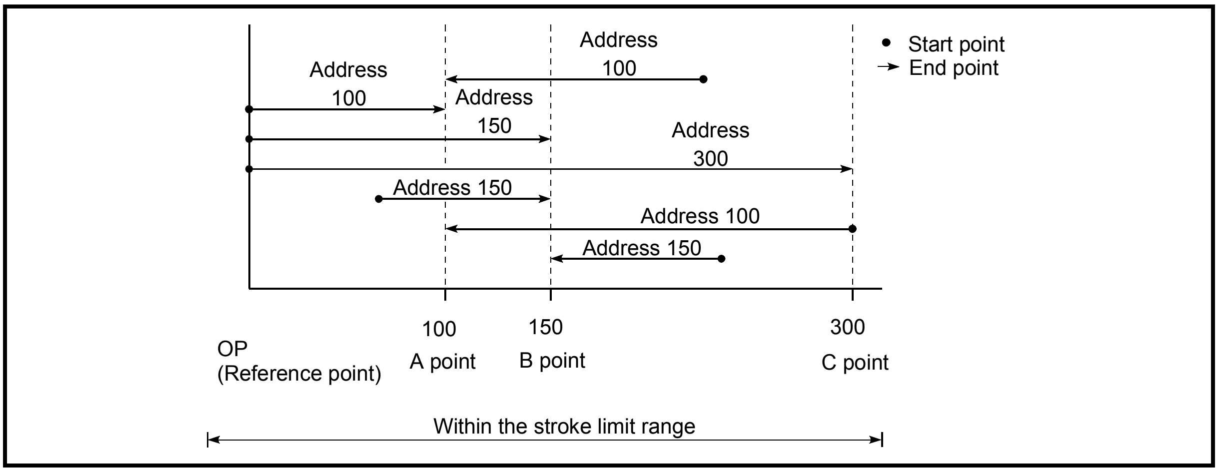


Fig. 9.6 Absolute system positioning

■ Incremental system

The position where the machine is currently stopped is regarded as the start point, and positioning is carried out for a designated movement amount in a designated movement direction.

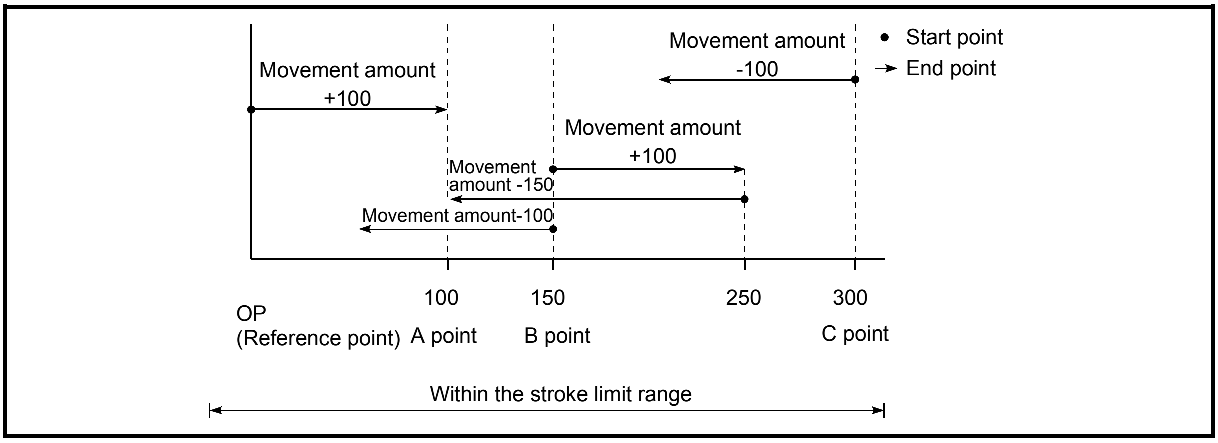


Fig. 9.7 Incremental system positioning

9.1.4 Confirming the current value

■ Values showing the current value

The following two types of addresses are used as values to show the position in the Simple Motion module.
These addresses ("current feed value" and "machine feed value") are stored in the monitor data area, and used in monitoring the current value display, etc.

Current feed value	• This is the value stored in "Md.20 Current feed value". • This value has an address established with a "machine OPR" as a reference, but the address can be changed by changing the current value to a new value.
Machine feed value	• This is the value stored in "Md.21 Machine feed value". • This value always has an address established with a "machine OPR" as a reference. The address cannot be changed, even if the current value is changed to a new value.

The "current feed value" and "machine feed value" are used in monitoring the current value display, etc.

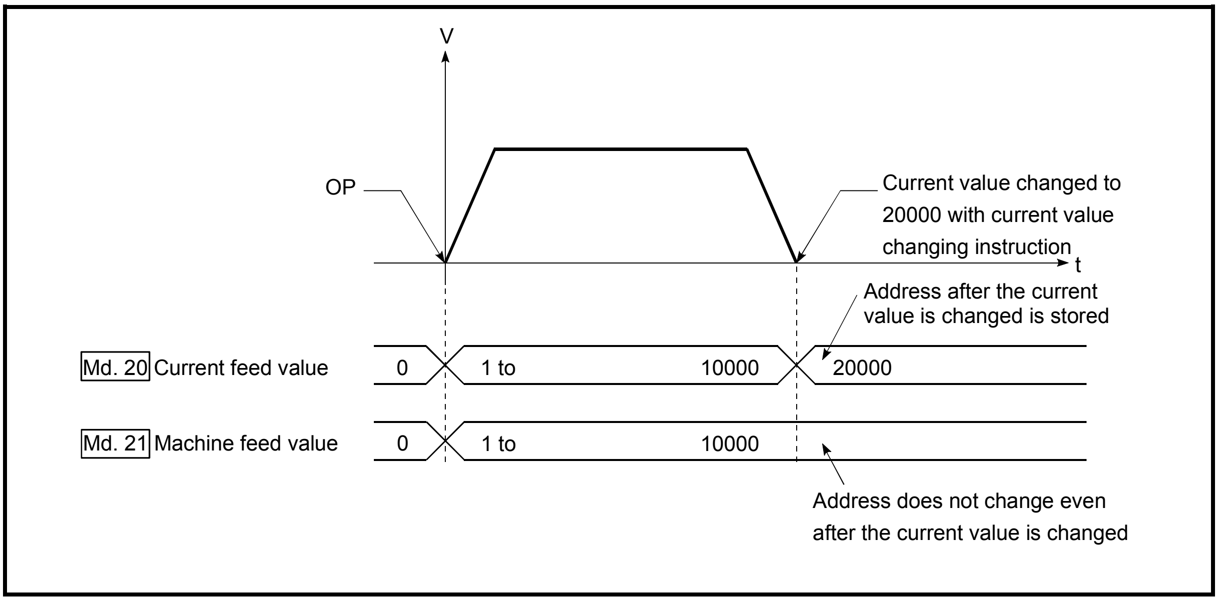


Fig. 9.8 Current feed value and machine feed value

■ Restrictions

(1) Operation cycle error will occur in the current value refresh cycle when the stored "current feed value" and "machine feed value" are used in the control.

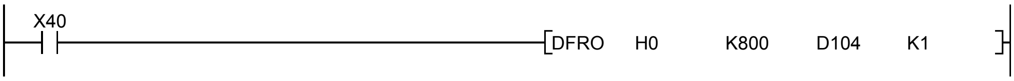
■ Monitoring the current value

The "current feed value" and "machine feed value" are stored in the following buffer memory addresses, and can be read using a "DFRO(P) instruction" or "DMOV(P) instruction" from the PLC CPU.

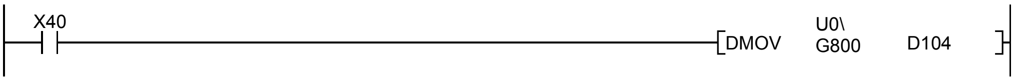
	Buffer memory addresses	
	QD77MS2/QD77MS4	QD77MS16
Md.20 Current feed value	800+100n 801+100n	2400+100n 2401+100n
Md.21 Machine feed value	802+100n 803+100n	2402+100n 2403+100n

(1) The following shows the examples of programs to read out the current feed value of the QD77MS4 [axis 1] to D104 and D105 when X40 is turned ON.

(a) For the DFRO(P) instruction



(b) For the DMOV(P) instruction

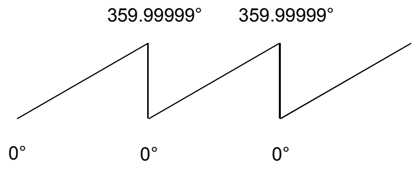


9.1.5 Control unit "degree" handling

When the control unit is set to "degree", the following items differ from when other control units are set.

[1] Current feed value and machine feed value addresses

The address of "Md.20 Current feed value" becomes a ring address from 0 to 359.99999°. The address of "Md.21 Machine feed value" will become a cumulative value. (They will not have a ring structure for values between 0 and 359.99999 degrees.) However, "Md.21 Machine feed value" is restored within the range of 0 to 359.99999 degrees at the communication start with servo amplifier after the power supply ON or PLC CPU reset.

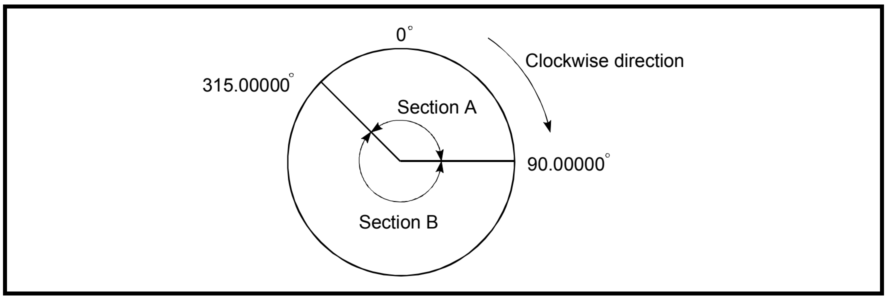


[2] Software stroke limit valid/invalid setting

With the control unit set to "degree", the software stroke limit upper and lower limit values are 0 to 359.99999.

(a) Setting to validate software stroke limit

To validate the software stroke limit, set the software stroke limit lower limit value and the upper limit value in a clockwise direction.



1) To set the movement range A, set as follows.
   - Software stroke limit lower limit value..................................315.00000°
   - Software stroke limit upper limit value...................................90.00000°

2) To set the movement range B, set as follows.
   - Software stroke limit lower limit value....................................90.00000°
   - Software stroke limit upper limit value.................................315.00000°

(b) Setting to invalidate software stroke limit

To invalidate the software stroke limit, set the software stroke limit lower limit value equal to the software stroke limit upper limit value.

The control can be carried out irrespective of the setting of the software stroke limit.

POINT

(1) When the upper/lower limit value of the axis which set the software stroke limit as valid are changed, perform the machine OPR after that.
(2) When the software stroke limit is set as valid in the incremental data system, perform the machine OPR after power supply on.

[3] Positioning control method when the control unit is set to "degree"

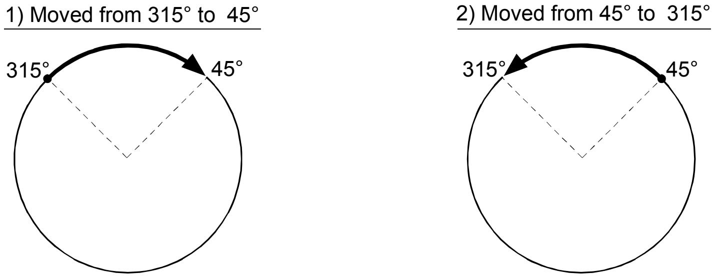
1) Absolute system

(a) When the software stroke limit is invalid

Positioning is carried out in the nearest direction to the designated address, using the current value as a reference.
(This is called "shortcut control".)

Example

1) Positioning is carried out in a clockwise direction when the current value is moved from 315° to 45°.
2) Positioning is carried out in a counterclockwise direction when the current value is moved from 45° to 315°.



To designate the positioning direction (not carrying out the shortcut control), the shortcut control is invalidated and positioning in a designated direction is carried out by the "Cd.40 ABS direction in degrees".
This function can perform only when the software stroke limit is invalid. When the software stroke limit is valid, an error "ABS direction in degrees illegal" (error code: 546) occurs and positioning is not started.
To designate the movement direction in the ABS control, a "1" or "2" is written to the "Cd.40 ABS direction in degrees" of the buffer memory (initial value: 0).
The value written to the "Cd.40 ABS direction in degrees" becomes valid only when the positioning control is started.
In the continuous positioning control and continuous path control, the operation is continued with the setting set at the time of start even if the setting is changed during the operation.

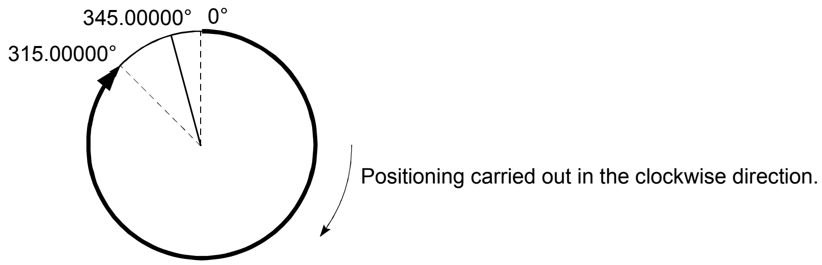
Name	Function	Buffer memory address		Initial value
		QD77MS2 QD77MS4	QD77MS16	
Cd.40 ABS direction in degrees	The ABS movement direction in the unit of degree is designated. 0: Shortcut (direction setting invalid) 1: ABS clockwise 2: ABS counterclockwise	1550+100n	4350+100n	0

(b) When the software stroke limit is valid

The positioning is carried out in a clockwise/counterclockwise direction depending on the software stroke limit range setting method.
Because of this, positioning with "shortcut control" may not be possible.

Example

When the current value is moved from 0° to 315°, positioning is carried out in the clockwise direction if the software stroke limit lower limit value is 0° and the upper limit value is 345°.



POINT

Positioning addresses are within a range of 0° to 359.99999°.
Use the incremental system to carry out positioning of one rotation or more.

2) Incremental system

Positioning is carried out for a designated movement amount in a designated movement direction when in the incremental system of positioning.
The movement direction is determined by the sign (+, –) of the movement amount.

- For a positive (+) movement direction ......Clockwise
- For a negative (–) movement direction.....Counterclockwise

POINT

Positioning of 360° or more can be carried out with the incremental system.
At this time, set as shown below to invalidate the software stroke limit.

[Software stroke limit upper limit value = Software stroke limit lower limit value]

Set the value within the setting range (0° to 359.99999°).

9.1.6 Interpolation control

■ Meaning of interpolation control

In "2-axis linear interpolation control", "3-axis linear interpolation control", "4-axis linear interpolation control", "2-axis fixed-feed control", "3-axis fixed-feed control", "4-axis fixed-feed control", "2-axis speed control", "3-axis speed control", "4-axis speed control", and "2-axis circular interpolation control", control is carried out so that linear and arc paths are drawn using a motor set in two to four axis directions. This kind of control is called "interpolation control".
In interpolation control, the axis in which the control system is set is defined as the "reference axis", and the other axis is defined as the "interpolation axis".
The Simple Motion module controls the "reference axis" following the positioning data set in the "reference axis", and controls the "interpolation axis" corresponding to the reference axis control so that a linear or arc path is drawn.
The following table shows the reference axis and interpolation axis combinations.

Axis definition / Interpolation of " Da.2 Control system"	QD77MS2		QD77MS4		QD77MS16	
	Reference axis	Interpolation axis	Reference axis	Interpolation axis	Reference axis	Interpolation axis
2-axis linear interpolation control 2-axis fixed-feed control 2-axis circular interpolation control 2-axis speed control	Any of axes 1 to 2	"Axis to be interpolated" set in reference axis	Any of axes 1 to 4	"Axis to be interpolated" set in reference axis	Any of axes 1 to 16	"Axis to be interpolated No.1" set in reference axis
3-axis linear interpolation control 3-axis fixed-feed control 3-axis speed control	–		Axis 1	Axis 2, Axis 3		"Axis to be interpolated No.1" and "Axis to be interpolated No.2" set in reference axis
	–		Axis 2	Axis 3, Axis 4		
	–		Axis 3	Axis 4, Axis 1		
	–		Axis 4	Axis 1, Axis 2		
4-axis linear interpolation control 4-axis fixed-feed control 4-axis speed control	–		Axis 1	Axis 2, Axis 3, Axis 4		"Axis to be interpolated No.1", "Axis to be interpolated No.2" and "Axis to be interpolated No.3" set in reference axis
	–		Axis 2	Axis 3, Axis 4, Axis 1		
	–		Axis 3	Axis 4, Axis 1, Axis 2		
	–		Axis 4	Axis 1, Axis 2, Axis 3		

■ Setting the positioning data during interpolation control

When carrying out interpolation control, the same positioning data Nos. are set for the "reference axis" and the "interpolation axis".
The following table shows the "positioning data" setting items for the reference axis and interpolation axis.

Axis Setting item			Reference axis setting item	Interpolation axis setting item
Same positioning data Nos	Da.1	Operation pattern	◎	–
	Da.2	Control system	Linear 2, 3, 4, Fixed-feed 2, 3, 4, Circular sub, Circular right, Circular left Forward run speed 2, 3, 4 Reverse run speed 2, 3, 4	–
	Da.3	Acceleration time No.	◎	–
	Da.4	Deceleration time No.	◎	–
	Da.5	Axis to be interpolated QD77MS2 QD77MS4	○ ∗1	–
	Da.6	Positioning address/ movement amount	△ (Forward run speed 2, 3, and 4. Reverse run speed 2, 3, and 4 not required.)	△ (Forward run speed 2, 3, and 4. Reverse run speed 2, 3, and 4 not required.)
	Da.7	Arc address	△ (Only during circular sub, circular right, and circular left).	△ (Only during circular sub, circular right, and circular left).
	Da.8	Command speed	◎	△ (Only during forward run speed 2, 3, 4 and reverse run speed 2, 3, 4).
	Da.9	Dwell time	○	–
	Da.10	M code	○	–
	Da.20	Axis to be interpolated No.1 QD77MS16	○ ∗2	–
	Da.21	Axis to be interpolated No.2 QD77MS16	○ ∗2	–
	Da.22	Axis to be interpolated No.3 QD77MS16	○ ∗2	–

◎ : Setting always required
○ : Set according to requirements (Set to "–" when not used.)
△ : Setting restrictions exist
– : Setting not required (Setting value is invalid. Use the initial value or a value within the setting range.)
∗1: For 2-axis interpolation, the partner axis is set. If the self-axis is set, an error "Illegal interpolation description command (error code: 521)" will occur. For 3- and 4-axis interpolation, the axis setting is not required.
∗2: The axis No. is set to axis to be interpolated No.1 for 2-axis linear interpolation, to axis to be interpolated No.1 and No.2 for 3-axis linear interpolation, and to axis to be interpolated No.1 to No.3 for 4-axis linear interpolation.
If the self-axis is set, an error "Illegal interpolation description command (error code: 521)" will occur.
The axes that are not used are not required.

(Note): Refer to Section 5.3 "List of positioning data" for information on the setting details.

■ Starting the interpolation control

The positioning data Nos. of the reference axis (axis in which interpolation control was set in "Da.2 Control system") are started when starting the interpolation control. (Starting of the interpolation axis is not required.)
The following errors or warnings will occur and the positioning will not start if both reference axis and the interpolation axis are started.

- Reference axis : Interpolation while interpolation axis BUSY (error code: 519)
- Interpolation axis : Control system setting error (error code: 524), start during operation (warning code: 100).

■ Interpolation control continuous positioning

When carrying out interpolation control in which "continuous positioning control" and "continuous path control" are designated in the operation pattern, the positioning method for all positioning data from the started positioning data to the positioning data in which "positioning complete" is set must be set to interpolation control.
The number of the interpolation axes and axes to be interpolated cannot be changed from the intermediate positioning data. When the number of the interpolation axes and axes to be interpolated are changed, an error "Control system setting error" (error code: 524) will occur and the positioning will stop.

■ Speed during interpolation control

Either the "composite speed" or "reference axis speed" can be designated as the speed during interpolation control.
(Pr.20 Interpolation speed designation method)
Only the "Reference axis speed" can be designated in the following interpolation control.
When a "composite speed" is set and positioning is started, the "Interpolation mode error (error code: 523)" occurs, and the system will not start.

- 4-axis linear interpolation
- 2-axis speed control
- 3-axis speed control
- 4-axis speed control

■ Cautions in interpolation control

(1) If either of the axes exceeds the "Pr.8 Speed limit value" in the 2- to 4-axes speed control, the axis which exceeded the speed limit value is controlled by the speed limit value.
For the other axes which perform interpolation, the speed can be suppressed by the ratio of a command speed.
If the reference axis exceeds "Pr.8 Speed limit value" during 2- to 4-axis linear interpolation control, 2- to 4-axis fixed-feed control or 2-axis circular interpolation control, the reference axis is controlled at the speed limit value. (The speed limit does not function on the interpolation axis side.)

(2) In 2-axis interpolation, you cannot change the combination of interpolated axes midway through operation.

POINT

When the "reference axis speed" is set during interpolation control, set so the major axis side becomes the reference axis. If the minor axis side is set as the reference axis, the major axis side speed may exceed the "Pr.8 Speed limit value".

■ Limits to interpolation control

There are limits to the interpolation control that can be executed and speed (Pr.20 Interpolation speed designation method) that can be set, depending on the "Pr.1 Unit setting" of the reference axis and interpolation axis. (For example, circular interpolation control cannot be executed if the reference axis and interpolation axis units differ.)

The following table shows the interpolation control and speed designation limits.

"Da.2 Control system" interpolation control	Pr.20 Interpolation speed designation method	Pr.1 Unit setting ＊1	
		Reference axis and interpolation axis units are the same, or a combination of "mm" and "inch". ＊3	Reference axis and interpolation axis units differ ＊3
Linear 2 (ABS, INC) Fixed-feed 2	Composite speed	○	×
	Reference axis speed	○	○
Circular sub (ABS, INC) Circular right (ABS, INC) Circular left (ABS, INC)	Composite speed	○ ＊2	×
	Reference axis speed	×	×
Linear 3 (ABS, INC) Fixed-feed 3	Composite speed	○	×
	Reference axis speed	○	○
Linear 4 (ABS, INC) Fixed-feed 4	Composite speed	×	×
	Reference axis speed	○	○

○ : Setting possible, × : Setting not possible.

＊1: "mm" and "inch" unit mix possible.
When "mm" and "inch" are mixed, convert as follows for the positioning.

- If interpolation control units are "mm", positioning is controlled by calculating position commands from the address, travel value, positioning speed and electronic gear, which have been converted to "mm" using the formula: inch setting value × 25.4 = mm setting value.
- If interpolation control units are "inch", positioning is controlled by calculating position commands from the address, travel value, positioning speed and electronic gear, which have been converted to "inch" using the formula: mm setting value ÷ 25.4 = inch setting value.

＊2: "degree" setting not possible. A "Circular interpolation not possible (error code: 535)" will occur and the positioning control does not start if circular interpolation control is set when the unit is "degree". The machine will immediately stop if "degree" is set during positioning control.

＊3: The unit set in the reference axis will be used for the speed unit during control if the units differ or if "mm" and "inch" are combined.

■ Axis operation status during interpolation control

"Interpolation" will be stored in the "Md.26 Axis operation status" during interpolation control. "Standby" will be stored when the interpolation operation is terminated. Both the reference axis and interpolation axis will carry out a deceleration stop if an error occurs during control, and "Error" will be stored in the operation status.

MEMO

9.2 Setting the positioning data

9.2.1 Relation between each control and positioning data

The setting requirements and details for the setting items of the positioning data to be set differ according to the "Da.2 Control system".
The following table shows the positioning data setting items corresponding to the different types of control. Details and settings for the operation of each control are shown in Section 9.2.2 and subsequent sections.
(In this section, it is assumed that the positioning data setting is carried out using GX Works2.)

Major positioning control / Positioning data setting items			Position control			Speed control
			1-axis linear control 2-axis linear interpolation control 3-axis linear interpolation control 4-axis linear interpolation control	1-axis fixed-feed control 2-axis fixed-feed control 3-axis fixed-feed control 4-axis fixed-feed control	2-axis circular interpolation control	1-axis, 2-axis, 3-axis, 4-axis Speed control
Da.1	Operation pattern	Independent positioning control (Positioning complete)	◎	◎	◎	◎
		Continuous positioning control	◎	◎	◎	×
		Continuous path control	◎	×	◎	×
Da.2	Control system		Linear 1 Linear 2 Linear 3 Linear 4 ✻	Fixed-feed 1 Fixed-feed 2 Fixed-feed 3 Fixed-feed 4	Circular sub Circular right Circular left ✻	Forward run speed 1 Reverse run speed 1 Forward run speed 2 Reverse run speed 2 Forward run speed 3 Reverse run speed 3 Forward run speed 4 Reverse run speed 4
Da.3	Acceleration time No.		◎	◎	◎	◎
Da.4	Deceleration time No.		◎	◎	◎	◎
Da.5	Axis to be interpolated QD77MS2 QD77MS4		◎: 2-axis –: 1, 3, 4-axis			
Da.6	Positioning address/movement amount		◎	◎	◎	–
Da.7	Arc address		–	–	◎	–
Da.8	Command speed		◎	◎	◎	◎
Da.9	Dwell time		○	○	○	–
Da.10	M code		○	○	○	○
Da.20	Axis to be interpolated No.1 QD77MS16		◎: 2, 3, 4-axis –: 1-axis			
Da.21	Axis to be interpolated No.2 QD77MS16		◎: 3, 4-axis –: 1, 2-axis			
Da.22	Axis to be interpolated No.3 QD77MS16		◎: 4-axis –: 1, 2,3 -axis			

		Other control				
Speed-position switching control	Position- speed switching control	NOP instruction	Current value changing	JUMP instruction	LOOP instruction	LEND instruction
◎	◎	–	◎	–	–	–
◎	×	–	◎	–	–	–
×	×	–	×	–	–	–
Forward run speed/position Reverse run speed/position ✻	Forward run position/speed Reverse run position/speed	NOP instruction	Current value changing	JUMP instruction	LOOP instruction	LEND instruction
◎	◎	–	–	–	–	–
◎	◎	–	–	–	–	–
–	–	–	–	–	–	–
◎	◎	–	Change destination address	–	–	–
–	–	–	–	–	–	–
◎	◎	–	–	–	–	–
○	○	–	–	JUMP destination-positioning data No.	–	–
○	○	–	○	Condition data No. at JUMP	Number of repetition	–
–	–	–	–	–	–	–
–	–	–	–	–	–	–
–	–	–	–	–	–	–

◎ : Always set
○ : Set according to requirements ("–" when not set)
× : Setting not possible (If setting is made, an error (error code: 516) will occur at a start.)
– : Setting not required (Setting value is invalid. Use the initial values or setting values within a range.)
✻ : The "ABS (absolute) system" or "INC (incremental) system" can be used for the control system.

REMARK

- It is recommended that the "positioning data" be set whenever possible with GX Works2. Execution by sequence program uses many sequence programs and devices. The execution becomes complicated, and the scan times will increase.

9.2.2 1-axis linear control

In "1-axis linear control" ("Da.2 Control system" = ABS linear 1, INC linear 1), one motor is used to carry out position control in a set axis direction.

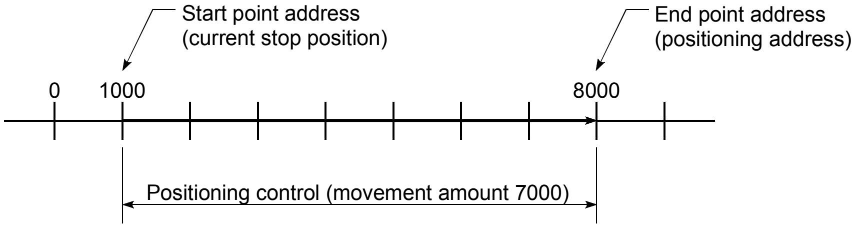
[1] 1-axis linear control (ABS linear 1)

■ Operation chart

In absolute system 1-axis linear control, positioning is carried out from the current stop position (start point address) to the address (end point address) set in "Da.6 Positioning address/movement amount".

Example

When the start point address (current stop position) is 1000, and the end point address (positioning address) is 8000, positioning is carried out in the positive direction for a movement amount of 7000 (8000-1000)



■ Positioning data setting example

[When "1-axis linear control (ABS linear 1)" is set in positioning data No. 1 of axis 1.]

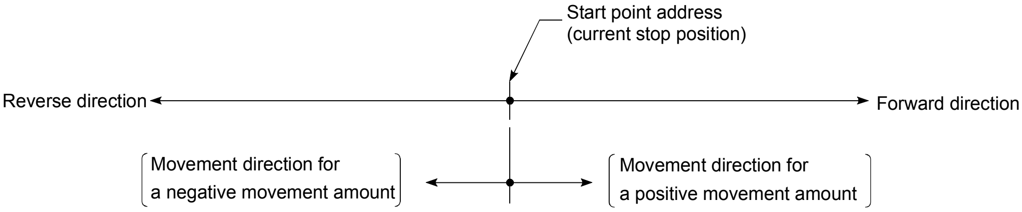
Setting item			Setting example		Setting details
			QD77MS2 QD77MS4	QD77MS16	
Axis 1 Positioning data No. 1	Da.1	Operation pattern	Positioning complete		Set "Positioning complete" assuming the next positioning data will not be executed.
	Da.2	Control system	ABS linear 1		Set absolute system 1-axis linear control.
	Da.3	Acceleration time No.	1		Designate the value set in "Pr.25 Acceleration time 1" as the acceleration time at start.
	Da.4	Deceleration time No.	0		Designate the value set in "Pr.10 Deceleration time 0" as the deceleration time at deceleration.
	Da.5	Axis to be interpolated QD77MS2 QD77MS4	–		Setting not required (setting value is ignored).
	Da.6	Positioning address/ movement amount	8000.0μm		Set the positioning address. (Assuming "mm" is set in "Pr.1 Unit setting".)
	Da.7	Arc address	–		Setting not required (setting value is ignored).
	Da.8	Command speed	6000.00mm/min		Set the speed during movement to the positioning address.
	Da.9	Dwell time	500ms		Set the time the machine dwells after the positioning stop (command stop) to the output of the positioning complete signal.
	Da.10	M code	10		Set this when other sub operation commands are issued in combination with the No.1 positioning data.
	Da.20	Axis to be interpolated No.1 QD77MS16		–	Setting not required (setting value is ignored).
	Da.21	Axis to be interpolated No.2 QD77MS16		–	
	Da.22	Axis to be interpolated No.3 QD77MS16		–	

(Note): Refer to Section 5.3 "List of positioning data" for information on the setting details.

[2] 1-axis linear control (INC linear 1)

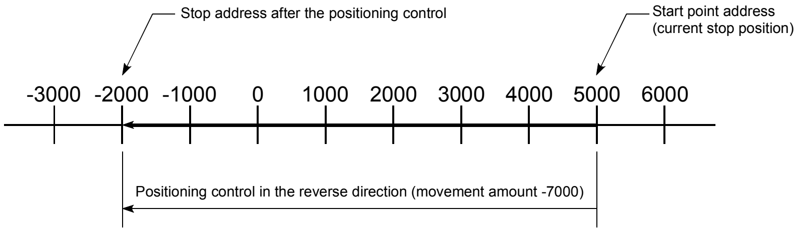
■ Operation chart

In incremental system 1-axis linear control, positioning is carried out from the current stop position (start point address) to a position at the end of the movement amount set in "Da.6 Positioning address/movement amount". The movement direction is determined by the sign of the movement amount.



Example

When the start point address is 5000, and the movement amount is -7000, positioning is carried out to the -2000 position.



■ Positioning data setting example

[When "1-axis linear control (INC linear 1)" is set in positioning data No. 1 of axis 1]

Setting item			Setting example		Setting details
			QD77MS2 QD77MS4	QD77MS16	
Axis 1 Positioning data No. 1	Da.1	Operation pattern	Positioning complete		Set "Positioning complete" assuming the next positioning data will not be executed.
	Da.2	Control system	INC linear 1		Set incremental system 1-axis linear control.
	Da.3	Acceleration time No.	1		Designate the value set in "Pr.25 Acceleration time 1" as the acceleration time at start.
	Da.4	Deceleration time No.	0		Designate the value set in "Pr.10 Deceleration time 0" as the deceleration time at deceleration.
	Da.5	Axis to be interpolated QD77MS2 QD77MS4	–		Setting not required (setting value is ignored).
	Da.6	Positioning address/ movement amount	-7000.0μm		Set the movement amount. (Assuming "mm" is set in "Pr.1 Unit setting".)
	Da.7	Arc address	–		Setting not required (setting value is ignored).
	Da.8	Command speed	6000.00mm/min		Set the speed during movement.
	Da.9	Dwell time	500ms		Set the time the machine dwells after the positioning stop (command stop) to the output of the positioning complete signal.
	Da.10	M code	10		Set this when other sub operation commands are issued in combination with the No.1 positioning data.
	Da.20	Axis to be interpolated No.1 QD77MS16		–	Setting not required (setting value is ignored).
	Da.21	Axis to be interpolated No.2 QD77MS16		–	
	Da.22	Axis to be interpolated No.3 QD77MS16		–	

(Note): Refer to Section 5.3 "List of positioning data" for information on the setting details.

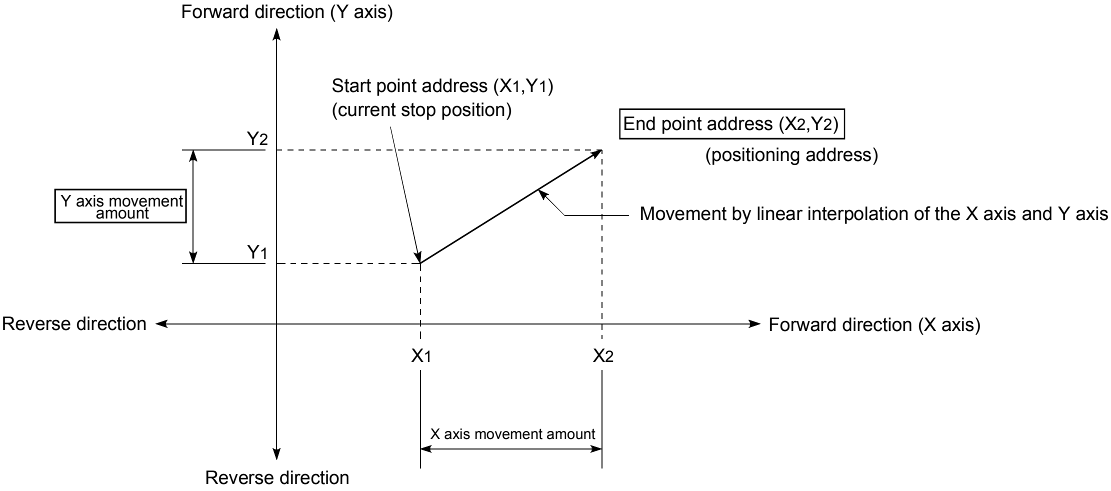
9.2.3 2-axis linear interpolation control

In "2-axis linear interpolation control" ("Da.2 Control system" = ABS linear 2, INC linear 2), two motors are used to carry out position control in a linear path while carrying out interpolation for the axis directions set in each axis.
(Refer to Section 9.1.6 "Interpolation control" for details on interpolation control.)

[1] 2-axis linear interpolation control (ABS linear 2)

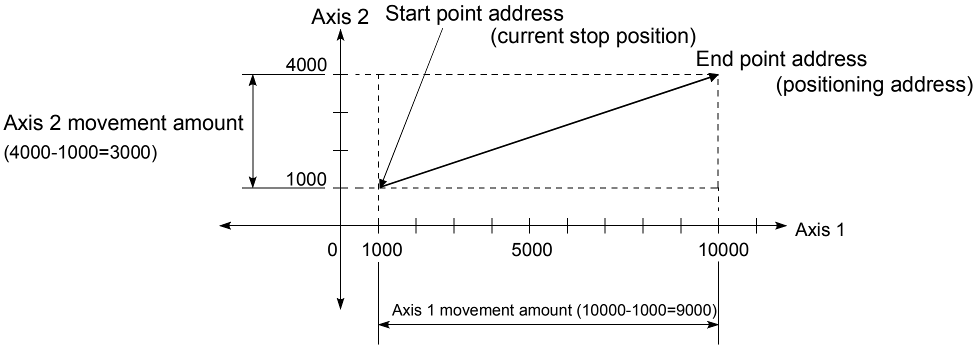
■ Operation chart

In absolute system 2-axis linear interpolation control, the designated 2 axes are used. Linear interpolation positioning is carried out from the current stop position (start point address) to the address (end point address) set in "Da.6 Positioning address/movement amount".



Example

When the start point address (current stop position) is (1000, 1000) and the end point address (positioning address) is (10000, 4000), positioning is carried out as follows.



■ Restrictions

An error will occur and the positioning will not start in the following cases. The machine will immediately stop if the error is detected during a positioning control.

- If the movement amount of each axis exceeds "1073741824 (=2^{30})" when "0: Composite speed" is set in "Pr.20 Interpolation speed designation method"
  The "Outside linear movement amount range error (error code: 504)" occurs at a positioning start.
  (The maximum movement amount that can be set in "Da.6 Positioning address/ movement amount" is "1073741824 (=2^{30})".)

■ Positioning data setting example

[When "2-axis linear interpolation control (ABS linear 2)" is set in positioning data No. 1 of axis 1]

- Reference axis............. Axis 1
- Interpolation axis.......... Axis 2 (The required values are also set in positioning data No. 1 of axis 2.)

Axis Setting item			QD77MS2/QD77MS4 setting example		QD77MS16 setting example		Setting details
			Axis 1 (reference axis)	Axis 2 (interpolation axis)	Axis 1 (reference axis)	Axis 2 (interpolation axis)	
Axis 1 Positioning data No. 1	Da.1	Operation pattern	Positioning complete	–	Positioning complete	–	Set "Positioning complete" assuming the next positioning data will not be executed.
	Da.2	Control system	ABS linear 2	–	ABS linear 2	–	Set absolute system 2-axis linear interpolation control.
	Da.3	Acceleration time No.	1	–	1	–	Designate the value set in "Pr.25 Acceleration time 1" as the acceleration time at start.
	Da.4	Deceleration time No.	0	–	0	–	Designate the value set in "Pr.10 Deceleration time 0" as the deceleration time at deceleration.
	Da.5	Axis to be interpolated QD77MS2 QD77MS4	Axis 2	–			Set the axis to be interpolated (partner axis). If the self-axis is set, an error will occur.
	Da.6	Positioning address/ movement amount	10000.0 µm	4000.0 µm	10000.0 µm	4000.0 µm	Set the end point address. (Assuming "mm" is set in "Pr.1 Unit setting".)
	Da.7	Arc address	–	–	–	–	Setting not required (setting value is ignored).
	Da.8	Command speed	6000.00 mm/min	–	6000.00 mm/min	–	Set the speed during movement to the end point address.
	Da.9	Dwell time	500ms	–	500ms	–	Set the time the machine dwells after the positioning stop (command stop) to the output of the positioning complete signal.
	Da.10	M code	10	–	10	–	Set this when other sub operation commands are issued in combination with the No.1 positioning data.
	Da.20	Axis to be interpolated No.1 QD77MS16			Axis 2	–	Set the axis to be interpolated. If the self-axis is set, an error will occur.
	Da.21	Axis to be interpolated No.2 QD77MS16			–	–	Setting not required (setting value is ignored).
	Da.22	Axis to be interpolated No.3 QD77MS16			–	–	

(Note): Refer to Section 5.3 "List of positioning data" for information on the setting details.

POINT

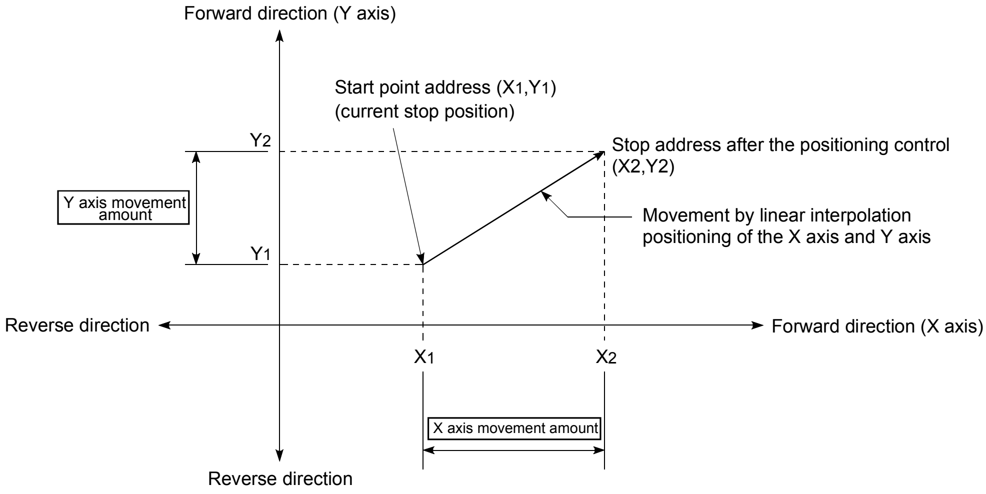
- When the "reference axis speed" is set during 2-axis linear interpolation control, set so the major axis side becomes the reference axis. If the minor axis side is set as the reference axis, the major axis side speed may exceed the "Pr.8 Speed limit value".

[2] 2-axis linear interpolation control (INC linear 2)

■ Operation chart

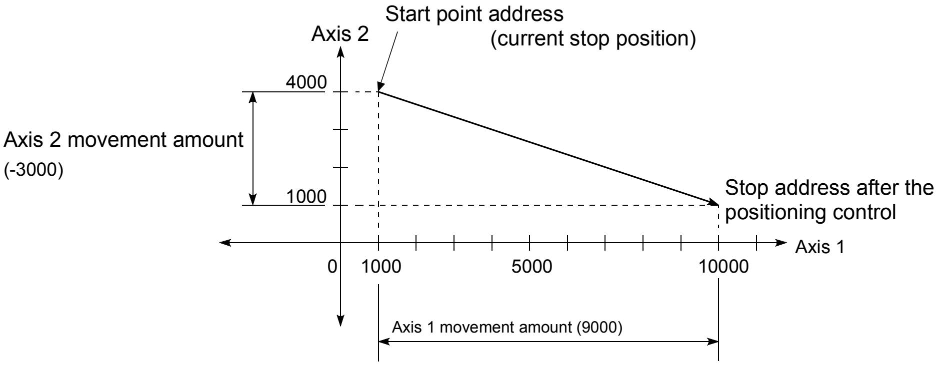
In incremental system 2-axis linear interpolation control, the designated 2 axes are used. Linear interpolation positioning is carried out from the current stop position (start point address) to a position at the end of the movement amount set in "Da.6 Positioning address/movement amount". The movement direction is determined by the sign of the movement amount.

- Positive movement amount .... Positioning control to forward direction (Address increase direction)
- Negative movement amount............. Positioning control to reverse direction (Address decrease direction)



Example

When the axis 1 movement amount is 9000 and the axis 2 movement amount is -3000, positioning address (10000, 4000) is carried out as follows.



■ Restrictions

An error will occur and the positioning will not start in the following cases. The machine will immediately stop if the error is detected during a positioning operation.

- If the movement amount of each axis exceeds "1073741824 (=2^{30})" when "0: Composite speed" is set in "Pr.20 Interpolation speed designation method"
  The "Outside linear movement amount range error (error code: 504)" occurs at a positioning start.
  (The maximum movement amount that can be set in "Da.6 Positioning address/ movement amount" is "1073741824 (=2^{30})".)

■ Positioning data setting example

[When "2-axis linear interpolation control (INC linear 2)" is set in positioning data No. 1 of axis 1]

- Reference axis............. Axis 1
- Interpolation axis.......... Axis 2 (The required values are also set in positioning data No. 1 of axis 2.)

Axis Setting item			QD77MS2/QD77MS4 setting example		QD77MS16 setting example		Setting details
			Axis 1 (reference axis)	Axis 2 (interpolation axis)	Axis 1 (reference axis)	Axis 2 (interpolation axis)	
Axis 1 Positioning data No. 1	Da.1	Operation pattern	Positioning complete	–	Positioning complete	–	Set "Positioning complete" assuming the next positioning data will not be executed.
	Da.2	Control system	INC linear 2	–	INC linear 2	–	Set incremental system 2-axis linear interpolation control.
	Da.3	Acceleration time No.	1	–	1	–	Designate the value set in "Pr.25 Acceleration time 1" as the acceleration time at start.
	Da.4	Deceleration time No.	0	–	0	–	Designate the value set in "Pr.10 Deceleration time 0" as the deceleration time at deceleration.
	Da.5	Axis to be interpolated QD77MS2 QD77MS4	Axis 2	–			Set the axis to be interpolated (partner axis). If the self-axis is set, an error will occur.
	Da.6	Positioning address/ movement amount	9000.0 μm	-3000.0 μm	9000.0 μm	-3000.0 μm	Set the movement amount. (Assuming "mm" is set in "Pr.1 Unit setting".)
	Da.7	Arc address	–	–	–	–	Setting not required (setting value is ignored).
	Da.8	Command speed	6000.00 mm/min	–	6000.00 mm/min	–	Set the speed during movement.
	Da.9	Dwell time	500ms	–	500ms	–	Set the time the machine dwells after the positioning stop (command stop) to the output of the positioning complete signal.
	Da.10	M code	10	–	10	–	Set this when other sub operation commands are issued in combination with the No.1 positioning data.
	Da.20	Axis to be interpolated No.1 QD77MS16			Axis 2	–	Set the axis to be interpolated. If the self-axis is set, an error will occur.
	Da.21	Axis to be interpolated No.2 QD77MS16			–	–	Setting not required (setting value is ignored).
	Da.22	Axis to be interpolated No.3 QD77MS16			–	–	

(Note): Refer to Section 5.3 "List of positioning data" for information on the setting details.

POINT

- When the "reference axis speed" is set during 2-axis linear interpolation control, set so the major axis side becomes the reference axis. If the minor axis side is set as the reference axis, the major axis side speed may exceed the "Pr.8 Speed limit value".

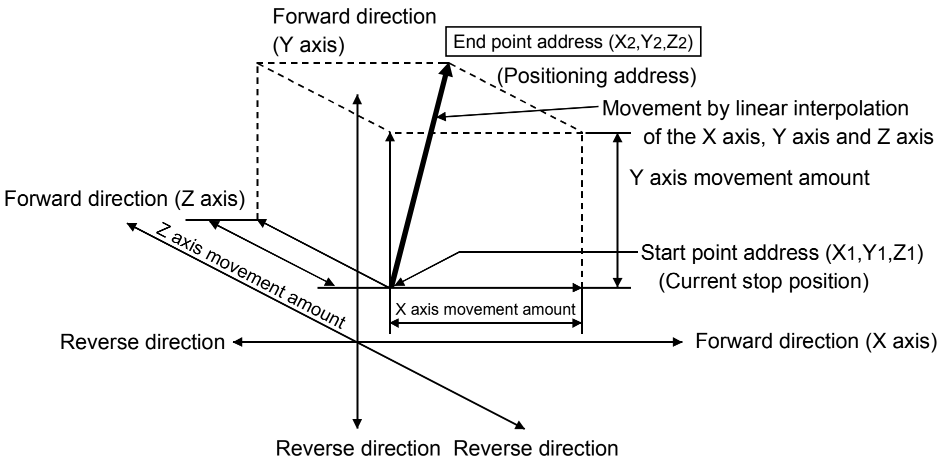
9.2.4 3-axis linear interpolation control

In "3-axis linear interpolation control" ("Da.2 Control system" = ABS linear 3, INC linear 3), three motors are used to carry out position control in a linear path while carrying out interpolation for the axis directions set in each axis.
(Refer to Section 9.1.6 "Interpolation control" for details on interpolation control.)

[1] 3-axis linear interpolation control (ABS linear 3)

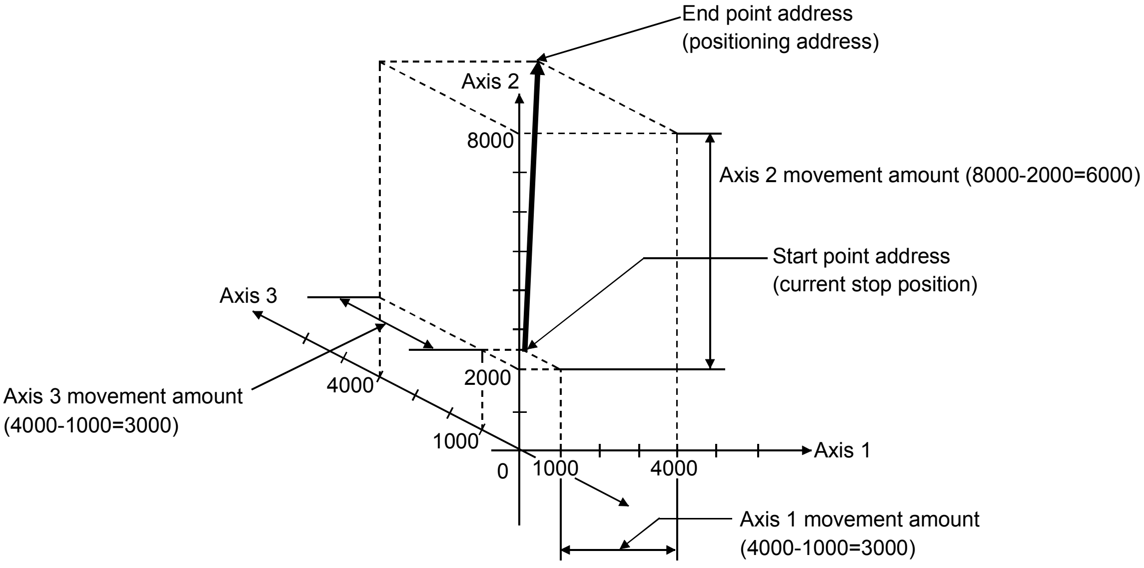
■ Operation chart

In the absolute system 3-axis linear interpolation control, the designated 3 axes are used. Linear interpolation positioning is carried out from the current stop position (start point address) to the address (end point address) set in the "Da.6 Positioning address/movement amount".



Example

When the start point address (current stop position) is (1000, 2000, 1000) and the end point address (positioning address) is (4000, 8000, 4000), positioning is carried out as follows.



■ Restrictions

An error will occur and the positioning will not start in the following cases. The machine will immediately stop if the error is detected during a positioning control.

- If the movement amount of each axis exceeds "1073741824 (=2^{30})" when "0: Composite speed" is set in "Pr.20 Interpolation speed designation method"
  The "Outside linear movement amount range error (error code: 504)" occurs at a positioning start.
  (The maximum movement amount that can be set in "Da.6 Positioning address/ movement amount" is "1073741824 (=2^{30})".)

■ Positioning data setting example

[When "3-axis linear interpolation control (ABS linear 3)" is set in positioning data No. 1 of axis 1]

- Reference axis............. Axis 1
- Interpolation axis.......... Axis 2, Axis3 (The required values are also set in positioning data No. 1 of axis 2 and axis 3.)

Setting item \ Axis			QD77MS4 setting example			QD77MS16 setting example			Setting details
			Axis 1 (reference axis)	Axis 2 (interpolation axis)	Axis 3 (interpolation axis)	Axis 1 (reference axis)	Axis 2 (interpolation axis)	Axis 3 (interpolation axis)	
Axis 1 Positioning data No. 1	Da.1	Operation pattern	Positioning complete	–	–	Positioning complete	–	–	Set "Positioning complete" assuming the next positioning data will not be executed.
	Da.2	Control system	ABS linear 3	–	–	ABS linear 3	–	–	Set absolute system 3-axis linear interpolation control.
	Da.3	Acceleration time No.	1	–	–	1	–	–	Designate the value set in "Pr.25 Acceleration time 1" as the acceleration time at start.
	Da.4	Deceleration time No.	0	–	–	0	–	–	Designate the value set in "Pr.10 Deceleration time 0" as the deceleration time at deceleration.
	Da.5	Axis to be interpolated QD77MS4	–	–	–				Setting not required (setting value is ignored). When axis 1 is used as a reference axis, the interpolation axes are axes 2 and 3.
	Da.6	Positioning address/ movement amount	4000.0 µm	8000.0 µm	4000.0 µm	4000.0 µm	8000.0 µm	4000.0 µm	Set the end point address. (Assuming "mm" is set in "Pr.1 Unit setting".)
	Da.7	Arc address	–	–	–	–	–	–	Setting not required (setting value is ignored).
	Da.8	Command speed	6000.00 mm/min	–	–	6000.00 mm/min	–	–	Set the speed during movement to the end point address.
	Da.9	Dwell time	500ms	–	–	500ms	–	–	Set the time the machine dwells after the positioning stop (command stop) to the output of the positioning complete signal.
	Da.10	M code	10	–	–	10	–	–	Set this when other sub operation commands are issued in combination with the No. 1 positioning data.
	Da.20	Axis to be interpolated No.1 QD77MS16				Axis 2	–	–	Set the axis to be interpolated. If the self-axis is set, an error will occur.
	Da.21	Axis to be interpolated No.2 QD77MS16				Axis 3	–	–	
	Da.22	Axis to be interpolated No.3 QD77MS16				–	–	–	Setting not required (setting value is ignored).

(Note): Refer to Section 5.3 "List of positioning data" for information on the setting details.

POINTS

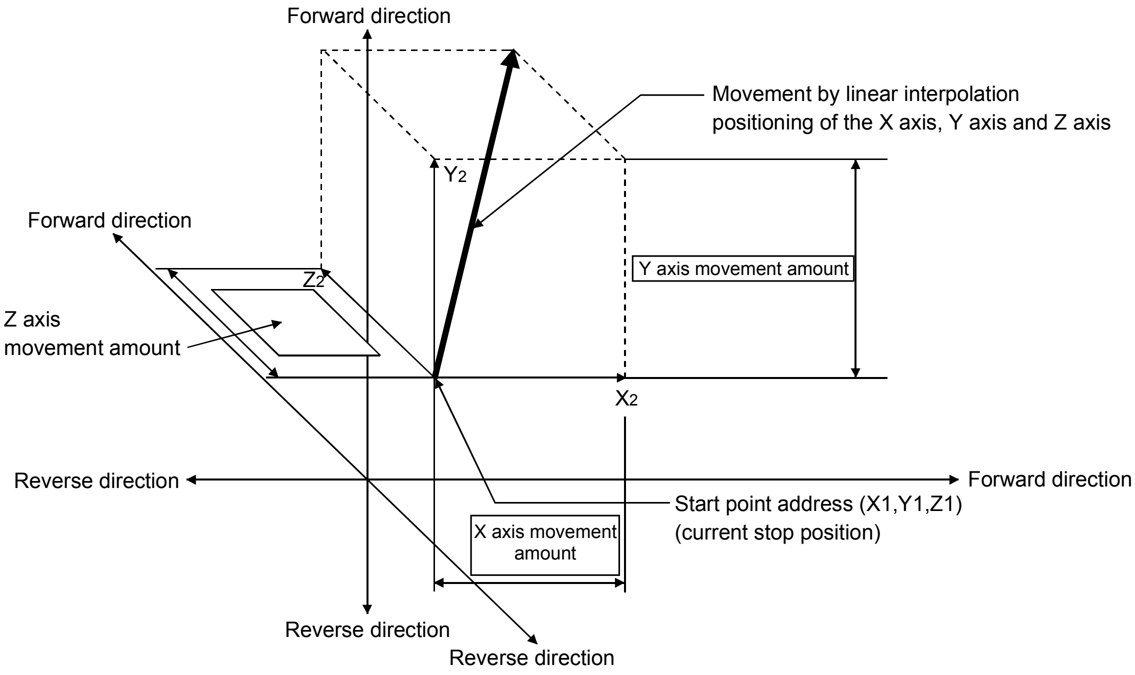
- When the "reference axis speed" is set during 3-axis linear interpolation control, set so the major axis side becomes the reference axis. If the minor axis side is set as the reference axis, the major axis side speed may exceed the "Pr.8 Speed limit value".
- Refer to Section 9.1.6 "Interpolation control" for the reference axis and interpolation axis combinations.

[2] 3-axis linear interpolation control (INC linear 3)

■ Operation chart

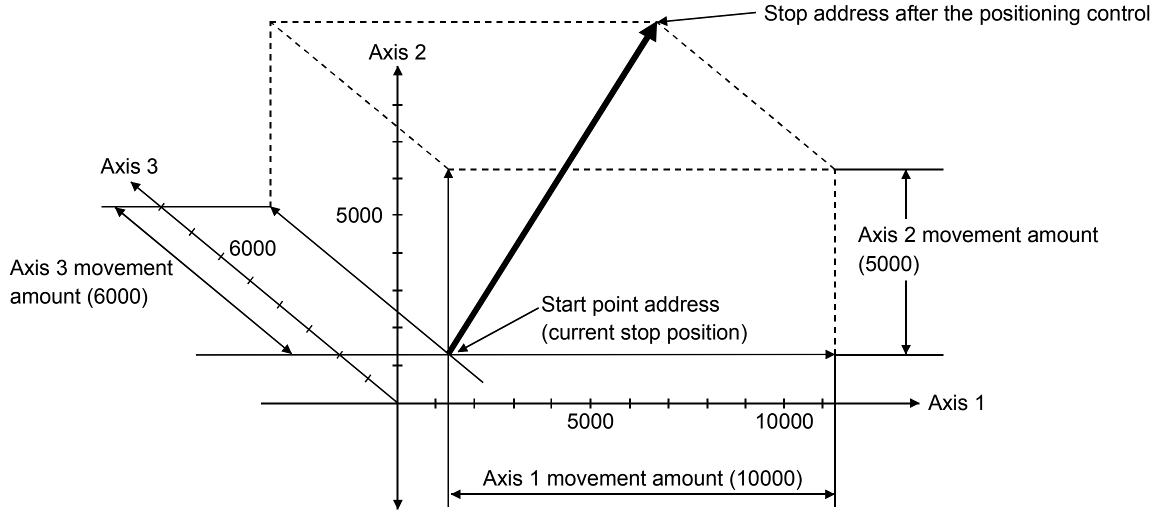
In the incremental system 3-axis linear interpolation control, the designated 3 axes are used. Linear interpolation positioning is carried out from the current stop position (start point address) to a position at the end of the movement amount set in the "Da.6 Positioning address/movement amount". The movement direction is determined the sign of the movement amount.

- Positive movement amount .... Positioning control to forward direction (Address increase direction)
- Negative movement amount............. Positioning control to reverse direction (Address decrease direction)



Example

When the axis 1 movement amount is 10000, the axis 2 movement amount is 5000 and the axis 3 movement amount is 6000, positioning is carried out as follows.



■ Restrictions

An error will occur and the positioning will not start in the following cases. The machine will immediately stop if the error is detected during a positioning operation.

- If the movement amount of each axis exceeds "1073741824 (=2^{30})" when "0: Composite speed" is set in "Pr.20 Interpolation speed designation method"
  The "Outside linear movement amount range error (error code: 504)" occurs at a positioning start.
  (The maximum movement amount that can be set in "Da.6 Positioning address/ movement amount" is "1073741824 (=2^{30})".)

■ Positioning data setting example

[When "3-axis linear interpolation control (INC linear 3)" is set in positioning data No. 1 of axis 1]

- Reference axis............. Axis 1
- Interpolation axis.......... Axis 2, Axis3 (The required values are also set in positioning data No. 1 of axis 2 and axis 3.)

Setting item		Axis	QD77MS4 setting example			QD77MS16 setting example			Setting details
			Axis 1 (reference axis)	Axis 2 (interpolation axis)	Axis 3 (interpolation axis)	Axis 1 (reference axis)	Axis 2 (interpolation axis)	Axis 3 (interpolation axis)	
Axis 1 Positioning data No. 1	Da.1	Operation pattern	Positioning complete	–	–	Positioning complete	–	–	Set "Positioning complete" assuming the next positioning data will not be executed.
	Da.2	Control system	INC linear 3	–	–	INC linear 3	–	–	Set incremental system 3-axis linear interpolation control.
	Da.3	Acceleration time No.	1	–	–	1	–	–	Designate the value set in "Pr.25 Acceleration time 1" as the acceleration time at start.
	Da.4	Deceleration time No.	0	–	–	0	–	–	Designate the value set in "Pr.10 Deceleration time 0" as the deceleration time at deceleration.
	Da.5	Axis to be interpolated QD77MS4	–	–	–				Setting not required (setting value is ignored). When axis 1 is used as a reference axis, the interpolation axes are axes 2 and 3.
	Da.6	Positioning address/ movement amount	10000.0 μm	5000.0 μm	6000.0 μm	10000.0 μm	5000.0 μm	6000.0 μm	Set the movement amount. (Assuming "mm" is set in "Pr.1 Unit setting".)
	Da.7	Arc address	–	–	–	–	–	–	Setting not required (setting value is ignored).
	Da.8	Command speed	6000.00 mm/min	–	–	6000.00 mm/min	–	–	Set the speed during movement to the end point address.
	Da.9	Dwell time	500ms	–	–	500ms	–	–	Set the time the machine dwells after the positioning stop (command stop) to the output of the positioning complete signal.
	Da.10	M code	10	–	–	10	–	–	Set this when other sub operation commands are issued in combination with the No. 1 positioning data.
	Da.20	Axis to be interpolated No.1 QD77MS16				Axis 2	–	–	Set the axis to be interpolated. If the self-axis is set, an error will occur.
	Da.21	Axis to be interpolated No.2 QD77MS16				Axis 3	–	–	
	Da.22	Axis to be interpolated No.3 QD77MS16				–	–	–	Setting not required (setting value is ignored).

(Note): Refer to Section 5.3 "List of positioning data" for information on the setting details.

POINTS

- When the "reference axis speed" is set during 3-axis linear interpolation control, set so the major axis side becomes the reference axis. If the minor axis side is set as the reference axis, the major axis side speed may exceed the "Pr.8 Speed limit value".
- Refer to Section 9.1.6 "Interpolation control" for the reference axis and interpolation axis combinations.

9.2.5 4-axis linear interpolation control

In "4-axis linear interpolation control" ("Da.2 Control system" = ABS linear 4, INC linear 4), four motors are used to carry out position control in a linear path while carrying out interpolation for the axis directions set in each axis.
(Refer to Section 9.1.6 "Interpolation control" for details on interpolation control.)

[1] 4-axis linear interpolation control (ABS linear 4)

In the absolute system 4-axis linear interpolation control, the designated 4 axes are used. Linear interpolation positioning is carried out from the current stop position (start point address) to the address (end point address) set in the "Da.6 Positioning address/movement amount".

■ Positioning data setting example

[When "4-axis linear interpolation control (ABS linear 4)" is set in positioning data No. 1 of axis 1]

- Reference axis............. Axis 1
- Interpolation axis.......... Axis 2, Axis3, Axis4 (The required values are also set in positioning data No. 1 of axis 2, axis 3 and axis 4.)

Axis			QD77MS4 setting example				QD77MS16 setting example				Setting details
Setting item			Axis 1 (reference axis)	Axis 2 (interpolation axis)	Axis 3 (interpolation axis)	Axis 4 (interpolation axis)	Axis 1 (reference axis)	Axis 2 (interpolation axis)	Axis 3 (interpolation axis)	Axis 4 (interpolation axis)	
Axis 1 Positioning data No. 1	Da.1	Operation pattern	Positioning complete	–	–	–	Positioning complete	–	–	–	Set "Positioning complete" assuming the next positioning data will not be executed.
	Da.2	Control system	ABS linear 4	–	–	–	ABS linear 4	–	–	–	Set absolute system 4-axis linear interpolation control.
	Da.3	Acceleration time No.	1	–	–	–	1	–	–	–	Designate the value set in "Pr.25 Acceleration time 1" as the acceleration time at start.
	Da.4	Deceleration time No.	0	–	–	–	0	–	–	–	Designate the value set in "Pr.10 Deceleration time 0" as the deceleration time at deceleration.
	Da.5	Axis to be interpolated QD77MS4	–	–	–	–					Setting not required (setting value is ignored). When axis 1 is used as a reference axis, the interpolation axes are axes 2, 3 and 4.
	Da.6	Positioning address/ movement amount	4000.0 μm	8000.0 μm	4000.0 μm	3000.0 μm	4000.0 μm	8000.0 μm	4000.0 μm	3000.0 μm	Set the end point address. (Assuming "mm" is set in "Pr.1 Unit setting".)
	Da.7	Arc address	–	–	–	–	–	–	–	–	Setting not required (setting value is ignored).
	Da.8	Command speed	6000.00 mm/min	–	–	–	6000.00 mm/min	–	–	–	Set the speed during movement to the end point address.
	Da.9	Dwell time	500ms	–	–	–	500ms	–	–	–	Set the time the machine dwells after the positioning stop (command stop) to the output of the positioning complete signal.
	Da.10	M code	10	–	–	–	10	–	–	–	Set this when other sub operation commands are issued in combination with the No. 1 positioning data.
	Da.20	Axis to be interpolated No.1 QD77MS16					Axis 2	–	–	–	Set the axis to be interpolated. If the self-axis is set, an error will occur.
	Da.21	Axis to be interpolated No.2 QD77MS16					Axis 3	–	–	–	
	Da.22	Axis to be interpolated No.3 QD77MS16					Axis 4	–	–	–	

(Note): Refer to Section 5.3 "List of positioning data" for information on the setting details.

POINTS

- When the "reference axis speed" is set during 4-axis linear interpolation control, set so the major axis side becomes the reference axis. If the minor axis side is set as the reference axis, the major axis side speed may exceed the "Pr.8 Speed limit value".
- Refer to Section 9.1.6 "Interpolation control" for the reference axis and interpolation axis combinations.

[2] 4-axis linear interpolation control (INC linear 4)

In the incremental system 4-axis linear interpolation control, the designated 4 axes are used. Linear interpolation positioning is carried out from the current stop position (start point address) to a position at the end of the movement amount set in the "Da.6 Positioning address/movement amount". The movement direction is determined by the sign of the movement amount.

■ Restrictions

An error will occur and the positioning will not start in the following cases. The machine will immediately stop if the error is detected during a positioning operation.

- When the movement amount for each axis exceeds "1073741824 (=2^{30})"
  An "outside linear movement amount range error (error code: 504)" will occur at the positioning start.
  (The maximum movement amount that can be set in "Da.6 Positioning address/ movement amount" is "1073741824 (=2^{30})".)

■ Positioning data setting example

[When "4-axis linear interpolation control (INC linear 4)" is set in positioning data No. 1 of axis 1]

- Reference axis............. Axis 1
- Interpolation axis.......... Axis 2, Axis3, Axis4 (The required values are also set in positioning data No. 1 of axis 2, axis 3 and axis 4.)

Setting item		Axis	QD77MS4 setting example				QD77MS16 setting example				Setting details
			Axis 1 (reference axis)	Axis 2 (interpolation axis)	Axis 3 (interpolation axis)	Axis 4 (interpolation axis)	Axis 1 (reference axis)	Axis 2 (interpolation axis)	Axis 3 (interpolation axis)	Axis 4 (interpolation axis)	
Axis 1 Positioning data No. 1	Da.1	Operation pattern	Positioning complete	–	–	–	Positioning complete	–	–	–	Set "Positioning complete" assuming the next positioning data will not be executed.
	Da.2	Control system	INC linear 4	–	–	–	INC linear 4	–	–	–	Set incremental system 4-axis linear interpolation control.
	Da.3	Acceleration time No.	1	–	–	–	1	–	–	–	Designate the value set in "Pr.25 Acceleration time 1" as the acceleration time at start.
	Da.4	Deceleration time No.	0	–	–	–	0	–	–	–	Designate the value set in "Pr.10 Deceleration time 0" as the deceleration time at deceleration.
	Da.5	Axis to be interpolated QD77MS4	–	–	–	–					Setting not required (setting value is ignored). When axis 1 is used as a reference axis, the interpolation axes are axes 2, 3 and 4.
	Da.6	Positioning address/ movement amount	4000.0 µm	8000.0 µm	4000.0 µm	3000.0 µm	4000.0 µm	8000.0 µm	4000.0 µm	3000.0 µm	Set the movement amount. (Assuming "mm" is set in "Pr.1 Unit setting".)
	Da.7	Arc address	–	–	–	–	–	–	–	–	Setting not required (setting value is ignored).
	Da.8	Command speed	6000.00 mm/min	–	–	–	6000.00 mm/min	–	–	–	Set the speed during movement.
	Da.9	Dwell time	500ms	–	–	–	500ms	–	–	–	Set the time the machine dwells after the positioning stop (command stop) to the output of the positioning complete signal.
	Da.10	M code	10	–	–	–	10	–	–	–	Set this when other sub operation commands are issued in combination with the No. 1 positioning data.
	Da.20	Axis to be interpolated No.1 QD77MS16					Axis 2	–	–	–	Set the axis to be interpolated. If the self-axis is set, an error will occur.
	Da.21	Axis to be interpolated No.2 QD77MS16					Axis 3	–	–	–	
	Da.22	Axis to be interpolated No.3 QD77MS16					Axis 4	–	–	–	

(Note): Refer to Section 5.3 "List of positioning data" for information on the setting details.

POINT

- When the "reference axis speed" is set during 4-axis linear interpolation control, set so the major axis side becomes the reference axis. If the minor axis side is set as the reference axis, the major axis side speed may exceed the "Pr.8 Speed limit value".
- Refer to Section 9.1.6 "Interpolation control" for the reference axis and interpolation axis combinations.

9.2.6 1-axis fixed-feed control

In "1-axis fixed-feed control" ("Da.2 Control system" = fixed-feed 1), one motor is used to carry out fixed-feed control in a set axis direction.

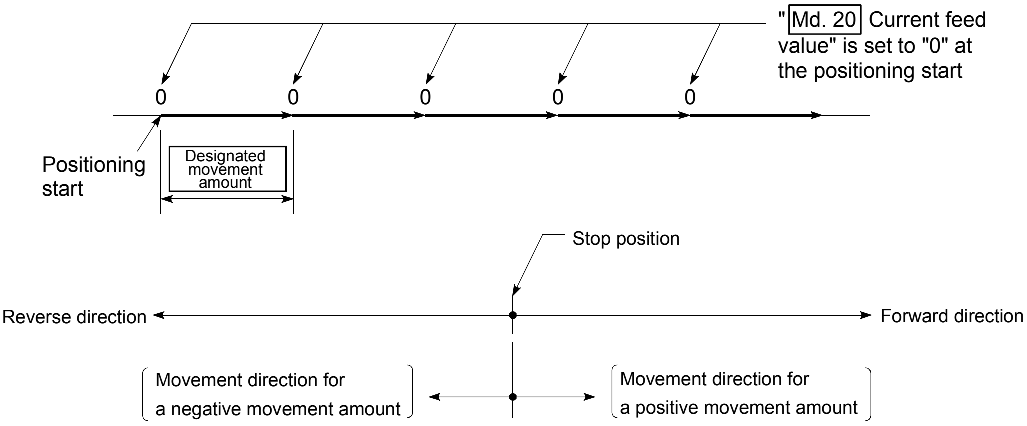
In fixed-feed control, any remainder of below control accuracy is rounded down to convert the movement amount designated in the positioning data into the command value to servo amplifier.

■ Operation chart

In 1-axis fixed-feed control, the address (Md.20 Current feed value) of the current stop position (start point address) is set to "0". Positioning is then carried out to a position at the end of the movement amount set in "Da.6 Positioning address/ movement amount".

The movement direction is determined by the movement amount sign.

- Positive movement amount .... Positioning control to forward direction (Address increase direction)
- Negative movement amount............. Positioning control to reverse direction (Address decrease direction)



■ Restrictions

(1) An axis error "Continuous path control invalid (error code: 516)" will occur and the operation cannot start if "continuous path control" is set in "Da.1 Operation pattern". ("Continuous path control" cannot be set in fixed-feed control.)

(2) "Fixed-feed" cannot be set in "Da.2 Control system" in the positioning data when "continuous path control" has been set in "Da.1 Operation pattern" of the immediately prior positioning data. (For example, if the operation pattern of positioning data No. 1 is "continuous path control", fixed-feed control cannot be set in positioning data No. 2.) An axis error "Continuous path control invalid (error code: 516)" will occur and the machine will carry out a deceleration stop if this type of setting is carried out.

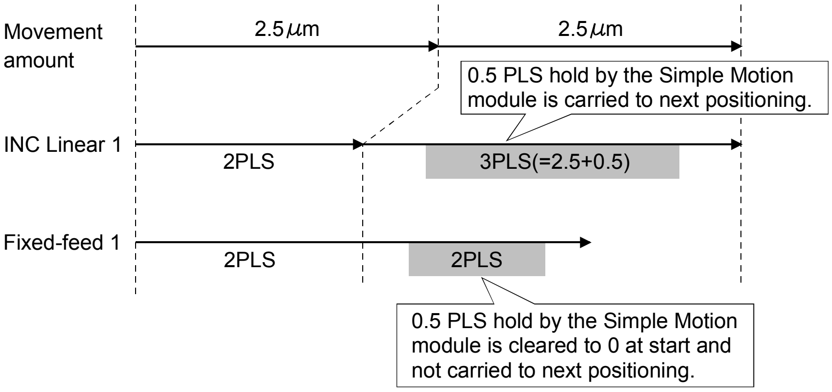
POINT

- When the movement amount is converted to the actual number of command pulses, a fraction appears after the decimal point, according to the movement amount per pulse. This fraction is normally retained in the Simple Motion module and reflected at the next positioning.
  For the fixed-feed control, since the movement distance is maintained constant (= the command number of pulses is maintained constant), the control is carried out after the fraction pulse is cleared to zero at start.

[Accumulation/cutoff for fractional pulses]

When movement amount per pulse is 1.0 [μm] and movement for 2.5 [μm] is executed two times.

→ Conversion to command pulses: 2.5 [μm] ÷ 1.0 = 2.5 [PLS]



■ Positioning data setting example

[When "1-axis fixed-feed control (fixed-feed 1)" is set in positioning data No.1 of axis 1]

Setting item			Setting example		Setting details
			QD77MS2 QD77MS4	QD77MS16	
Axis 1 Positioning data No. 1	Da.1	Operation pattern	Positioning complete		Set "Positioning complete" assuming the next positioning data will not be executed.
	Da.2	Control system	Fixed-feed 1		Set 1-axis fixed-feed control.
	Da.3	Acceleration time No.	1		Designate the value set in "Pr.25 Acceleration time 1" as the acceleration time at start.
	Da.4	Deceleration time No.	0		Designate the value set in "Pr.10 Deceleration time 0" as the deceleration time at deceleration.
	Da.5	Axis to be interpolated QD77MS2 QD77MS4	–		Setting not required (setting value is ignored).
	Da.6	Positioning address/ movement amount	8000.0μm		Set the positioning address. (Assuming "mm" is set in "Pr.1 Unit setting")
	Da.7	Arc address	–		Setting not required (setting value is ignored).
	Da.8	Command speed	6000.00mm/min		Set the speed during movement to the positioning address.
	Da.9	Dwell time	500ms		Set the time the machine dwells after the positioning stop (command stop) to the output of the positioning complete signal.
	Da.10	M code	10		Set this when other sub operation commands are issued in combination with the No. 1 positioning data.
	Da.20	Axis to be interpolated No.1 QD77MS16		–	Setting not required (setting value is ignored).
	Da.21	Axis to be interpolated No.2 QD77MS16		–	
	Da.22	Axis to be interpolated No.3 QD77MS16		–	

(Note): Refer to Section 5.3 "List of positioning data" for information on the setting details.

9.2.7 2-axis fixed-feed control (interpolation)

In "2-axis fixed-feed control" ("Da.2 Control system" = fixed-feed 2), two motors are used to carry out fixed-feed control in a linear path while carrying out interpolation for the axis directions set in each axis.

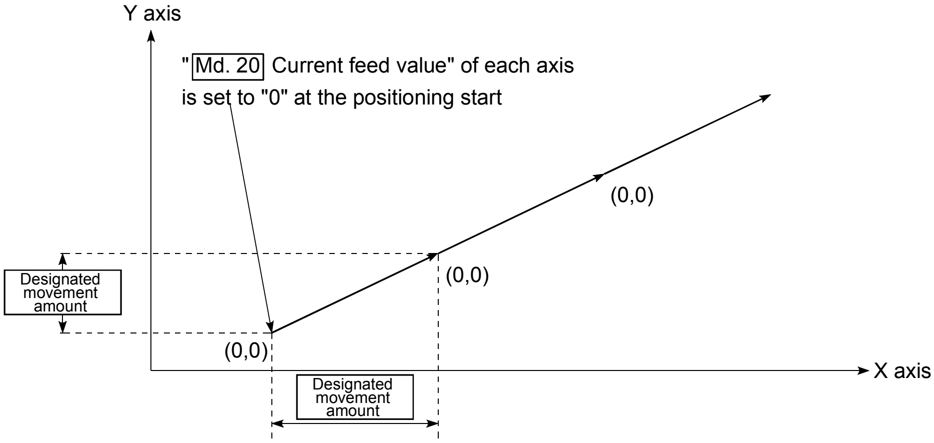
In fixed-feed control, any remainder of below control accuracy is rounded down to convert the movement amount designated in the positioning data into the command value to servo amplifier.

(Refer to Section 9.1.6 "Interpolation control" for details on interpolation control.)

■ Operation chart

In incremental system 2-axis fixed-feed control, the addresses (Md.20 Current feed value) of the current stop position (start addresses) of both axes are set to "0". Linear interpolation positioning is then carried out from that position to a position at the end of the movement amount set in "Da.6 Positioning address/movement amount". The movement direction is determined by the sign of the movement amount.

• Positive movement amount	Positioning control to forward direction (Address increase direction)
• Negative movement amount.............	Positioning control to reverse direction (Address decrease direction)



■ Restrictions

(1) An axis error "Continuous path control not possible (error code: 516)" will occur and the operation cannot start if "continuous path control" is set in "Da.1 Operation pattern". ("Continuous path control" cannot be set in fixed-feed control.)

(2) "Fixed-feed" cannot be set in "Da.2 Control system" in the positioning data when "continuous path control" has been set in "Da.1 Operation pattern" of the immediately prior positioning data. (For example, if the operation pattern of positioning data No. 1 is "continuous path control", fixed-feed control cannot be set in positioning data No. 2.) An axis error "Continuous path control not possible (error code: 516)" will occur and the machine will carry out a deceleration stop if this type of setting is carried out.

■ Positioning data setting example

[When "2-axis fixed-feed control (fixed-feed 2)" is set in positioning data No. 1 of axis 1]

- Reference axis............. Axis 1
- Interpolation axis.......... Axis 2 (The required values are also set in positioning data No. 1 of axis 2.)

Setting item		Axis	QD77MS2/QD77MS4 setting example		QD77MS16 setting example		Setting details
			Axis 1 (reference axis)	Axis 2 (interpolation axis)	Axis 1 (reference axis)	Axis 2 (interpolation axis)	
Axis 1 Positioning data No. 1	Da.1	Operation pattern	Positioning complete	–	Positioning complete	–	Set "Positioning complete" assuming the next positioning data will not be executed.
	Da.2	Control system	Fixed-feed 2	–	Fixed-feed 2	–	Set 2-axis fixed-feed control.
	Da.3	Acceleration time No.	1	–	1	–	Designate the value set in "Pr.25 Acceleration time 1" as the acceleration time at start.
	Da.4	Deceleration time No.	0	–	0	–	Designate the value set in "Pr.10 Deceleration time 0" as the deceleration time at deceleration.
	Da.5	Axis to be interpolated QD77MS2 QD77MS4	Axis 2	–			Set the axis to be interpolated (partner axis). If the self-axis is set, an error will occur.
	Da.6	Positioning address/ movement amount	8000.0 µm	6000.0 µm	8000.0 µm	6000.0 µm	Set the positioning address. (Assuming "mm" is set in "Pr.1 Unit setting".)
	Da.7	Arc address	–	–	–	–	Setting not required (setting value is ignored).
	Da.8	Command speed	6000.00 mm/min	–	6000.00 mm/min	–	Set the speed during movement. (Designate the composite speed of reference axis speed in "Pr.20 Interpolation speed designation method".)
	Da.9	Dwell time	500ms	–	500ms	–	Set the time the machine dwells after the positioning stop (command stop) to the output of the positioning complete signal.
	Da.10	M code	10	–	10	–	Set this when other sub operation commands are issued in combination with the No. 1 positioning data.
	Da.20	Axis to be interpolated No.1 QD77MS16			Axis 2	–	Set the axis to be interpolated. If the self-axis is set, an error will occur.
	Da.21	Axis to be interpolated No.2 QD77MS16			–	–	Setting not required (setting value is ignored).
	Da.22	Axis to be interpolated No.3 QD77MS16			–	–	

(Note): Refer to Section 5.3 "List of positioning data" for information on the setting details.

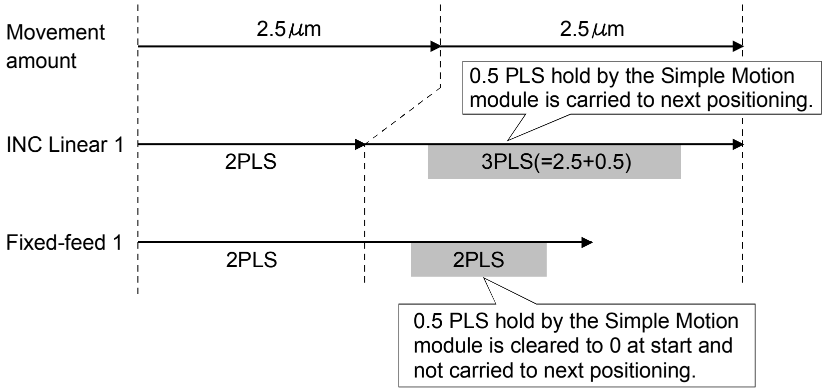
POINTS

- When the movement amount is converted to the actual number of command pulses, a fraction appears after the decimal point, according to the movement amount per pulse. This fraction is normally retained in the Simple Motion module and reflected at the next positioning.
  For the fixed-feed control, since the movement distance is maintained constant (= the command number of pulses is maintained constant), the control is carried out after the fraction pulse is cleared to zero at start.

[Accumulation/cutoff for fractional pulses]

When movement amount per pulse is 1.0 [μm] and movement for 2.5 [μm] is executed two times.

→ Conversion to command pulses: 2.5 [μm] ÷ 1.0 = 2.5 [PLS]



- When the "reference axis speed" is set during 2-axis fixed-feed control, set so the major axis side becomes the reference axis. If the minor axis side is set as the reference axis, the major axis side speed may exceed the "Pr.8 Speed limit value".

9.2.8 3-axis fixed-feed control (interpolation)

In "3-axis fixed-feed control" "Da.2 Control system" = fixed-feed 3), three motors are used to carry out fixed-feed control in a linear path while carrying out interpolation for the axis directions set in each axis.

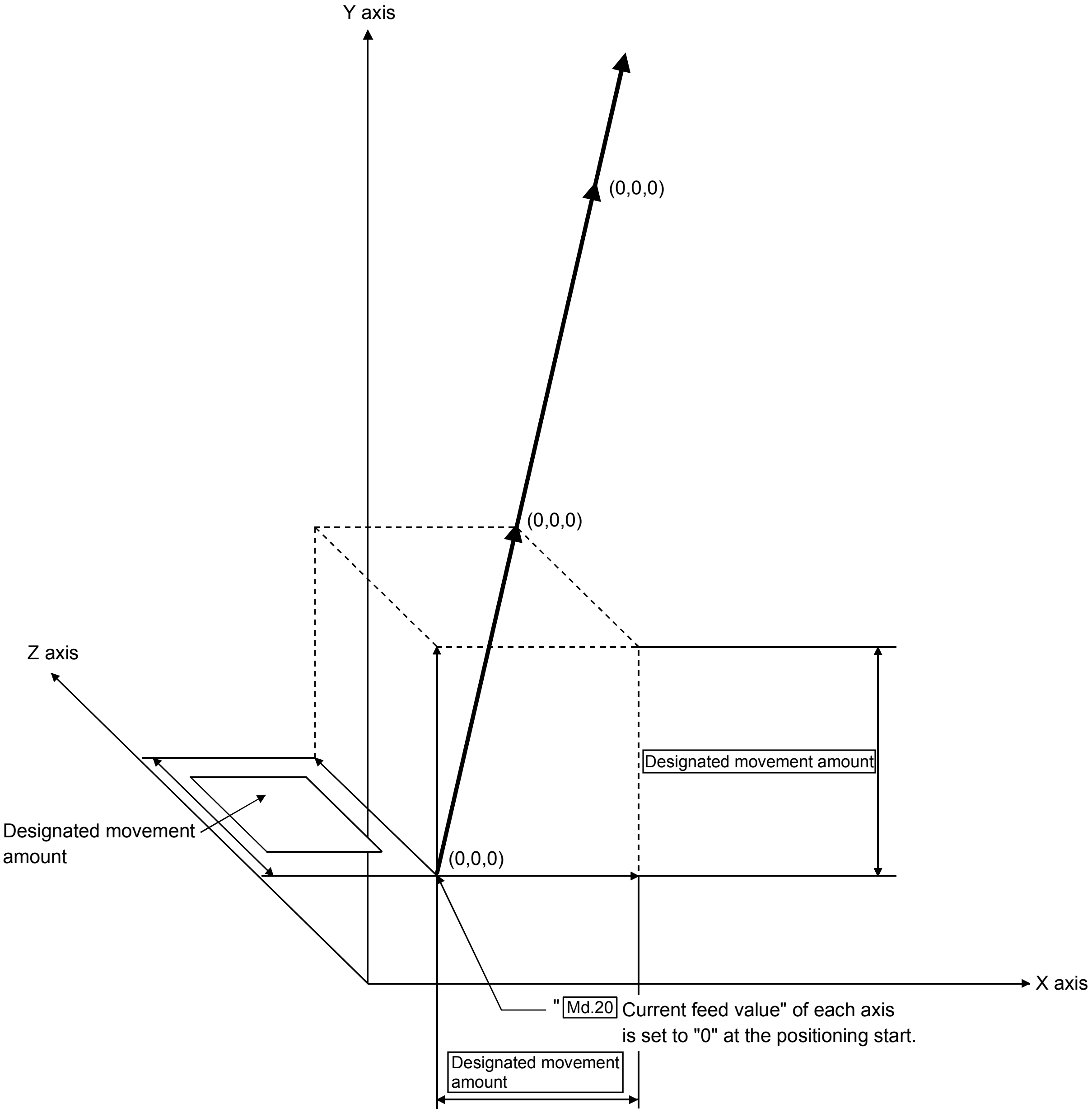
In fixed-feed control, any remainder of below control accuracy is rounded down to convert the movement amount designated in the positioning data into the command value to servo amplifier.

(Refer to Section 9.1.6 "Interpolation control" for details on interpolation control.)

■ Operation chart

In incremental system 3-axis fixed-feed control, the addresses (Md.20 Current feed value) of the current stop position (start addresses) of every axes are set to "0". Linear interpolation positioning is then carried out from that position to a position at the end of the movement amount set in "Da.6 Positioning address/movement amount". The movement direction is determined by the sign of the movement amount.

- Positive movement amount ....Positioning control to forward direction (Address increase direction)
- Negative movement amount.............Positioning control to reverse direction (Address decrease direction)



■ Restrictions

(1) An axis error "Continuous path control not possible (error code: 516)" will occur and the operation cannot start if "continuous path control" is set in "Da.1 Operation pattern". ("Continuous path control" cannot be set in fixed-feed control.)

(2) If the movement amount of each axis exceeds "1073741824 (=2^{30})" when "0: Composite speed" is set in "Pr.20 Interpolation speed designation method", the "Outside linear movement amount range" (error code: 504) occurs at a positioning start and positioning cannot be started. (The maximum movement amount that can be set in "Da.6 Positioning address/movement amount" is "1073741824 (= 2^{30})".

(3) "Fixed-feed" cannot be set in "Da.2 Control system" in the positioning data when "continuous path control" has been set in "Da.1 Operation pattern" of the immediately prior positioning data. (For example, if the operation pattern of positioning data No. 1 is "continuous path control", fixed-feed control cannot be set in positioning data No. 2.) An axis error "Continuous path control not possible" (error code: 516) will occur and the machine will carry out a deceleration stop if this type of setting is carried out.

■ Positioning data setting example

[When "3-axis fixed-feed control (fixed-feed 3)" is set in positioning data No. 1 of axis 1]

- Reference axis............. Axis 1
- Interpolation axis.......... Axis 2, Axis3 (The required values are also set in positioning data No. 1 of axis 2 and axis 3.)

		Axis	QD77MS4 setting example			QD77MS16 setting example			Setting details
Setting item			Axis 1 (reference axis)	Axis 2 (interpolation axis)	Axis 3 (interpolation axis)	Axis 1 (reference axis)	Axis 2 (interpolation axis)	Axis 3 (interpolation axis)	
Axis 1 Positioning data No. 1	Da.1	Operation pattern	Positioning complete	–	–	Positioning complete	–	–	Set "Positioning complete" assuming the next positioning data will not be executed.
	Da.2	Control system	Fixed-feed 3	–	–	Fixed-feed 3	–	–	Set 3-axis fixed-feed control.
	Da.3	Acceleration time No.	1	–	–	1	–	–	Designate the value set in "Pr.25 Acceleration time 1" as the acceleration time at start.
	Da.4	Deceleration time No.	0	–	–	0	–	–	Designate the value set in "Pr.10 Deceleration time 0" as the deceleration time at deceleration.
	Da.5	Axis to be interpolated QD77MS4	–	–	–				Setting not required (setting value is ignored). When axis 1 is used as a reference axis, the interpolation axes are axes 2 and 3.
	Da.6	Positioning address/ movement amount	10000.0 µm	5000.0 µm	6000.0 µm	10000.0 µm	5000.0 µm	6000.0 µm	Set the positioning address. (Assuming "mm" is set in "Pr.1 Unit setting".)
	Da.7	Arc address	–	–	–	–	–	–	Setting not required (setting value is ignored).
	Da.8	Command speed	6000.00 mm/min	–	–	6000.00 mm/min	–	–	Set the speed during movement.
	Da.9	Dwell time	500ms	–	–	500ms	–	–	Set the time the machine dwells after the positioning stop (command stop) to the output of the positioning complete signal.
	Da.10	M code	10	–	–	10	–	–	Set this when other sub operation commands are issued in combination with the No. 1 positioning data.
	Da.20	Axis to be interpolated No.1 QD77MS16				Axis 2	–	–	Set the axis to be interpolated. If the self-axis is set, an error will occur.
	Da.21	Axis to be interpolated No.2 QD77MS16				Axis 3	–	–	
	Da.22	Axis to be interpolated No.3 QD77MS16				–	–	–	Setting not required (setting value is ignored).

(Note): Refer to Section 5.3 "List of positioning data" for information on the setting details.

POINTS

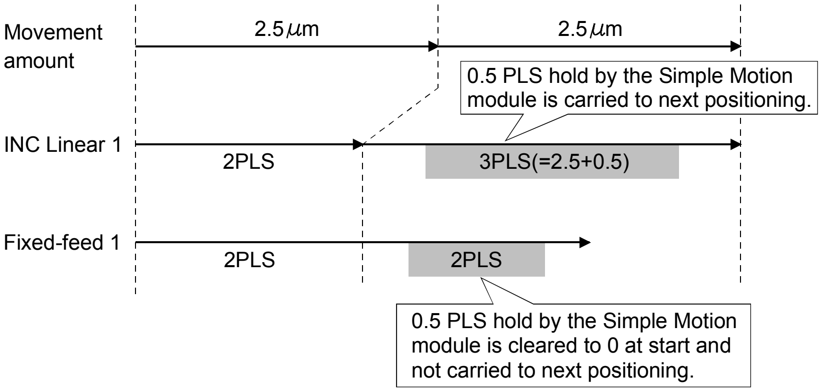
- When the movement amount is converted to the actual number of command pulses, a fraction appears after the decimal point, according to the movement amount per pulse. This fraction is normally retained in the Simple Motion module and reflected at the next positioning.

  For the fixed-feed control, since the movement distance is maintained constant (= the command number of pulses is maintained constant), the control is carried out after the fraction pulse is cleared to zero at start.

[Accumulation/cutoff for fractional pulses]

When movement amount per pulse is 1.0 [μm] and movement for 2.5 [μm] is executed two times.

→ Conversion to command pulses: 2.5 [μm] ÷ 1.0 = 2.5 [PLS]



- When the "reference axis speed" is set during 3-axis fixed-feed control, set so the major axis side becomes the reference axis. If the minor axis side is set as the reference axis, the major axis side speed may exceed the "Pr.8 Speed limit value".
- Refer to Section 9.1.6 "Interpolation control" for the reference axis and interpolation axis combinations.

9.2.9 4-axis fixed-feed control (interpolation)

In "4-axis fixed-feed control" ("Da.2 Control system" = fixed-feed 4), four motors are used to carry out fixed-feed control in a linear path while carrying out interpolation for the axis directions set in each axis.
In fixed-feed control, any remainder of below control accuracy is rounded down to convert the movement amount designated in the positioning data into the command value to servo amplifier.
(Refer to Section 9.1.6 "Interpolation control" for details on interpolation control.)

■ Operation chart

In incremental system 4-axis fixed-feed control, the addresses (Md.20 Current feed value) of the current stop position (start addresses) of every axes are set to "0". Linear interpolation positioning is then carried out from that position to a position at the end of the movement amount set in "Da.6 Positioning address/movement amount". The movement direction is determined by the sign of the movement amount.

• Positive movement amount	Positioning control to forward direction (Address increase direction)
• Negative movement amount	Positioning control to reverse direction (Address decrease direction)

■ Restrictions

(1) An axis error "Continuous path control not possible (error code: 516)" will occur and the operation cannot start if "continuous path control" is set in "Da.1 Operation pattern". ("Continuous path control" cannot be set in fixed-feed control.)

(2) "Fixed-feed" cannot be set in "Da.2 Control system" in the positioning data when "continuous path control" has been set in "Da.1 Operation pattern" of the immediately prior positioning data. (For example, if the operation pattern of positioning data No. 1 is "continuous path control", fixed-feed control cannot be set in positioning data No. 2.) An axis error "Continuous path control not possible (error code: 516)" will occur and the machine will carry out a deceleration stop if this type of setting is carried out.

■ Positioning data setting example

[When "4-axis fixed-feed control (fixed-feed 4)" is set in positioning data No.1 of axis 1]

- Reference axis............. Axis 1
- Interpolation axis.......... Axis 2, Axis3, Axis4 (The required values are also set in positioning data No. 1 of axis 2, axis 3 and axis 4.)

Setting item		Axis	QD77MS4 setting example				QD77MS16 setting example				Setting details
			Axis 1 (reference axis)	Axis 2 (interpolation axis)	Axis 3 (interpolation axis)	Axis 4 (interpolation axis)	Axis 1 (reference axis)	Axis 2 (interpolation axis)	Axis 3 (interpolation axis)	Axis 4 (interpolation axis)	
Axis 1 Positioning data No. 1	Da.1	Operation pattern	Positioning complete	–	–	–	Positioning complete	–	–	–	Set "Positioning complete" assuming the next positioning data will not be executed.
	Da.2	Control system	Fixed-feed 4	–	–	–	Fixed-feed 4	–	–	–	Set 4-axis fixed-feed control.
	Da.3	Acceleration time No.	1	–	–	–	1	–	–	–	Designate the value set in "Pr.25 Acceleration time 1" as the acceleration time at start.
	Da.4	Deceleration time No.	0	–	–	–	0	–	–	–	Designate the value set in "Pr.10 Deceleration time 0" as the deceleration time at deceleration.
	Da.5	Axis to be interpolated QD77MS4	–	–	–	–					Setting not required (setting value is ignored). When axis 1 is used as a reference axis, the interpolation axes are axes 2, 3 and 4.
	Da.6	Positioning address/ movement amount	4000.0 µm	8000.0 µm	4000.0 µm	3000.0 µm	4000.0 µm	8000.0 µm	4000.0 µm	3000.0 µm	Set the positioning address. (Assuming "mm" is set in "Pr.1 Unit setting ".)
	Da.7	Arc address	–	–	–	–	–	–	–	–	Setting not required (setting value is ignored).
	Da.8	Command speed	6000.00 mm/min	–	–	–	6000.00 mm/min	–	–	–	Set the speed during movement.
	Da.9	Dwell time	500ms	–	–	–	500ms	–	–	–	Set the time the machine dwells after the positioning stop (command stop) to the output of the positioning complete signal.
	Da.10	M code	10	–	–	–	10	–	–	–	Set this when other sub operation commands are issued in combination with the No. 1 positioning data.
	Da.20	Axis to be interpolated No.1 QD77MS16					Axis 2	–	–	–	Set the axis to be interpolated. If the self-axis is set, an error will occur.
	Da.21	Axis to be interpolated No.2 QD77MS16					Axis 3	–	–	–	
	Da.22	Axis to be interpolated No.3 QD77MS16					Axis 4	–	–	–	

(Note): Refer to Section 5.3 "List of positioning data" for information on the setting details.

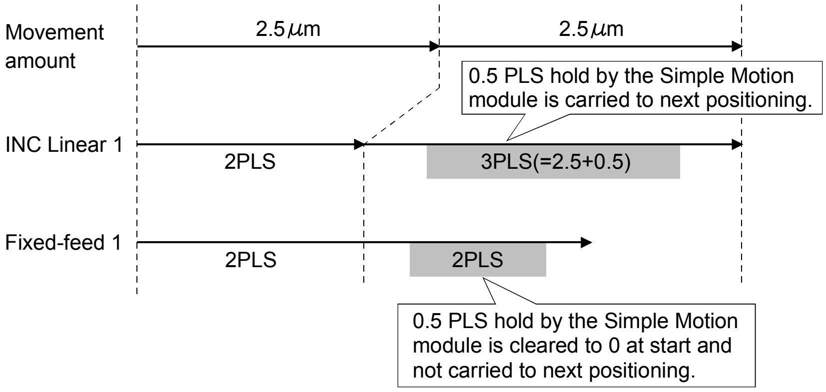
POINTS

- When the movement amount is converted to the actual number of command pulses, a fraction appears after the decimal point, according to the movement amount per pulse. This fraction is normally retained in the Simple Motion module and reflected at the next positioning.
  For the fixed-feed control, since the movement distance is maintained constant (= the command number of pulses is maintained constant), the control is carried out after the fraction pulse is cleared to zero at start.

[Accumulation/cutoff for fractional pulses]

When movement amount per pulse is 1.0 [µm] and movement for 2.5 [µm] is executed two times.

→ Conversion to command pulses: 2.5 [µm] ÷ 1.0 = 2.5 [PLS]



- When the "reference axis speed" is set during 4-axis fixed-feed control, set so the major axis side becomes the reference axis. If the minor axis side is set as the reference axis, the major axis side speed may exceed the "Pr.8 Speed limit value".
- Refer to Section 9.1.6 "Interpolation control" for the reference axis and interpolation axis combinations.

9.2.10 2-axis circular interpolation control with sub point designation

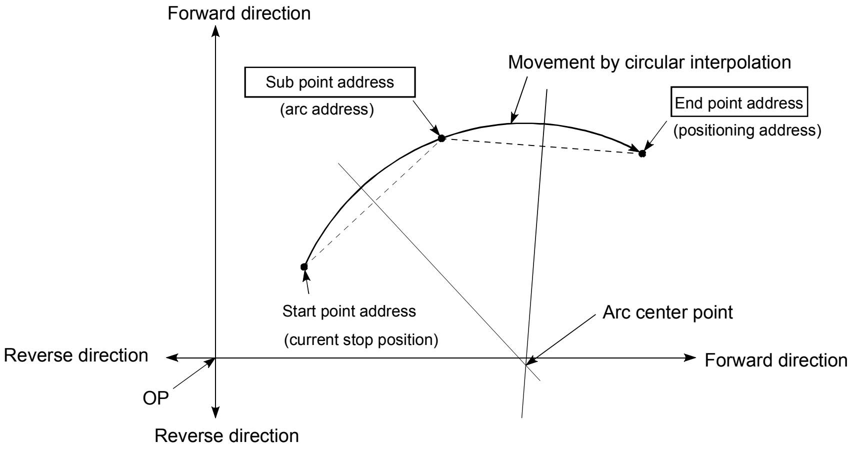
In "2-axis circular interpolation control" ("Da.2 Control system" = ABS circular sub, INC circular sub), two motors are used to carry out position control in an arc path passing through designated sub points, while carrying out interpolation for the axis directions set in each axis.
(Refer to Section 9.1.6 "Interpolation control" for details on interpolation control.)

[1] 2-axis circular interpolation control with sub point designation (ABS circular sub)

■ Operation chart

In the absolute system, 2-axis circular interpolation control with sub point designation, positioning is carried out from the current stop position (start point address) to the address (end point address) set in "Da.6 Positioning address/ movement amount", in an arc path that passes through the sub point address set in "Da.7 Arc address".

The resulting control path is an arc having as its center the intersection point of perpendicular bisectors of a straight line between the start point address (current stop position) and sub point address (arc address), and a straight line between the sub point address (arc address) and end point address (positioning address).



■ Restrictions

(1) 2-axis circular interpolation control cannot be set in the following cases.

- When "degree" is set in "Pr.1 Unit setting"
- When the units set in "Pr.1 Unit setting" are different for the reference axis and interpolation axis. ("mm" and "inch" combinations are possible.)
- When "reference axis speed" is set in "Pr.20 Interpolation speed designation method"

(2) An error will occur and the positioning start will not be possible in the following cases. The machine will immediately stop if the error is detected during positioning control.

- When the radius exceeds "536870912 (=2^{29})". (The maximum radius for which circular interpolation control is possible is "536870912 (=2^{29})"
  ... An error "Outside radius range (error code: 544)" will occur at positioning start.
- When the center point address is outside the range of "–2147483648 (-2^{31}) to 2147483647 ($2^{31}-1$)"
  ... A "Sub point setting error" (error code: 525) will occur at positioning start.
- When the start point address is the same as the end point address
  ... An "End point setting error" (error code: 526) will occur.
- When the start point address is the same as the sub point address
  ... A "Sub point setting error" (error code: 525) will occur.
- When the end point address is the same as the sub point address
  ... A "Sub point setting error" (error code: 525) will occur.
- When the start point address, sub point address, and end point address are in a straight line
  ... A "Sub point setting error" (error code: 525) will occur.

■ Positioning data setting example

[When "2-axis circular interpolation control with sub point designation (ABS circular sub)" is set in positioning data No. 1 of axis 1]

- Reference axis............. Axis 1
- Interpolation axis.......... Axis 2 (The required values are also set in positioning data No. 1 of axis 2.)

Setting item \ Axis			QD77MS2/QD77MS4 setting example		QD77MS16 setting example		Setting details
			Axis 1 (reference axis)	Axis 2 (interpolation axis)	Axis 1 (reference axis)	Axis 2 (interpolation axis)	
Axis 1 Positioning data No. 1	Da.1	Operation pattern	Positioning complete	–	Positioning complete	–	Set "Positioning complete" assuming the next positioning data will not be executed.
	Da.2	Control system	ABS circular sub	–	ABS circular sub	–	Set absolute system, 2-axis circular interpolation control with sub point designation.
	Da.3	Acceleration time No.	1	–	1	–	Designate the value set in "Pr.25 Acceleration time 1" as the acceleration time at start.
	Da.4	Deceleration time No.	0	–	0	–	Designate the value set in "Pr.10 Deceleration time 0" as the deceleration time at deceleration.
	Da.5	Axis to be interpolated QD77MS2 QD77MS4	Axis 2	–			Set the axis to be interpolated (partner axis). If the self-axis is set, an error will occur.
	Da.6	Positioning address/ movement amount	8000.0 μm	6000.0 μm	8000.0 μm	6000.0 μm	Set the positioning address. (Assuming "mm" is set in "Pr.1 Unit setting".)
	Da.7	Arc address	4000.0 μm	3000.0 μm	4000.0 μm	3000.0 μm	Set the sub point address. (Assuming that the "Pr.1 Unit setting" is set to "mm".)
	Da.8	Command speed	6000.00 mm/min	–	6000.00 mm/min	–	Set the speed when moving to the end point address. (Designate the composite speed in "Pr.20 Interpolation speed designation method".)
	Da.9	Dwell time	500ms	–	500ms	–	Set the time the machine dwells after the positioning stop (command stop) to the output of the positioning complete signal.
	Da.10	M code	10	–	10	–	Set this when other sub operation commands are issued in combination with the No. 1 positioning data.
	Da.20	Axis to be interpolated No.1 QD77MS16			Axis 2	–	Set the axis to be interpolated. If the self-axis is set, an error will occur.
	Da.21	Axis to be interpolated No.2 QD77MS16			–	–	Setting not required (setting value is ignored).
	Da.22	Axis to be interpolated No.3 QD77MS16			–	–	

(Note): Refer to Section 5.3 "List of positioning data" for information on the setting details.

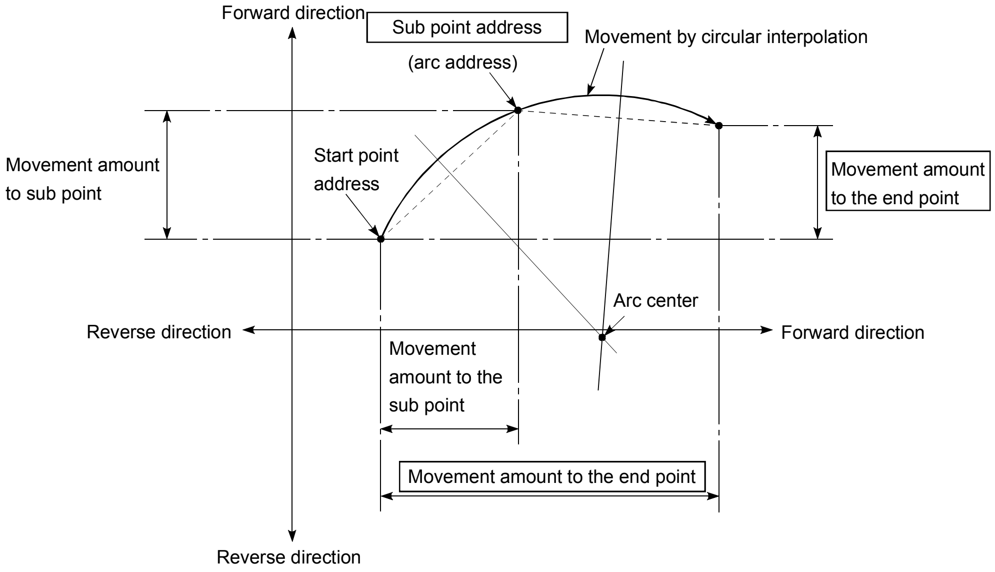
POINT

Set a value in "Da.8 Command speed" so that the speed of each axis does not exceed the "Pr.8 Speed limit value". (The speed limit does not function for the speed calculated by the Simple Motion module during interpolation control.)

[2] 2-axis circular interpolation control with sub point designation (INC circular sub)

■ Operation chart

In the incremental system, 2-axis circular interpolation control with sub point designation, positioning is carried out from the current stop position (start point address) to a position at the end of the movement amount set in " Da.6 Positioning address/movement amount" in an arc path that passes through the sub point address set in " Da.7 Arc address". The movement direction depends on the sign (+ or -) of the movement amount.
The resulting control path is an arc having as its center the intersection point of perpendicular bisectors of the straight line between the start point address (current stop position) and sub point address (arc address) calculated from the movement amount to the sub point, and a straight line between the sub point address (arc address) and end point address (positioning address) calculated from the movement amount to the end point.



■ Restrictions

(1) 2-axis circular interpolation control cannot be set in the following cases.

- When "degree" is set in "Pr.1 Unit setting"
- When the units set in "Pr.1 Unit setting" are different for the reference axis and interpolation axis. ("mm" and "inch" combinations are possible.)
- When "reference axis speed" is set in "Pr.20 Interpolation speed designation method"

(2) An error will occur and the positioning start will not be possible in the following cases. The machine will immediately stop if the error is detected during positioning control.

- When the radius exceeds "536870912 (=2^{29})". (The maximum radius for which circular interpolation control is possible is "536870912 (=2^{29})"
  ... An error "Outside radius range (error code: 544)" will occur at positioning start.
- When the sub point address is outside the range of "–2147483648 (-2^{31}) to 2147483647 ($2^{31}-1$)"
  ... A "Sub point setting error" (error code: 525) will occur.
- When the end point address is outside the range of "–2147483648 (-2^{31}) to 2147483647 ($2^{31}-1$)"
  ... An "End point setting error" (error code: 526) will occur.
- When the center point address is outside the range of "–2147483648 (-2^{31}) to 2147483647 ($2^{31}-1$)"
  ... A "Sub point setting error" (error code: 525) will occur at positioning start.
- When the start point address is the same as the end point address
  ... An "End point setting error" (error code: 526) will occur.
- When the start point address is the same as the sub point address
  ... A "Sub point setting error" (error code: 525) will occur.
- When the end point address is the same as the sub point address
  ... A "Sub point setting error" (error code: 525) will occur.
- When the start point address, sub point address, and end point address are in a straight line
  ... A "Sub point setting error" (error code: 525) will occur.

■ Positioning data setting example

[When "2-axis circular interpolation control with sub point designation (INC circular sub)" is set in positioning data No. 1 of axis 1]

- Reference axis............. Axis 1
- Interpolation axis.......... Axis 2 (The required values are also set in positioning data No. 1 of axis 2.)

Axis / Setting item			QD77MS2/QD77MS4 setting example		QD77MS16 setting example		Setting details
			Axis 1 (reference axis)	Axis 2 (interpolation axis)	Axis 1 (reference axis)	Axis 2 (interpolation axis)	
Axis 1 Positioning data No. 1	Da.1	Operation pattern	Positioning complete	–	Positioning complete	–	Set "Positioning complete" assuming the next positioning data will not be executed.
	Da.2	Control system	INC circular sub	–	INC circular sub	–	Set incremental system, 2-axis circular interpolation control with sub point designation.
	Da.3	Acceleration time No.	1	–	1	–	Designate the value set in "Pr.25 Acceleration time 1" as the acceleration time at start.
	Da.4	Deceleration time No.	0	–	0	–	Designate the value set in "Pr.10 Deceleration time 0" as the deceleration time at deceleration.
	Da.5	Axis to be interpolated QD77MS2 QD77MS4	Axis 2	–			Set the axis to be interpolated (partner axis). If the self-axis is set, an error will occur.
	Da.6	Positioning address/ movement amount	8000.0 μm	6000.0 μm	8000.0 μm	6000.0 μm	Set the movement amount. (Assuming that the "Pr.1 Unit setting" is set to "mm".)
	Da.7	Arc address	4000.0 μm	3000.0 μm	4000.0 μm	3000.0 μm	Set the sub point address. (Assuming that the "Pr.1 Unit setting" is set to "mm".)
	Da.8	Command speed	6000.00 mm/min	–	6000.00 mm/min	–	Set the speed during movement. (Designate the composite speed in "Pr.20 Interpolation speed designation method".)
	Da.9	Dwell time	500ms	–	500ms	–	Set the time the machine dwells after the positioning stop (command stop) to the output of the positioning complete signal.
	Da.10	M code	10	–	10	–	Set this when other sub operation commands are issued in combination with the No. 1 positioning data.
	Da.20	Axis to be interpolated No.1 QD77MS16			Axis 2	–	Set the axis to be interpolated. If the self-axis is set, an error will occur.
	Da.21	Axis to be interpolated No.2 QD77MS16			–	–	Setting not required (setting value is ignored).
	Da.22	Axis to be interpolated No.3 QD77MS16			–	–	

(Note): Refer to Section 5.3 "List of positioning data" for information on the setting details.

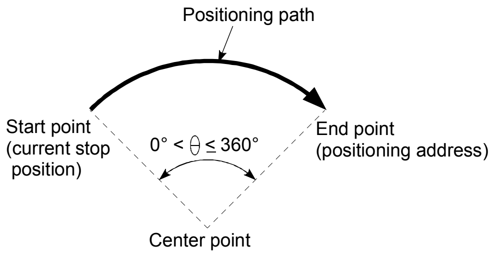
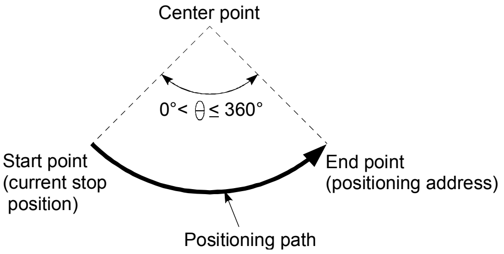
POINT

Set a value in "Da.8 Command speed" so that the speed of each axis does not exceed the "Pr.8 Speed limit value". (The speed limit does not function for the speed calculated by the Simple Motion module during interpolation control.)

9.2.11 2-axis circular interpolation control with center point designation

In "2-axis circular interpolation control" ("Da.2 Control system" = ABS circular right, INC circular right, ABS circular left, INC circular left), two motors are used to carry out position control in an arc path having an arc address as a center point, while carrying out interpolation for the axis directions set in each axis.
(Refer to Section 9.1.6 "Interpolation control" for details on interpolation control.)

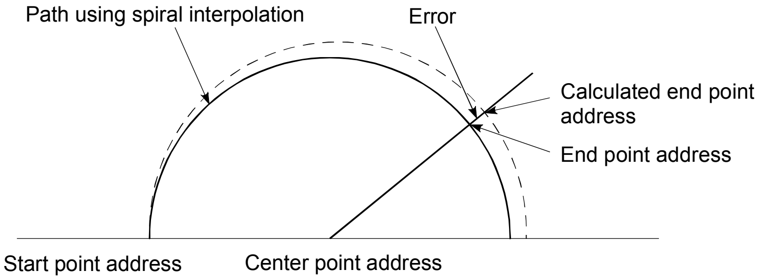
The following table shows the rotation directions, arc center angles that can be controlled, and positioning paths for the different control systems.

Control system	Rotation direction	Arc center angle that can be controlled	Positioning path
ABS circular right	Clockwise	$0^\circ < \theta \leq 360^\circ$	
INC circular right			
ABS circular left	Counterclockwise		
INC circular left			

■ Circular interpolation error compensation

In circular interpolation control with center point designation, the arc path calculated from the start point address and center point address may deviate from the position of the end point address set in "Da.6 Positioning address/movement amount".
(Refer to "Pr.41 Allowable circular interpolation error width".)

(1) Calculated error ≤ "Pr.41 Allowable circular interpolation error width"
Circular interpolation control to the set end point address is carried out while the error compensation is carried out. (This is called "spiral interpolation".)



In circular interpolation control with center point designation, an angular velocity is calculated on the assumption that operation is carried out at a command speed on the arc using the radius calculated from the start point address and center point address, and the radius is compensated in proportion to the angular velocity deviated from that at the start point.
Thus, when there is a difference (error) between a radius calculated from the start point address and center point address (start point radius) and a radius calculated from the end point address and center point address (end point radius), the composite speed differs from the command speed as follows.

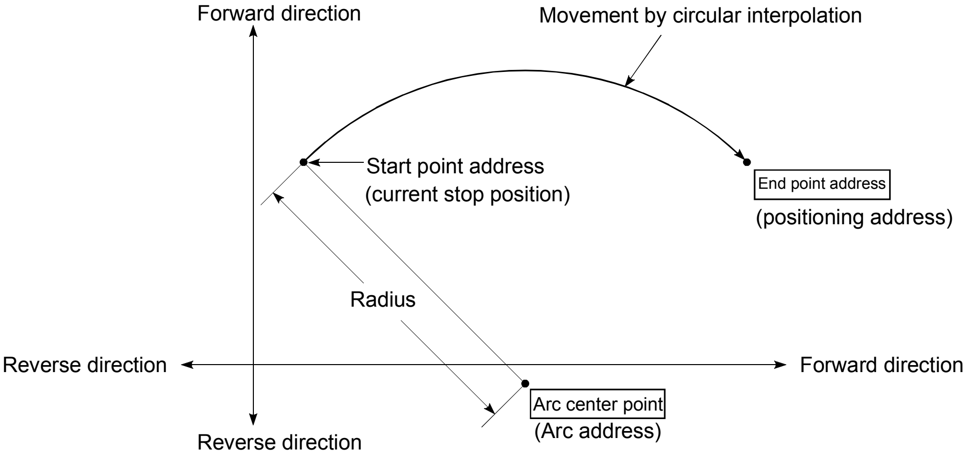
＊ Start point radius > End point radius: As compared with the speed without error, the speed becomes slower as end point address is reached.
＊ Start point radius < End point radius: As compared with the speed without error, the speed becomes faster as end point address is reached.

(2) Calculated error > "Pr.41 Allowable circular interpolation error width"
At the positioning start, an error "Outside circular interpolation error allowable limit" (error code: 506) will occur and the control will not start. The machine will immediately stop if the error is detected during positioning control.

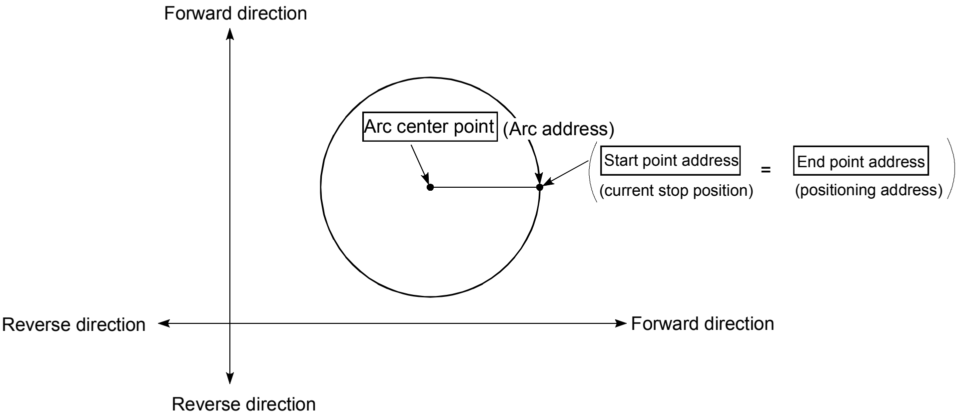
[1] 2-axis circular interpolation control with center point designation (ABS circular right, ABS circular left)

■ Operation chart

In the absolute system, 2-axis circular interpolation control with center point designation positioning is carried out from the current stop position (start point address) to the address (end point address) set in " Da.6 Positioning address/ movement amount", in an arc path having as its center the address (arc address) of the center point set in " Da.7 Arc address".



Positioning of a complete round with a radius from the start point address to the arc center point can be carried out by setting the end point address (positioning address) to the same address as the start point address.



In circular interpolation control with center point designation, an angular velocity is calculated on the assumption that operation is carried out at a command speed on the arc using the radius calculated from the start point address and center point address, and the radius is compensated in proportion to the angular velocity deviated from that at the start point.
Thus, when there is a difference (error) between a radius calculated from the start point address and center point address (start point radius) and a radius calculated from the end point address and center point address (end point radius), the composite speed differs from the command speed as follows.

＊ Start point radius > End point radius:	As compared with the speed without error, the speed becomes slower as end point address is reached.
＊ Start point radius < End point radius:	As compared with the speed without error, the speed becomes faster as end point address is reached.

■ Restrictions

(1) 2-axis circular interpolation control cannot be set in the following cases.
- When "degree" is set in "Pr.1 Unit setting"
- When the units set in "Pr.1 Unit setting" are different for the reference axis and interpolation axis. ("mm" and "inch" combinations are possible.)
- When "reference axis speed" is set in "Pr.20 Interpolation speed designation method"

(2) An error will occur and the positioning start will not be possible in the following cases. The machine will immediately stop if the error is detected during positioning control.
- When the radius exceeds "536870912 (=2^{29})". (The maximum radius for which circular interpolation control is possible is "536870912 (=2^{29})"
  ... An error "Outside radius range" (error code: 544) will occur at positioning start.
- When the start point address is the same as the center point address
  ... A "Center point setting error" (error code: 527) will occur.
- When the end point address is the same as the center point address
  ... A "Center point setting error" (error code: 527) will occur.
- When the center point address is outside the range of –2147483648 (-2^{31}) to 2147483647 (2^{31}-1)
  ... A "Center point setting error" (error code: 527) will occur.

■ Positioning data setting examples

[When "2-axis circular interpolation control with center point designation (ABS circular right, ABS circular left)" is set in positioning data No. 1 of axis 1]

- Reference axis............. Axis 1
- Interpolation axis.......... Axis 2 (The required values are also set in positioning data No. 1 of axis 2.)

Setting item \ Axis			QD77MS2/QD77MS4 setting example		QD77MS16 setting example		Setting details
			Axis 1 (reference axis)	Axis 2 (interpolation axis)	Axis 1 (reference axis)	Axis 2 (interpolation axis)	
Axis 1 Positioning data No. 1	Da.1	Operation pattern	Positioning complete	–	Positioning complete	–	Set "Positioning complete" assuming the next positioning data will not be executed.
	Da.2	Control system	ABS circular right ABS circular left	–	ABS circular right ABS circular left	–	Set absolute system, 2-axis circular interpolation control with center point designation. (Select clockwise or counterclockwise according to the control.)
	Da.3	Acceleration time No.	1	–	1	–	Designate the value set in "Pr.25 Acceleration time 1" as the acceleration time at start.
	Da.4	Deceleration time No.	0	–	0	–	Designate the value set in "Pr.10 Deceleration time 0" as the deceleration time at deceleration.
	Da.5	Axis to be interpolated QD77MS2 QD77MS4	Axis 2	–			Set the axis to be interpolated (partner axis). If the self-axis is set, an error will occur.
	Da.6	Positioning address/ movement amount	8000.0 µm	6000.0 µm	8000.0 µm	6000.0 µm	Set the positioning address. (Assuming "mm" is set in "Pr.1 Unit setting".)
	Da.7	Arc address	4000.0 µm	3000.0 µm	4000.0 µm	3000.0 µm	Set the arc address (center point address). (Assuming that the "Pr.1 Unit setting" is set to "mm".)
	Da.8	Command speed	6000.00 mm/min	–	6000.00 mm/min	–	Set the speed when moving to the end point address. (Designate the composite speed in "Pr.20 Interpolation speed designation method".)
	Da.9	Dwell time	500ms	–	500ms	–	Set the time the machine dwells after the positioning stop (command stop) to the output of the positioning complete signal.
	Da.10	M code	10	–	10	–	Set this when other sub operation commands are issued in combination with the No.1 positioning data.
	Da.20	Axis to be interpolated No.1 QD77MS16			Axis 2	–	Set the axis to be interpolated. If the self-axis is set, an error will occur.
	Da.21	Axis to be interpolated No.2 QD77MS16			–	–	Setting not required (setting value is ignored).
	Da.22	Axis to be interpolated No.3 QD77MS16			–	–	

(Note): Refer to Section 5.3 "List of positioning data" for information on the setting details.

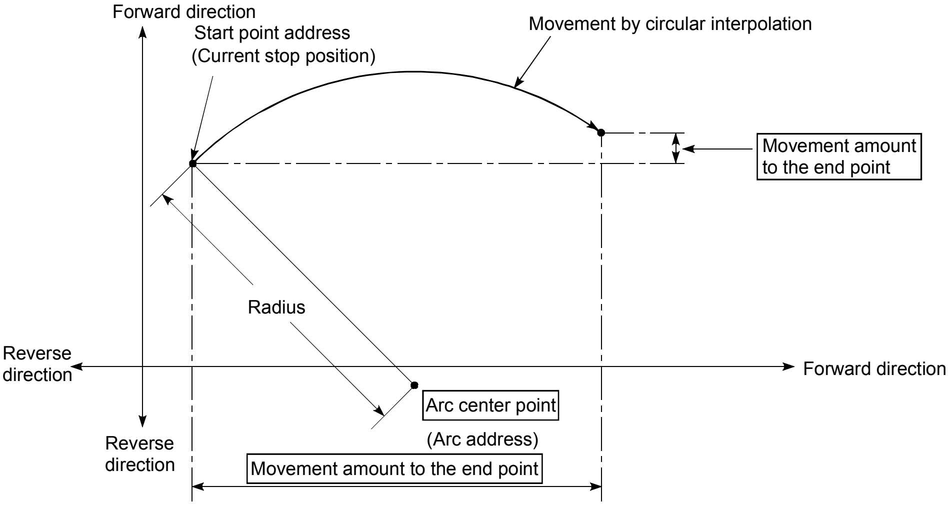
POINT

Set a value in "Da.8 Command speed" so that the speed of each axis does not exceed the "Pr.8 Speed limit value". (The speed limit does not function for the speed calculated by the Simple Motion module during interpolation control.)

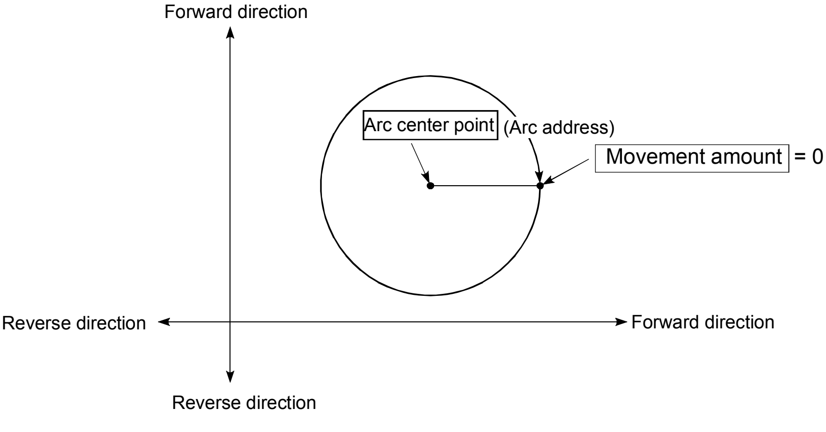
[2] 2-axis circular interpolation control with center point designation (INC circular right, INC circular left)

■ Operation chart

In the incremental system, 2-axis circular interpolation control with center point designation, positioning is carried out from the current stop position (start point address) to a position at the end of the movement amount set in "Da.6 Positioning address/movement amount", in an arc path having as its center the address (arc address) of the center point set in "Da.7 Arc address".



Positioning of a complete round with a radius of the distance from the start point address to the arc center point can be carried out by setting the movement amount to "0".



In circular interpolation control with center point designation, an angular velocity is calculated on the assumption that operation is carried out at a command speed on the arc using the radius calculated from the start point address and center point address, and the radius is compensated in proportion to the angular velocity deviated from that at the start point.
Thus, when there is a difference (error) between a radius calculated from the start point address and center point address (start point radius) and a radius calculated from the end point address and center point address (end point radius), the composite speed differs from the command speed as follows.

✻ Start point radius > End point radius: As compared with the speed without error, the speed becomes slower as end point address is reached.
✻ Start point radius < End point radius: As compared with the speed without error, the speed becomes faster as end point address is reached.

■ Restrictions

(1) 2-axis circular interpolation control cannot be set in the following cases.

- When "degree" is set in "Pr.1 Unit setting"
- When the units set in "Pr.1 Unit setting" are different for the reference axis and interpolation axis. ("mm" and "inch" combinations are possible.)
- When "reference axis speed" is set in "Pr.20 Interpolation speed designation method"

(2) An error will occur and the positioning start will not be possible in the following cases. The machine will immediately stop if the error is detected during positioning control.

- When the radius exceeds "536870912 (=2^{29})". (The maximum radius for which circular interpolation control is possible is "536870912 (=2^{29})"
  ... An "Outside radius range" (error code: 544) will occur at positioning start.
- When the end point address is outside the range of –2147483648 (-2^{31}) to 2147483647 ($2^{31}-1$)
  ... An "End point setting error" (error code: 526) will occur.
- When the start point address is the same as the center point address
  ... A "Center point setting error" (error code: 527) will occur.
- When the end point address is the same as the center point address
  ... A "Center point setting error" (error code: 527) will occur.
- When the center point address is outside the range of –2147483648 (-2^{31}) to 2147483647 ($2^{31}-1$)
  ... A "Center point setting error" (error code: 527) will occur.

■ Positioning data setting examples

[When "2-axis circular interpolation control with center point designation (INC circular right, INC circular left)" is set in positioning data No. 1 of axis 1]

- Reference axis............. Axis 1
- Interpolation axis.......... Axis 2 (The required values are also set in positioning data No. 1 of axis 2.)

Setting item		Axis	QD77MS2/QD77MS4 setting example		QD77MS16 setting example		Setting details
			Axis 1 (reference axis)	Axis 2 (interpolation axis)	Axis 1 (reference axis)	Axis 2 (interpolation axis)	
Axis 1 Positioning data No. 1	Da.1	Operation pattern	Positioning complete	–	Positioning complete	–	Set "Positioning complete" assuming the next positioning data will not be executed.
	Da.2	Control system	INC circular right INC circular left	–	INC circular right INC circular left	–	Set incremental system, 2-axis circular interpolation control with center point designation. (Select clockwise or counterclockwise according to the control.)
	Da.3	Acceleration time No.	1	–	1	–	Designate the value set in "Pr.25 Acceleration time 1" as the acceleration time at start.
	Da.4	Deceleration time No.	0	–	0	–	Designate the value set in "Pr.10 Deceleration time 0" as the deceleration time at deceleration.
	Da.5	Axis to be interpolated QD77MS2 QD77MS4	Axis 2	–			Set the axis to be interpolated (partner axis). If the self-axis is set, an error will occur.
	Da.6	Positioning address/ movement amount	8000.0 μm	6000.0 μm	8000.0 μm	6000.0 μm	Set the movement amount. (Assuming that the "Pr.1 Unit setting" is set to "mm".)
	Da.7	Arc address	4000.0 μm	3000.0 μm	4000.0 μm	3000.0 μm	Set the center point address (center point address). (Assuming that the "Pr.1 Unit setting" is set to "mm".)
	Da.8	Command speed	6000.00 mm/min	–	6000.00 mm/min	–	Set the speed when moving to the end point address. (Designate the composite speed in "Pr.20 Interpolation speed designation method".)
	Da.9	Dwell time	500ms	–	500ms	–	Set the time the machine dwells after the positioning stop (command stop) to the output of the positioning complete signal.
	Da.10	M code	10	–	10	–	Set this when other sub operation commands are issued in combination with the No.1 positioning data.
	Da.20	Axis to be interpolated No.1 QD77MS16			Axis 2	–	Set the axis to be interpolated. If the self-axis is set, an error will occur.
	Da.21	Axis to be interpolated No.2 QD77MS16			–	–	Setting not required (setting value is ignored).
	Da.22	Axis to be interpolated No.3 QD77MS16			–	–	

(Note): Refer to Section 5.3 "List of positioning data" for information on the setting details.

POINT

Set a value in "Da.8 Command speed" so that the speed of each axis does not exceed the "Pr.8 Speed limit value". (The speed limit does not function for the speed calculated by the Simple Motion module during interpolation control.)

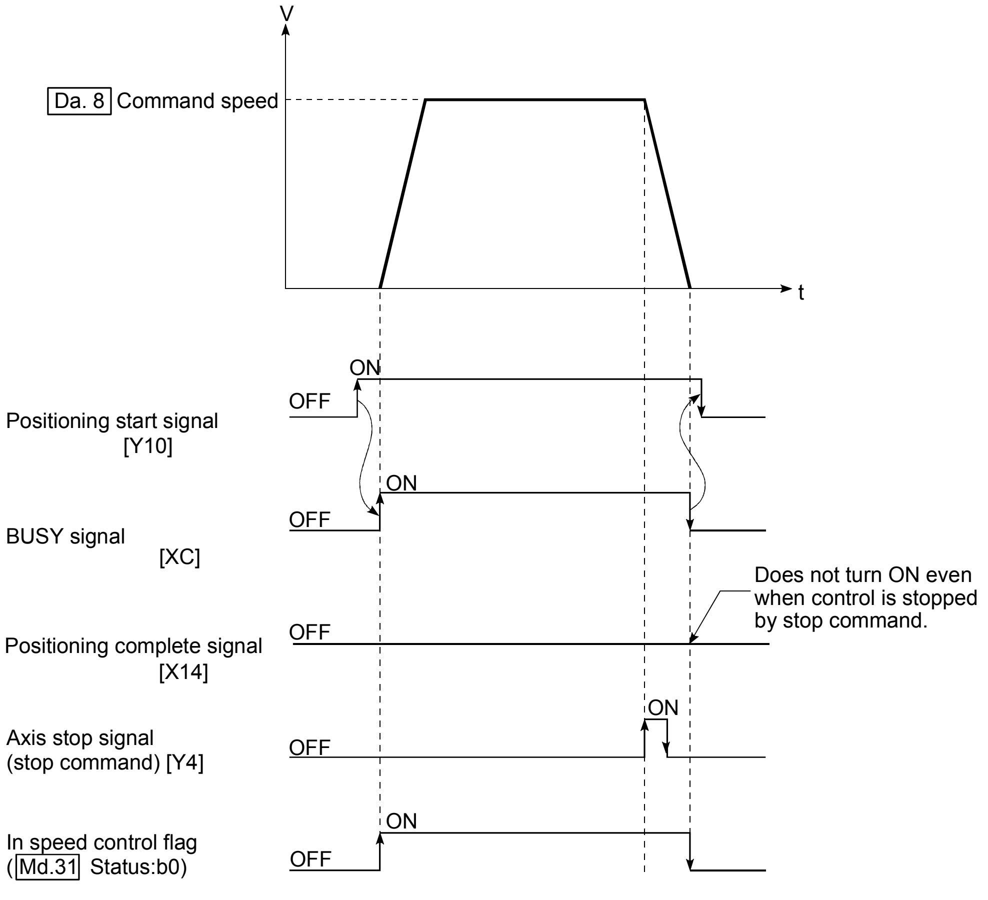
9.2.12 1-axis speed control

In "1-axis speed control" ("Da.2 Control system" = Forward run: speed 1, Reverse run: speed 1), control is carried out in the axis direction in which the positioning data has been set by continuously outputting pulses for the speed set in "Da.8 Command speed" until the input of a stop command.
The two types of 1-axis speed control are "Forward run: speed 1" in which the control starts in the forward run direction, and "Reverse run: speed 1" in which control starts in the reverse run direction.

■ Operation chart

The following chart shows the operation timing for 1-axis speed control with axis 1 as the reference axis.
The "in speed control" flag (Md.31 Status: b0) is turned ON during speed control.
The "Positioning complete signal" is not turned ON.

[QD77MS4 operation example]



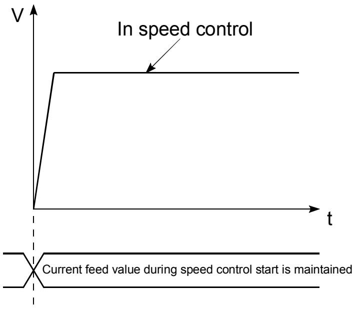
(Note): Refer to Section 3.3 for input/output signal of QD77MS16.

Fig.9.9 1-axis speed control operation timing

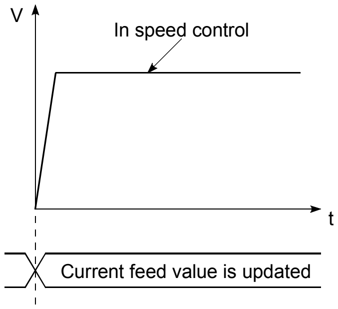
■ Current feed value during 1-axis speed control

The following table shows the "Md.20 Current feed value" during 1-axis speed control corresponding to the "Pr.21 Current feed value during speed control" settings.

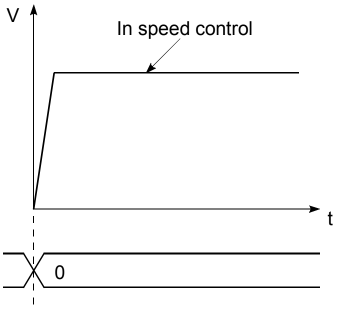
"Pr.21 Current feed value during speed control" setting	Md.20 Current feed value
0: Do not update current feed value	The current feed value at speed control start is maintained.
1: Update current feed value	The current feed value is updated.
2: Zero clear current feed value	The current feed value is fixed at 0.



(a) Current feed value not updated



(b) Current feed value updated



(c) Current feed value zero cleared

■ Restrictions

(1) Set "Positioning complete" in "Da.1 Operation pattern". An axis error "Continuous path control not possible (error code: 516)" will occur and the operation cannot start if "continuous positioning control" or "continuous path control" is set in "Da.1 Operation pattern".
("Continuous positioning control" and "continuous path control" cannot be set in speed control.)

(2) Set the WITH mode in "Pr.18 M code ON signal output timing" when using an M code. The M code will not be output, and the M code ON signal will not turn ON if the AFTER mode is set.

(3) An error "No command speed (error code: 503)" will occur if the current speed (-1) is set in "Da.8 Command speed".

(4) The software stroke limit check is not carried out if the control unit is set to "degree".

■ Positioning data setting examples

[When "1-axis speed control (forward run: speed 1)" is set in the positioning data No. 1 of axis 1]

Setting item			Setting example		Setting details
			QD77MS2 QD77MS4	QD77MS16	
Axis 1 Positioning data No. 1	Da.1	Operation pattern	Positioning complete		Setting other than "Positioning complete" is not possible in speed control.
	Da.2	Control system	Forward run speed 1		Set 1-axis speed control.
	Da.3	Acceleration time No.	1		Designate the value set in "Pr.25 Acceleration time 1" as the acceleration time at start.
	Da.4	Deceleration time No.	0		Designate the value set in "Pr.10 Deceleration time 0" as the deceleration time at deceleration.
	Da.5	Axis to be interpolated QD77MS2 QD77MS4	–		Setting not required (setting value is ignored).
	Da.6	Positioning address/ movement amount	–		
	Da.7	Arc address	–		
	Da.8	Command speed	6000.00mm/min		Set the speed to be commanded.
	Da.9	Dwell time	–		Setting not required (setting value is ignored).
	Da.10	M code	10		Set this when other sub operation commands are issued in combination with the No. 1 positioning data. ("Pr.18 M code ON signal output timing" setting only possible in the WITH mode.)
	Da.20	Axis to be interpolated No.1 QD77MS16		–	Setting not required (setting value is ignored).
	Da.21	Axis to be interpolated No.2 QD77MS16		–	
	Da.22	Axis to be interpolated No.3 QD77MS16		–	

(Note): Refer to Section 5.3 "List of positioning data" for information on the setting details.

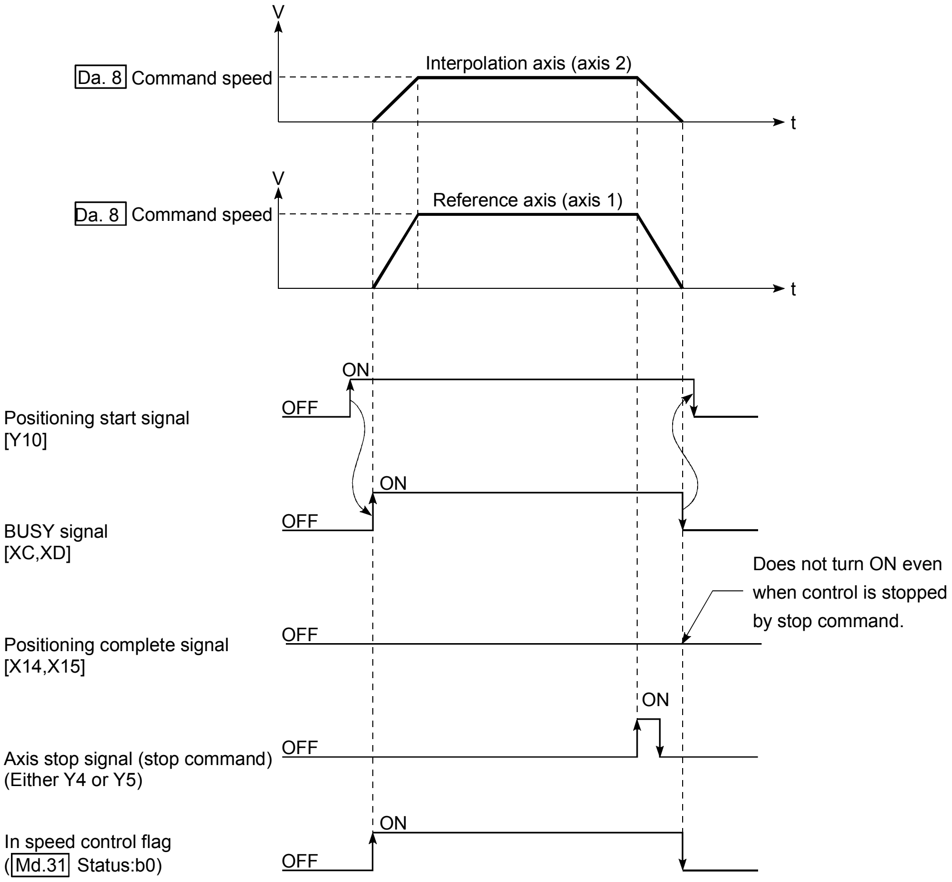
9.2.13 2-axis speed control

In "2-axis speed control" ("Da.2 Control system" = Forward run: speed 2, Reverse run: speed 2), control is carried out in the 2-axis direction in which the positioning data has been set by continuously outputting pulses for the speed set in "Da.8 Command speed" until the input of a stop command.
The two types of 2-axis speed control are "Forward run: speed 2" in which the control starts in the forward run direction, and "Reverse run: speed 2" in which control starts in the reverse run direction.
(Refer to Section 9.1.6 "Interpolation control" for the combination of the reference axis with the interpolation axis.)

■ Operation chart

The following chart shows the operation timing for 2-axis (axes 1 and 2) speed control with axis 1 as the reference axis. The "in speed control" flag (Md.31 Status: b0) is turned ON during speed control.
The "positioning complete signal" is not turned ON.

[QD77MS4 operation example]



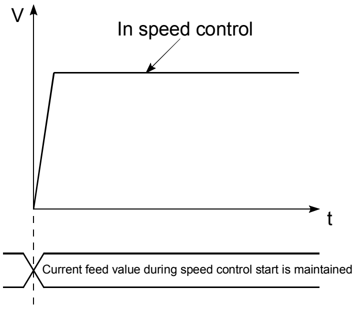
(Note): Refer to Section 3.3 for input/output signal of QD77MS16.

Fig. 9.10 2-axis speed control operation timing

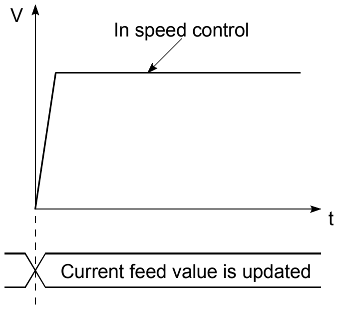
■ Current feed value during 2-axis speed control

The following table shows the "Md.20 Current feed value" during 2-axis speed control corresponding to the "Pr.21 Current feed value during speed control" settings. (Note that the reference axis setting values are used for parameters.)

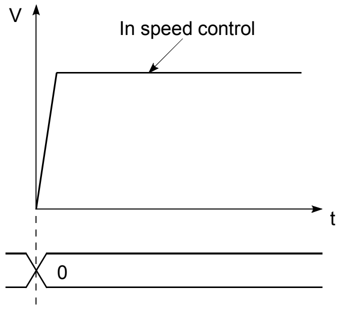
"Pr.21 Current feed value during speed control" setting	Md.20 Current feed value
0: Do not update current feed value	The current feed value at speed control start is maintained.
1: Update current feed value	The current feed value is updated.
2: Zero clear current feed value	The current feed value is fixed at 0.



(a) Current feed value not updated



(b) Current feed value updated



(c) Current feed value zero cleared

■ Restrictions

(1) Set "Positioning complete" in "Da.1 Operation pattern". An axis error "Continuous path control not possible (error code: 516)" will occur and the operation cannot start if "continuous positioning control" or "continuous path control" is set. ("Continuous positioning control" and "continuous path control" cannot be set in speed control.)

(2) Set the WITH mode in "Pr.18 M code ON signal output timing" when using an M code. The M code will not be output, and the M code ON signal will not turn ON if the AFTER mode is set.

(3) Set the "reference axis speed" in "Pr.20 Interpolation speed designation method". An "Interpolation mode error (error code: 523)" will occur and the operation cannot start if a composite speed is set.

(4) When either of two axes exceeds the speed limit, that axis is controlled with the speed limit value. The speeds of the other axes are limited at the ratios of "Da.8 Command speed".

(Examples)

Axis Setting item		Axis 1 setting	Axis 2 setting
Pr.8	Speed limit value	4000.00mm/min	5000.00mm/min
Da.8	Command speed	8000.00mm/min	6000.00mm/min

With the settings shown above, the operation speed in speed control is as follows.

Axis 1: 4000.00 mm/min (Speed is limited by Pr.8).

Axis 2: 3000.00 mm/min (Speed is limited at a ratio of an axis 1 command speed to an axis 2 command speed).

(Note): Operation runs at speed 1 when a reference axis speed is less than 1 as a result of speed limit.

In addition, when "Pr.7 Bias speed at start" is set, the set value will be the minimum speed.

(5) An error "No command speed (error code: 503)" occurs if a current speed (-1) is set in "Da.8 Command speed".

(6) The software stroke limit check is not carried out when the control unit is set to "degree".

■ Positioning data setting examples

[When "2-axis speed control (forward run: speed 2)" is set in the positioning data No. 1 of axis 1]

- Reference axis............. Axis 1
- Interpolation axis.......... Axis 2 (The required values are also set in positioning data No.1 of axis 2.)

Setting item \ Axis			QD77MS2/QD77MS4 setting example		QD77MS16 setting example		Setting details
			Axis 1 (reference axis)	Axis 2 (interpolation axis)	Axis 1 (reference axis)	Axis 2 (interpolation axis)	
Axis 1 Positioning data No. 1	Da.1	Operation pattern	Positioning complete	–	Positioning complete	–	Setting other than "Positioning complete" is not possible in speed control.
	Da.2	Control system	Forward run speed 2	–	Forward run speed 2	–	Set 2-axis speed control.
	Da.3	Acceleration time No.	1	–	1	–	Designate the value set in "Pr.25 Acceleration time 1" as the acceleration time at start.
	Da.4	Deceleration time No.	0	–	0	–	Designate the value set in "Pr.10 Deceleration time 0" as the deceleration time at deceleration.
	Da.5	Axis to be interpolated QD77MS2 QD77MS4	Axis 2	–			Set the axis to be interpolated (partner axis). If the self-axis is set, an error will occur.
	Da.6	Positioning address/ movement amount	–	–	–	–	Setting not required (setting value is ignored).
	Da.7	Arc address	–	–	–	–	
	Da.8	Command speed	6000.00 mm/min	3000.00 mm/min	6000.00 mm/min	3000.00 mm/min	Set the speed to be commanded.
	Da.9	Dwell time	–	–	–	–	Setting not required (setting value is ignored).
	Da.10	M code	10	–	10	–	Set this when other sub operation commands are issued in combination with the No. 1 positioning data. ("Pr.18 M code ON signal output timing" setting only possible in the WITH mode.)
	Da.20	Axis to be interpolated No.1 QD77MS16			Axis 2	–	Set the axis to be interpolated. If the self-axis is set, an error will occur.
	Da.21	Axis to be interpolated No.2 QD77MS16			–	–	Setting not required (setting value is ignored).
	Da.22	Axis to be interpolated No.3 QD77MS16			–	–	

(Note): Refer to Section 5.3 "List of positioning data" for information on the setting details.

9.2.14 3-axis speed control

In "3-axis speed control" ("Da.2 Control system" = Forward run: speed 3, Reverse run: speed 3), control is carried out in the 3-axis direction in which the positioning data has been set by continuously outputting pulses for the speed set in "Da.8 Command speed" until the input of a stop command.

The two types of 3-axis speed control are "Forward run: speed 3" in which the control starts in the forward run direction, and "Reverse run: speed 3" in which control starts in the reverse run direction.

(Refer to Section 9.1.6 "Interpolation control" for the combination of the reference axis with the interpolation axes.)

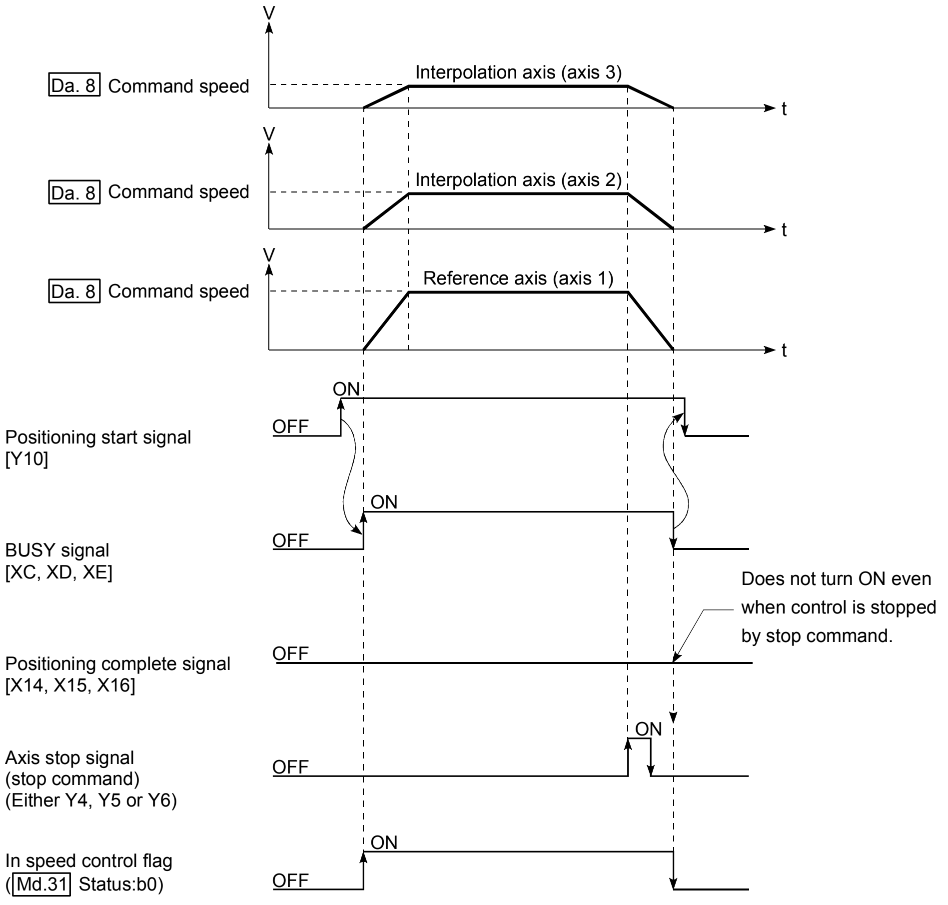
■ Operation chart

The following chart shows the operation timing for 3-axis (axes 1, 2, and 3) speed control with axis 1 as the reference axis.

The "in speed control" flag (Md.31 Status: b0) is turned ON during speed control.

The "positioning complete signal" is not turned ON.

[QD77MS4 operation example]



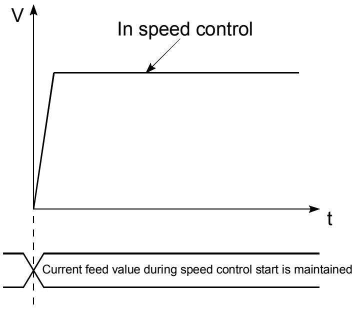
(Note): Refer to Section 3.3 for input/output signal of QD77MS16.

Fig. 9.11 3-axis speed control operation timing

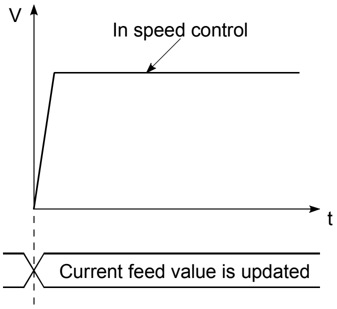
■ Current feed value during 3-axis speed control

The following table shows the "Md.20 Current feed value" during 3-axis speed control corresponding to the "Pr.21 Current feed value during speed control" settings. (Note that the reference axis setting values are used for parameters.)

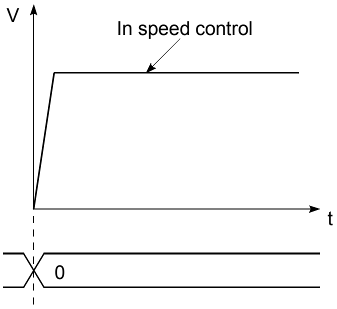
"Pr.21 Current feed value during speed control" setting	Md.20 Current feed value
0: Do not update current feed value	The current feed value at speed control start is maintained.
1: Update current feed value	The current feed value is updated.
2: Zero clear current feed value	The current feed value is fixed at 0.



(a) Current feed value not updated



(b) Current feed value updated



(c) Current feed value zero cleared

■ Restrictions

(1) Set "Positioning complete" in "Da.1 Operation pattern". An axis error "Continuous path control not possible (error code: 516)" will occur and the operation cannot start if "continuous positioning control" or "continuous path control" is set. ("Continuous positioning control" and "continuous path control" cannot be set in speed control.)

(2) Set the WITH mode in "Pr.18 M code ON signal output timing" when using an M code. The M code will not be output, and the M code ON signal will not turn ON if the AFTER mode is set.

(3) Set the "reference axis speed" in "Pr.20 Interpolation speed designation method". An "Interpolation mode error (error code: 523)" will occur and the operation cannot start if a composite speed is set.

(4) When either of three axes exceeds the speed limit, that axis is controlled with the speed limit value. The speeds of the other axes are limited at the ratios of "Da.8 Command speed".
(Examples)

Setting item \ Axis		Axis 1 setting	Axis 2 setting	Axis 3 setting
Pr.8	Speed limit value	4000.00mm/min	5000.00mm/min	6000.00mm/min
Da.8	Command speed	8000.00mm/min	6000.00mm/min	4000.00mm/min

With the settings shown above, the operation speed in speed control is as follows.

Axis 1: 4000.00 mm/min (Speed is limited by Pr.8.)

Axis 2: 3000.00 mm/min (Speed is limited at ratios in axes 1, 2, and 3 command speeds.)

Axis 3: 2000.00 mm/min (Speed is limited at ratios in axes 1, 2, and 3 command speeds.)

(Note): Operation runs at speed 1 when a reference axis speed is less than 1 as a result of speed limit.
In addition, when "Pr.7 Bias speed at start" is set, the set value will be the minimum speed.

(5) An error "No command speed (error code: 503)" will occur if a current speed (-1) is set in "Da.8 Command speed".

(6) The software stroke limit check is not carried out when the control unit is set to "degree".

■ Positioning data setting examples

[When "3-axis speed control (forward run: speed 3)" is set in the positioning data No. 1 of axis 1]

- Reference axis............. Axis 1
- Interpolation axis.......... Axis 2, Axis 3 (The required values are also set in positioning data No.1 of axis 2 and axis 3.)

Setting item		Axis	QD77MS4 setting example			QD77MS16 setting example			Setting details
			Axis 1 (reference axis)	Axis 2 (interpolation axis)	Axis 3 (interpolation axis)	Axis 1 (reference axis)	Axis 2 (interpolation axis)	Axis 3 (interpolation axis)	
Axis 1 Positioning data No. 1	Da.1	Operation pattern	Positioning complete	–	–	Positioning complete	–	–	Setting other than "Positioning complete" is not possible in speed control.
	Da.2	Control system	Forward run speed 3	–	–	Forward run speed 3	–	–	Set 3-axis speed control.
	Da.3	Acceleration time No.	1	–	–	1	–	–	Designate the value set in "Pr.25 Acceleration time 1" as the acceleration time at start.
	Da.4	Deceleration time No.	0	–	–	0	–	–	Designate the value set in "Pr.10 Deceleration time 0" as the deceleration time at deceleration.
	Da.5	Axis to be interpolated QD77MS4	–	–	–				Setting not required (setting value is ignored). When axis 1 is used as a reference axis, the interpolation axes are axes 2 and 3.
	Da.6	Positioning address/ movement amount	–	–	–	–	–	–	Setting not required (setting value is ignored).
	Da.7	Arc address	–	–	–	–	–	–	
	Da.8	Command speed	6000.00 mm/min	3000.00 mm/min	2000.00 mm/min	6000.00 mm/min	3000.00 mm/min	2000.00 mm/min	Set the speed to be commanded.
	Da.9	Dwell time	–	–	–	–	–	–	Setting not required (setting value is ignored).
	Da.10	M code	10	–	–	10	–	–	Set this when other sub operation commands are issued in combination with the No. 1 positioning data. ("Pr.18 M code ON signal output timing" setting only possible in the WITH mode.)
	Da.20	Axis to be interpolated No.1 QD77MS16				Axis 2	–	–	Set the axis to be interpolated. If the self-axis is set, an error will occur.
	Da.21	Axis to be interpolated No.2 QD77MS16				Axis 3	–	–	
	Da.22	Axis to be interpolated No.3 QD77MS16				–	–	–	Setting not required (setting value is ignored).

(Note): Refer to Section 5.3 "List of positioning data" for information on the setting details.

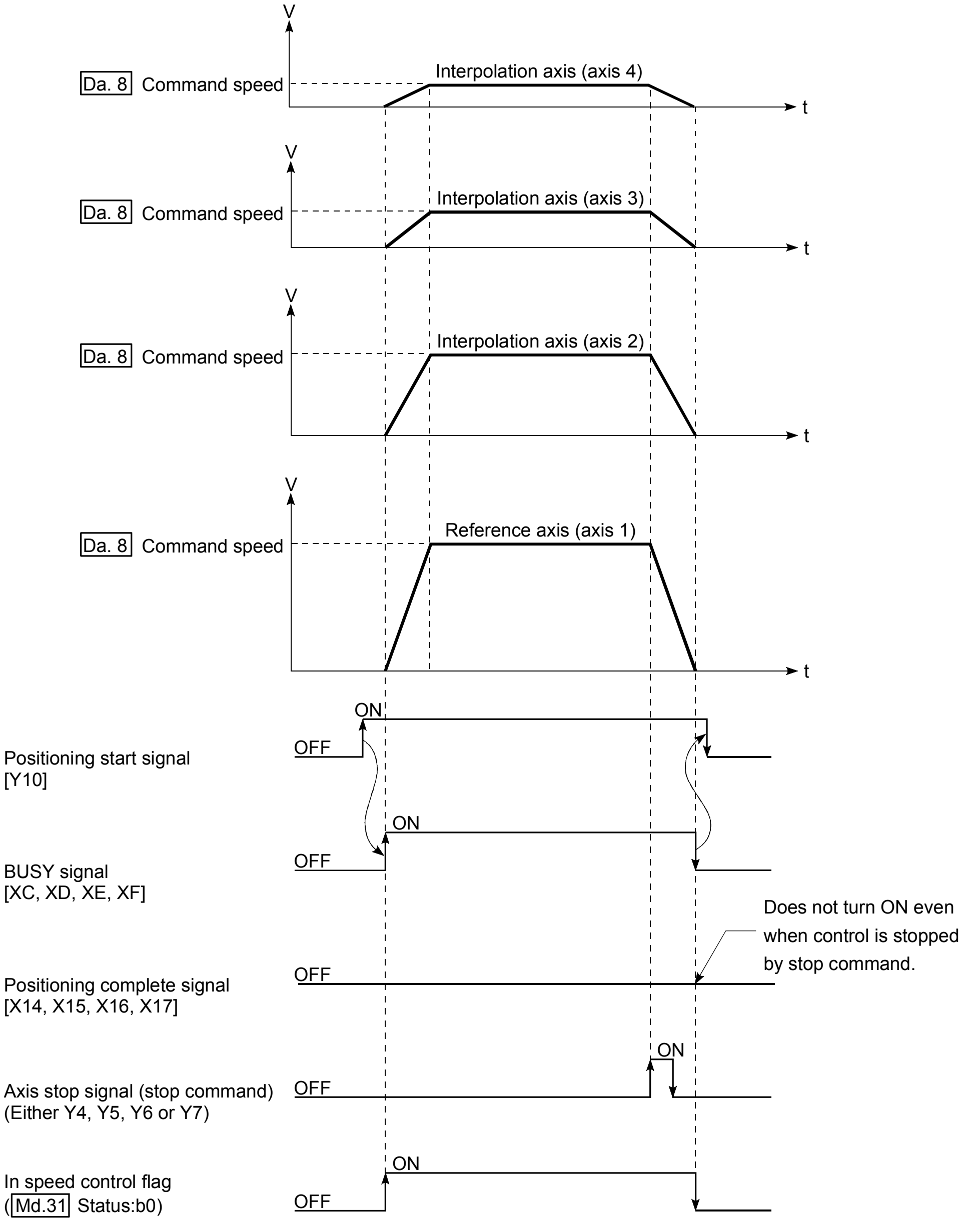
9.2.15 4-axis speed control

In "4-axis speed control" ("Da.2 Control system" = Forward run: speed 4, Reverse run: speed 4), control is carried out in the 4-axis direction in which the positioning data has been set by continuously outputting pulses for the speed set in "Da.8 Command speed" until the input of a stop command.
The two types of 4-axis speed control are "Forward run: speed 4" in which the control starts in the forward run direction, and "Reverse run: speed 4" in which control starts in the reverse run direction.
(Refer to Section 9.1.6 "Interpolation control" for the combination of the reference axis with the interpolation axes.)

■ Operation chart

The following chart shows the operation timing for 4-axis speed control with axis 1 as the reference axis.
The "in speed control" flag (Md.31 Status: b0) is turned ON during speed control.
The "positioning complete signal" is not turned ON.

[QD77MS4 operation example]



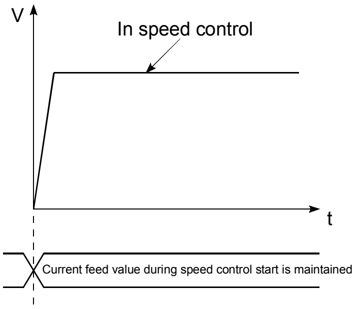
(Note): Refer to Section 3.3 for input/output signal of QD77MS16.

Fig. 9.12 4-axis speed control operation timing

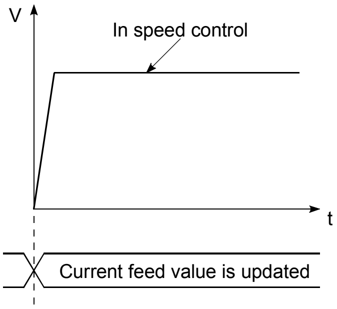
■ Current feed value during 4-axis speed control

The following table shows the "Md.20 Current feed value" during 4-axis speed control corresponding to the "Pr.21 Current feed value during speed control" settings. (Note that the reference axis setting values are used for parameters.)

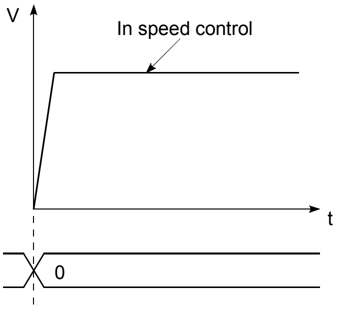
"Pr.21 Current feed value during speed control" setting	Md.20 Current feed value
0: Do not update current feed value	The current feed value at speed control start is maintained.
1: Update current feed value	The current feed value is updated.
2: Zero clear current feed value	The current feed value is fixed at 0.



(a) Current feed value not updated



(b) Current feed value updated



(c) Current feed value zero cleared

■ Restrictions

(1) Set "Positioning complete" in "Da.1 Operation pattern". An axis error "Continuous path control not possible (error code: 516)" will occur and the operation cannot start if "continuous positioning control" or "continuous path control" is set. ("Continuous positioning control" and "continuous path control" cannot be set in speed control.)

(2) Set the WITH mode in "Pr.18 M code ON signal output timing" when using an M code. The M code will not be output, and the M code ON signal will not turn ON if the AFTER mode is set.

(3) Set the "reference axis speed" in "Pr.20 Interpolation speed designation method". An "Interpolation mode error (error code: 523)" will occur and the operation cannot start if a composite speed is set.

(4) When either of four axes exceeds the speed limit, that axis is controlled with the speed limit value. The speeds of the other axes are limited at the ratios of "Da.8 Command speed ".
(Examples)

Setting item \ Axis		Axis 1 setting	Axis 2 setting	Axis 3 setting	Axis 4 setting
Pr.8	Speed limit value	4000.00mm/min	5000.00mm/min	6000.00mm/min	8000.00mm/min
Da.8	Command speed	8000.00mm/min	6000.00mm/min	4000.00mm/min	1500.00mm/min

With the settings shown above, the operation speed in speed control is as follows.

Axis 1: 4000.00 mm/min (Speed is limited by Pr.8 .)
Axis 2: 3000.00 mm/min (Speed is limited at ratios in axes 1, 2, 3 and 4 command speeds.)
Axis 3: 2000.00 mm/min (Speed is limited at ratios in axes 1, 2, 3 and 4 command speeds.)
Axis 4: 750.00 mm/min (Speed is limited at ratios in axes 1, 2, 3 and 4 command speeds.)

(Note): Operation runs at speed 1 when a reference axis speed is less than 1 as a result of speed limit.
In addition, when "Pr.7 Bias speed at start" is set, the set value will be the minimum speed.

(5) An error "No command speed (error code: 503)" will occur if a current speed (-1) is set in "Da.8 Command speed".

(6) The software stroke limit check is not carried out when the control unit is set to "degree".

■ Positioning data setting examples

[When "4-axis speed control (forward run: speed 4)" is set in the positioning data No. 1 of axis 1]

- Reference axis............. Axis 1
- Interpolation axis.......... Axis 2 to Axis 4 (The required values are also set in positioning data No. 1 of axis 2 to axis 4.)

Setting item		Axis	QD77MS4 setting example				QD77MS16 setting example				Setting details
			Axis 1 (reference axis)	Axis 2 (interpolation axis)	Axis 3 (interpolation axis)	Axis 4 (interpolation axis)	Axis 1 (reference axis)	Axis 2 (interpolation axis)	Axis 3 (interpolation axis)	Axis 4 (interpolation axis)	
Axis 1 Positioning data No. 1	Da.1	Operation pattern	Positioning complete	–	–	–	Positioning complete	–	–	–	Setting other than "Positioning complete" is not possible in speed control.
	Da.2	Control system	Forward run speed 4	–	–	–	Forward run speed 4	–	–	–	Set 4-axis speed control.
	Da.3	Acceleration time No.	1	–	–	–	1	–	–	–	Designate the value set in "Pr.25 Acceleration time 1" as the acceleration time at start.
	Da.4	Deceleration time No.	0	–	–	–	0	–	–	–	Designate the value set in "Pr.10 Deceleration time 0" as the deceleration time at deceleration.
	Da.5	Axis to be interpolated QD77MS4	–	–	–	–					Setting not required (setting value is ignored). When axis 1 is used as a reference axis, the interpolation axes are axes 2, 3 and 4.
	Da.6	Positioning address/ movement amount	–	–	–	–	–	–	–	–	Setting not required (setting value is ignored).
	Da.7	Arc address	–	–	–	–	–	–	–	–	
	Da.8	Command speed	6000.00 mm/min	3000.00 mm/min	2000.00 mm/min	1000.00 mm/min	6000.00 mm/min	3000.00 mm/min	2000.00 mm/min	1000.00 mm/min	Set the speed to be commanded.
	Da.9	Dwell time	–	–	–	–	–	–	–	–	Setting not required (setting value is ignored).
	Da.10	M code	10	–	–	–	10	–	–	–	Set this when other sub operation commands are issued in combination with the No. 1 positioning data. ("Pr.18 M code ON signal output timing" setting only possible in the WITH mode.)
	Da.20	Axis to be interpolated No.1 QD77MS16					Axis 2	–	–	–	Set the axis to be interpolated. If the self-axis is set, an error will occur.
	Da.21	Axis to be interpolated No.2 QD77MS16					Axis 3	–	–	–	
	Da.22	Axis to be interpolated No.3 QD77MS16					Axis 4	–	–	–	

(Note): Refer to Section 5.3 "List of positioning data" for information on the setting details.

9.2.16 Speed-position switching control (INC mode)

In "speed-position switching control (INC mode)" ("Da.2 Control system" = Forward run: speed/position, Reverse run: speed/position), the pulses of the speed set in "Da.8 Command speed" are kept output on the axial direction set to the positioning data. When the "speed-position switching signal" is input, position control of the movement amount set in "Da.6 Positioning address/movement amount" is exercised.

"Speed-position switching control (INC mode)" is available in two different types: "forward run: speed/position" which starts the axis in the forward run direction and "reverse run: speed/position" which starts the axis in the reverse run direction.

Use the detailed parameter 1 "Pr.81 Speed-position function selection" with regard to the choice for "speed-position switching control (INC mode)".

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Pr.81	Speed-position function selection	0	Speed-position switching control (INC mode)	34+150n	

(Note): If the set value is other than 0 and 2, it is regarded as 0 and operation is performed in the INC mode.
For details of the setting, refer to Section 5.2 "List of parameters".

■ Switching over from speed control to position control

(1) The control is selected the switching method from speed control to position control by the setting value of "Cd.45 Speed-position switching device selection".

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Cd.45	Speed-position switching device selection	→	The device used for speed-position switching is selected. 0: Use the external command signal for switching from speed control to position control 1: Use the near-point signal for switching from speed control to position control 2: Use the "Cd.46 Speed-position switching command" for switching from speed control to position control	1566+100n	4366+100n

The switching is performed by using the following device when "2" is set.

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Cd.46	Speed-position switching command	→	The speed-position control switching is performed when "2" is set in "Cd.45 Speed-position switching device selection".	1567+100n	4367+100n

(2) "Cd.24 Speed-position switching enable flag" must be turned ON to switch over from speed control to position control. (If the "Cd.24 Speed-position switching enable flag" turns ON after the speed-position switching signal turns ON, the control will continue as speed control without switching over to position control. The control will be switched over from position control to speed control when the speed-position switching signal turns from OFF to ON again. Only position control will be carried out when the "Cd.24 Speed-position switching enable flag" and speed-position switching signal are ON at the operation start.)

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Cd.24	Speed-position switching enable flag	1	Speed control will be taken over by position control when the external command signal [DI] comes ON.	1528+100n	4328+100n

■ Operation chart

The following chart (Fig.9.13) shows the operation timing for speed-position switching control (INC mode). The "in speed control flag" (Md.31 Status: b0) is turned ON during speed control of speed-position switching control (INC mode).

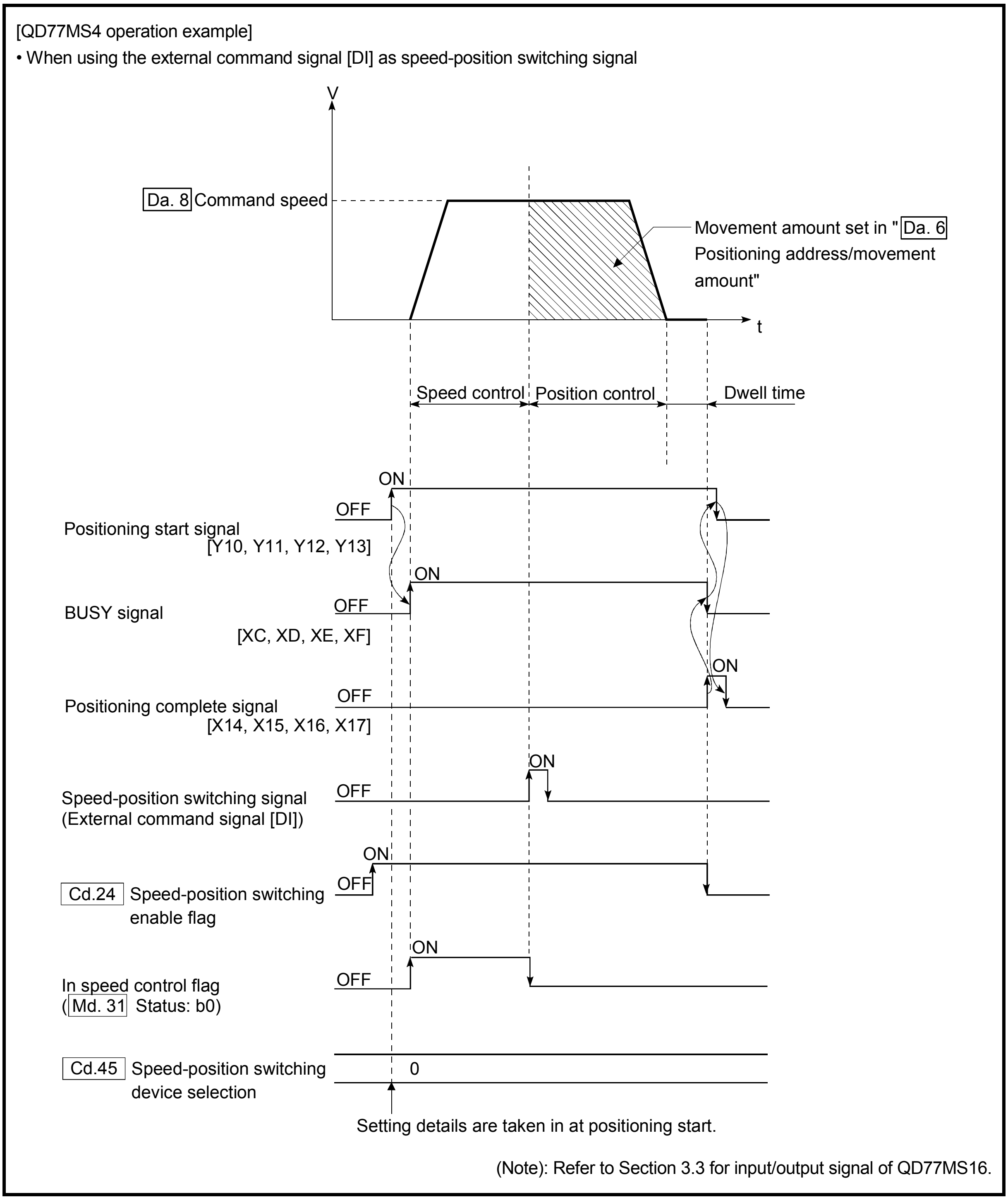
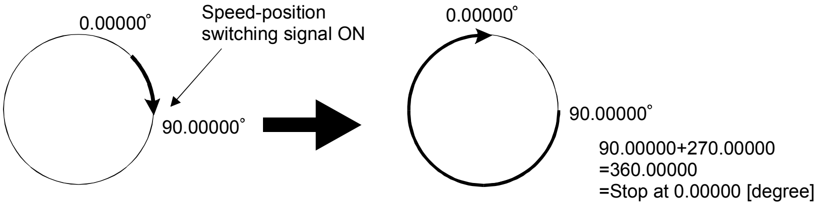


Fig. 9.13 Speed-position switching control (INC mode) operation timing

[Operation example]

The following operation assumes that the speed-position switching signal is input at the position of the current feed value of 90.00000 [degree] during execution of "Da.2 Control system" "Forward run: speed/ position" at "Pr.1 Unit setting" of "2: degree" and "Pr.21 Current feed value during speed control" setting of "1: Update current feed value".

(The value set in "Da.6 Positioning address/movement amount" is 270.00000 [degree])



■ Operation timing and processing time during speed-position switching control (INC mode)

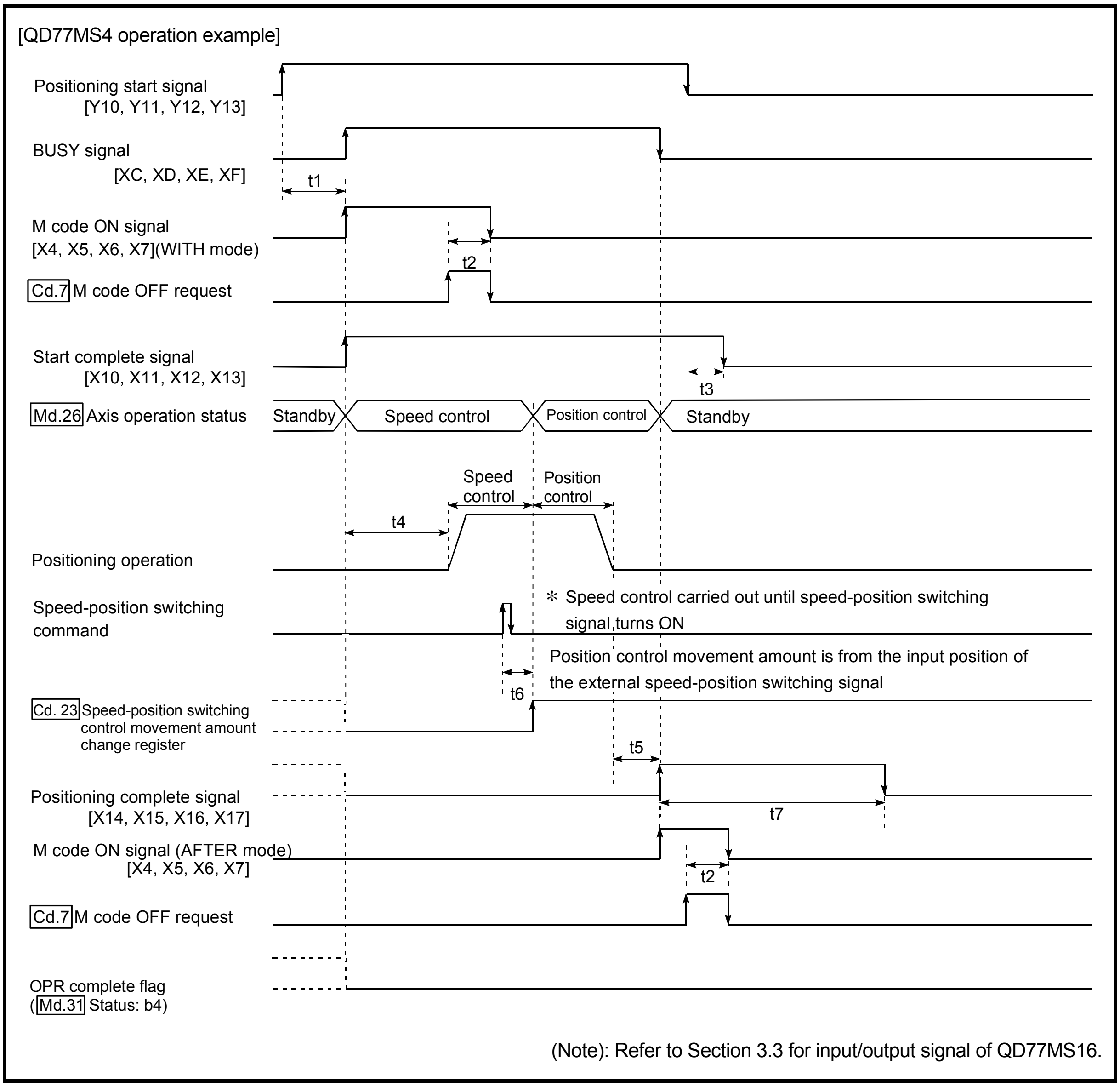


Fig. 9.14 Operation timing and processing time during speed-position switching control (INC mode)

Normal timing time Unit: [ms]

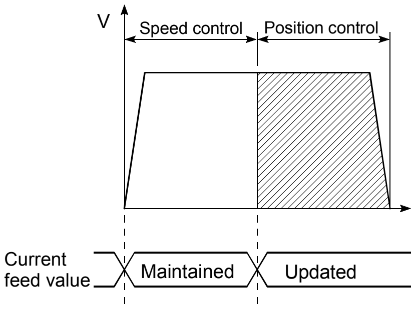
	Operation cycle	t1	t2	t3	t4	t5	t6	t7
QD77MS2	0.88	0.2 to 0.3	0 to 0.9	0 to 0.9	1.8 to 2.7	0 to 0.9	0.2	Follows parameters
	1.77	0.2 to 0.3	0 to 1.8	0 to 1.8	2.5 to 3.9	0 to 1.8	0.2	Follows parameters
QD77MS4	0.88	0.2 to 0.3	0 to 0.9	0 to 0.9	1.8 to 2.7	0 to 0.9	0.2	Follows parameters
	1.77	0.2 to 0.3	0 to 1.8	0 to 1.8	2.5 to 3.9	0 to 1.8	0.2	Follows parameters
QD77MS16	0.88	0.3 to 1.4	0 to 0.9	0 to 0.9	1.8 to 2.7	0 to 0.9	0.2	Follows parameters
	1.77	0.3 to 1.4	0 to 1.8	0 to 1.8	3.2 to 3.9	0 to 1.8	0.2	Follows parameters

- The t1 timing time could be delayed by the operation state of other axes.
- When using the near-point dog signal or "Cd.46 Speed-position switching command", the t6 timing time could be delayed or vary influenced by the PLC scan time or communication with servo amplifier.

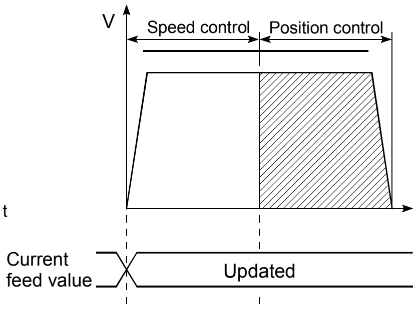
■ Current feed value during speed-position switching control (INC mode)

The following table shows the "Md.20 Current feed value" during speed-position switching control (INC mode) corresponding to the "Pr.21 Current feed value during speed control" settings.

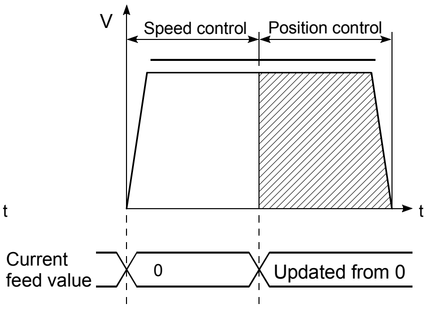
"Pr.21 Current feed value during speed control" setting	Md.20 Current feed value
0: Do not update current feed value	The current feed value at control start is maintained during speed control, and updated from the switching to position control.
1: Update current feed value	The current feed value is updated during speed control and position control.
2: Zero clear current feed value	The current feed value is cleared (set to "0") at control start, and updated from the switching to position control.



(a) Current feed value not updated



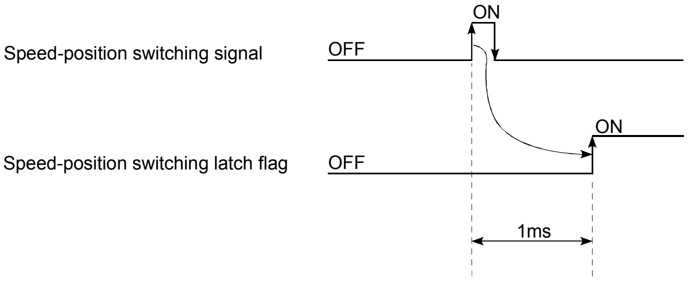
(b) Current feed value updated



(c) Current feed value zero cleared

■ Switching time from speed control to position control

There is 1ms from the time the speed-position switching signal is turned ON to the time the speed-position switching latch flag (Md.31 Status: b1) turns ON.



■ Speed-position switching signal setting

(1) The following table shows the items that must be set to use the external command signals [DI] as speed-position switching signals.

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Pr.42	External command function selection	2	Speed-position, position-speed switching request.	62+150n	
Cd.8	External command valid	1	Validates an external command.	1505+100n	4305+100n
Cd.45	Speed-position switching device selection	0	Use the external command signal for switching from speed control to position control.	1566+100n	4366+100n

(Note): Set the external command signal [DI] in "Pr.95 External command signal selection" at QD77MS16 use. Refer to Section 5.2 "List of parameters" and Section 5.7 "List of control data" for information on the setting details.

(2) The following table shows the items that must be set to use the near-point dog signal (DOG) as speed-position switching signals.

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Cd.45	Speed-position switching device selection	1	Use the near-point dog signal for switching from speed control to position control	1566+100n	4366+100n

(Note): The setting is not required for "Pr.42 External command function selection" and "Cd.8 External command valid".
Refer to Section 5.7 "List of control data" for information on the setting details.

(3) The following table shows the items that must be set to use "Cd.46 Speed-position switching command" as speed-position switching signals.

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Cd.45	Speed-position switching device selection	2	Use the "Cd.46 Speed-position switching command" for switching from speed control to position control	1566+100n	4366+100n

(Note): The setting is not required for "Pr.42 External command function selection" and "Cd.8 External command valid".
Refer to Section 5.7 "List of control data" for information on the setting details.

■ Changing the position control movement amount

In "speed-position switching control (INC mode)", the position control movement amount can be changed during the speed control section.

(1) The position control movement amount can be changed during the speed control section of speed-position switching control (INC mode).
A movement amount change request will be ignored unless issued during the speed control section of the speed-position switching control (INC mode).

(2) The "new movement amount" is stored in "Cd.23 Speed-position switching control movement amount change register" by the sequence program during speed control.
When the speed-position switching signal is turned ON, the movement amount for position control is stored in "Cd.23 Speed-position switching control movement amount change register".

(3) The movement amount is stored in the "Md.29 Speed-position switching control positioning amount" of the axis monitor area from the point where the control changes to position control by the input of a speed-position switching signal from an external device.

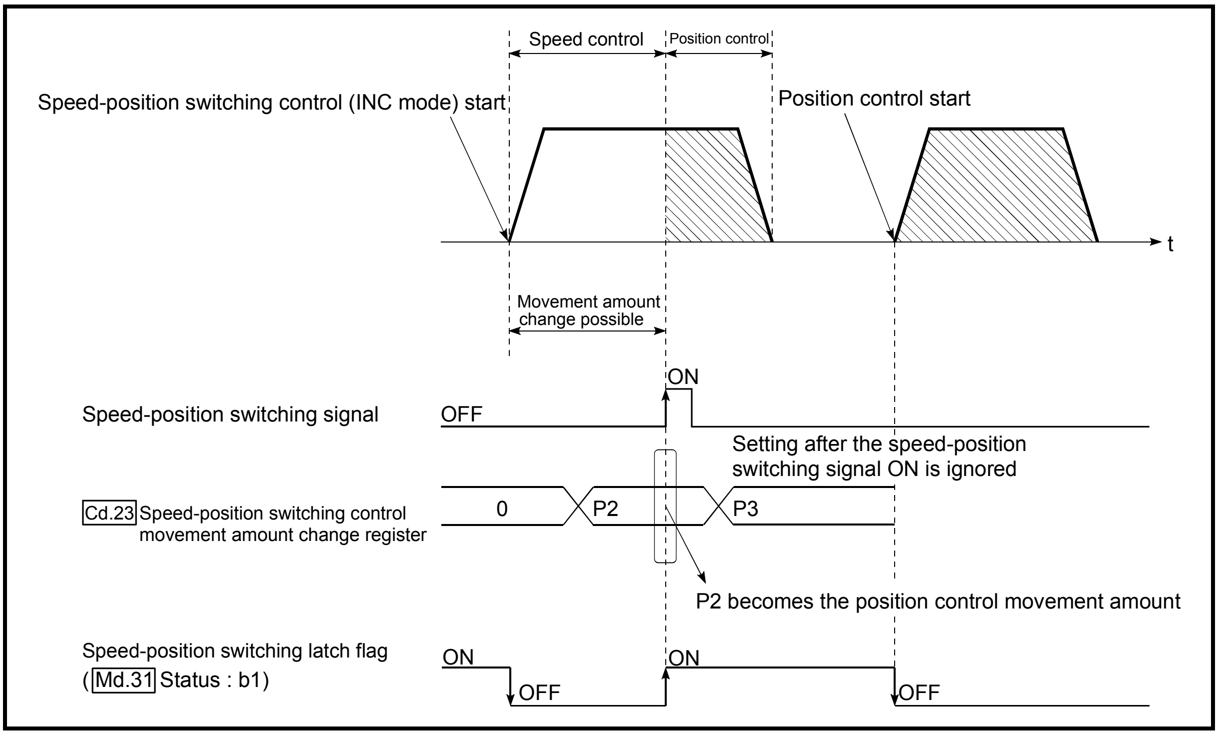


Fig. 9.15 Position control movement amount change timing

POINT

- The machine recognizes the presence of a movement amount change request when the data is written to "Cd.23 Speed-position switching control movement amount change register" with the sequence program.
- The new movement amount is validated after execution of the speed-position switching control (INC mode), before the input of the speed-position switching signal.
- The movement amount change can be enable/disable with the interlock function in position control using the "speed-position switching latch flag" (Md.31 Status: b1) of the axis monitor area.

■ Restrictions

(1) An axis error (error code: 516) will occur and the operation cannot start if "continuous positioning control" or "continuous path control" is set in "Da.1 Operation pattern".

(2) "Speed-position switching control" cannot be set in "Da.2 Control system" of the positioning data when "continuous path control" has been set in "Da.1 Operation pattern" of the immediately prior positioning data. (For example, if the operation pattern of positioning data No. 1 is "continuous path control", "speed-position switching control" cannot be set in positioning data No. 2.) An axis error (error code: 516) will occur and the machine will carry out a deceleration stop if this type of setting is carried out.

(3) An error (error code: 503) will occur if "current speed (-1)" is set in "Da.8 Command speed".

(4) The software stroke limit range check during speed control is made only when the following (a) and (b) are satisfied:

   (a) "Pr.21 Current feed value during speed control" is "1: Update current feed value".
   If the movement amount exceeds the software stroke limit range during speed control in case of the setting of other than "1: Update current feed value", an error (error code: 507 or 508) will occur as soon as speed control is changed to position control and the axis will decelerate to a stop.

   (b) When "Pr.1 Unit setting" is other than "2: degree"
   If the unit is "degree", the software stroke limit range check is not performed.

(5) If the value set in "Da.6 Positioning address/movement amount" is negative, an error (error code: 530) will occur.

(6) Deceleration processing is carried out from the point where the speed-position switching signal is input if the position control movement amount set in "Da.6 Positioning address/movement amount" is smaller than the deceleration distance from the "Da.8 Command speed".

(7) Turn ON the speed-position switching signal in the speed stabilization region (constant speed status). A warning (warning code: 508) will occur because of large deviation in the droop pulse amount if the signal is turned ON during acceleration.
During use of the servo motor, the actual movement amount after switching of speed control to position control is the "preset movement amount + droop pulse amount". If the signal is turned ON during acceleration/deceleration, the stop position will vary due to large variation of the droop pulse amount. Even though "Md.29 Speed-position switching control positioning amount" is the same, the stop position will change due to a change in droop pulse amount when "Da.8 Command speed" is different.

■ Positioning data setting examples

[When "speed-position switching control (INC mode) by forward run" is set in positioning data No. 1 of axis 1]

Setting item			Setting example		Setting details
			QD77MS2 QD77MS4	QD77MS16	
Axis 1 Positioning data No. 1	Da.1	Operation pattern	Positioning complete		Set "Positioning complete" assuming the next positioning data will not be executed. ("Continuous path control" cannot be set in "speed-position switching control (INC mode)".)
	Da.2	Control system	Forward run: speed/position		Set speed-position switching control by forward run.
	Da.3	Acceleration time No.	1		Designate the value set in "Pr.25 Acceleration time 1" as the acceleration time at start.
	Da.4	Deceleration time No.	0		Designate the value set in "Pr.10 Deceleration time 0" as the deceleration time at deceleration.
	Da.5	Axis to be interpolated QD77MS2 QD77MS4	–		Setting not required. (Setting value is ignored.)
	Da.6	Positioning address/ movement amount	10000.0μm		INC mode (Pr.81 = 0) Set the movement amount after the switching to position control. (Assuming that the "Pr.1 Unit setting" is set to "mm".)
	Da.7	Arc address	–		Setting not required. (Setting value is ignored.)
	Da.8	Command speed	6000.00mm/min		Set the speed to be controlled.
	Da.9	Dwell time	500ms		Set a time from the positioning stop (command stop) by position control until the positioning complete signal is output. When the system is stopped by speed control, ignore the setting value.
	Da.10	M code	10		Set this when other sub operation commands are issued in combination with the No.1 positioning data.
	Da.20	Axis to be interpolated No.1 QD77MS16		–	Setting not required (setting value is ignored).
	Da.21	Axis to be interpolated No.2 QD77MS16		–	
	Da.22	Axis to be interpolated No.3 QD77MS16		–	

(Note): Refer to Section 5.3 "List of positioning data" for information on the setting details.

9.2.17 Speed-position switching control (ABS mode)

In case of "speed-position switching control (ABS mode)" ("Da.2 Control system" = Forward run: speed/position, Reverse run: speed/position), the pulses of the speed set in "Da.8 Command speed" are kept output in the axial direction set to the positioning data. When the "speed-position switching signal" is input, position control to the address set in "Da.6 Positioning address/movement amount" is exercised.

"Speed-position switching control (ABS mode)" is available in two different types: "forward run: speed/position" which starts the axis in the forward run direction and "reverse run: speed/position" which starts the axis in the reverse run direction.

"Speed-position switching control (ABS mode)" is valid only when "Pr.1 Unit setting" is "2: degree".

Pr.1 Unit setting Speed-position function selection	mm	inch	degree	PLS
INC mode	○	○	○	○
ABS mode	×	×	○	×

○: Setting allowed,

×: Setting disallowed (If setting is made, an error (error code: 935) will occur when the PLC READY signal [Y0] turns ON.)

Use the detailed parameter 1 "Pr.81 Speed-position function selection" to choose "speed-position switching control (ABS mode)".

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Pr.81	Speed-position function selection	2	Speed-position switching control (ABS mode)	34+150n	

(Note): If the set value is other than 0 and 2, it is regarded as 0 and operation is performed in the INC mode.
For details of the setting, refer to Section 5.2 "List of parameters".

■ Switching over from speed control to position control

(1) The control is selected the switching method from speed control to position control by the setting value of "Cd.45 Speed-position switching device selection".

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Cd.45	Speed-position switching device selection	→	The device used for speed-position switching is selected. 0: Use the external command signal for switching from position control to speed control 1: Use the near-point signal for switching from position control to speed control 2: Use the "Cd.46 Speed-position switching command" for switching from position control to speed control	1566+100n	4366+100n

The switching is performed by using the following device when "2" is set.

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Cd.46	Speed-position switching command	→	The speed-position control switching is performed when "2" is set in "Cd.45 Speed-position switching device selection".	1567+100n	4367+100n

(2) "Cd.24 Speed-position switching enable flag" must be turned ON to switch over from speed control to position control. (If the "Cd.24 Speed-position switching enable flag" turns ON after the speed-position switching signal turns ON, the control will continue as speed control without switching over to position control. The control will be switched over from speed control to position control when the speed-position switching signal turns from OFF to ON again. Only position control will be carried out when the "Cd.24 Speed-position switching enable flag" and speed-position switching signal are ON at the operation start.)

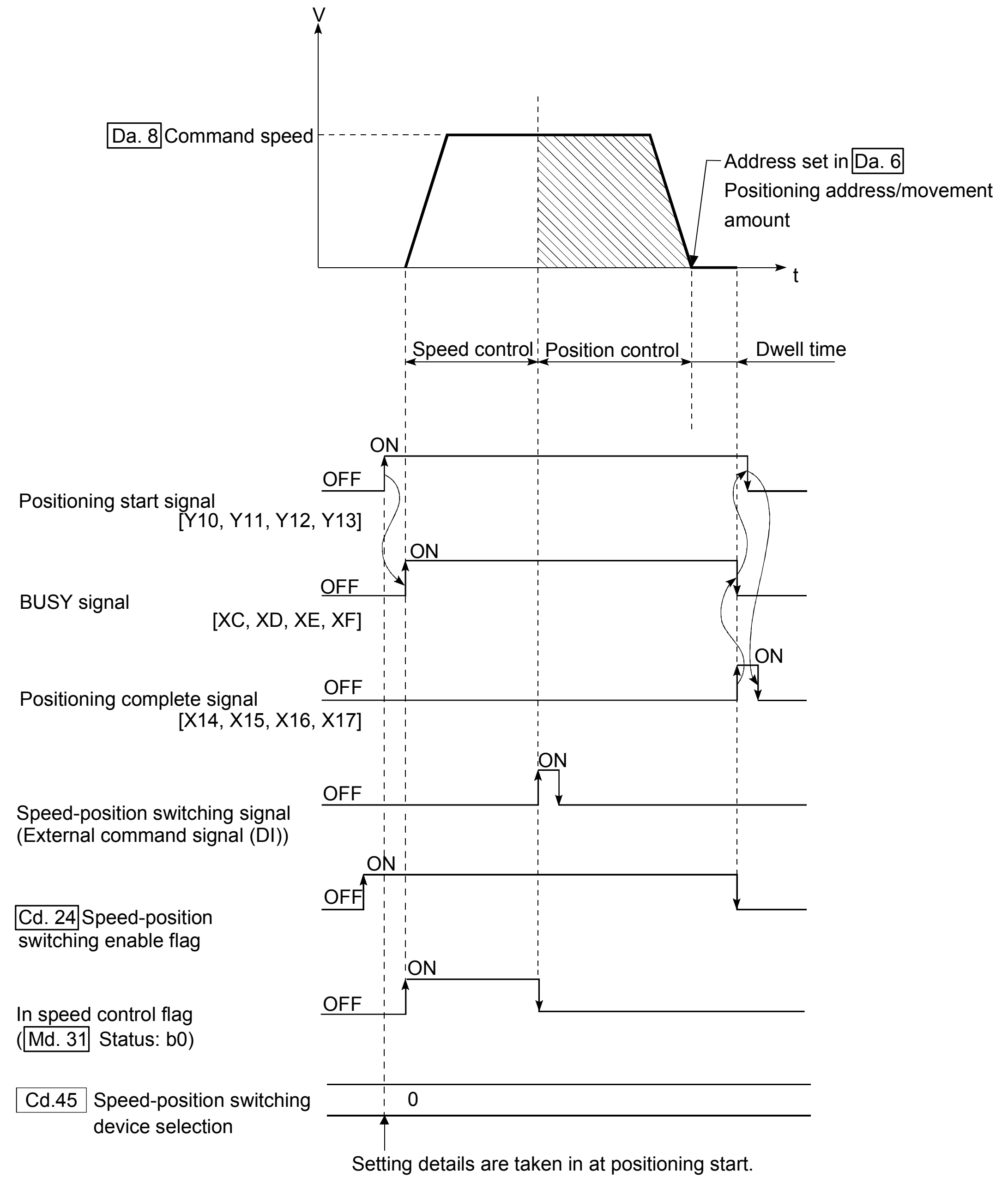
Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Cd.24	Speed-position switching enable flag	1	Speed control will be taken over by position control when the external command signal [DI] comes ON.	1528+100n	4328+100n

■ Operation chart

The following chart (Fig.9.16) shows the operation timing for speed-position switching control (ABS mode). The "in speed control flag" (Md.31 Status: b0) is turned ON during speed control of speed-position switching control (ABS mode).

[QD77MS4 operation example]

• When using the external command signal [DI] as speed-position switching signal

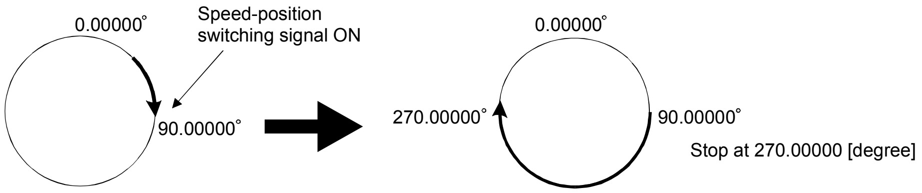


(Note): Refer to Section 3.3 for input/output signal of QD77MS16.

Fig. 9.16 Speed-position switching control (ABS mode) operation timing

[Operation example]

The following operation assumes that the speed-position switching signal is input at the position of the current feed value of 90.00000 [degree] during execution of "Da.2 Control system" "Forward run: speed/ position" at "Pr.1 Unit setting" of "2: degree" and "Pr.21 Current feed value during speed control" setting of "1: Update current feed value".
(The value set in "Da.6 Positioning address/movement amount" is 270.00000 [degree])



■ Operation timing and processing time during speed-position switching control (ABS mode)

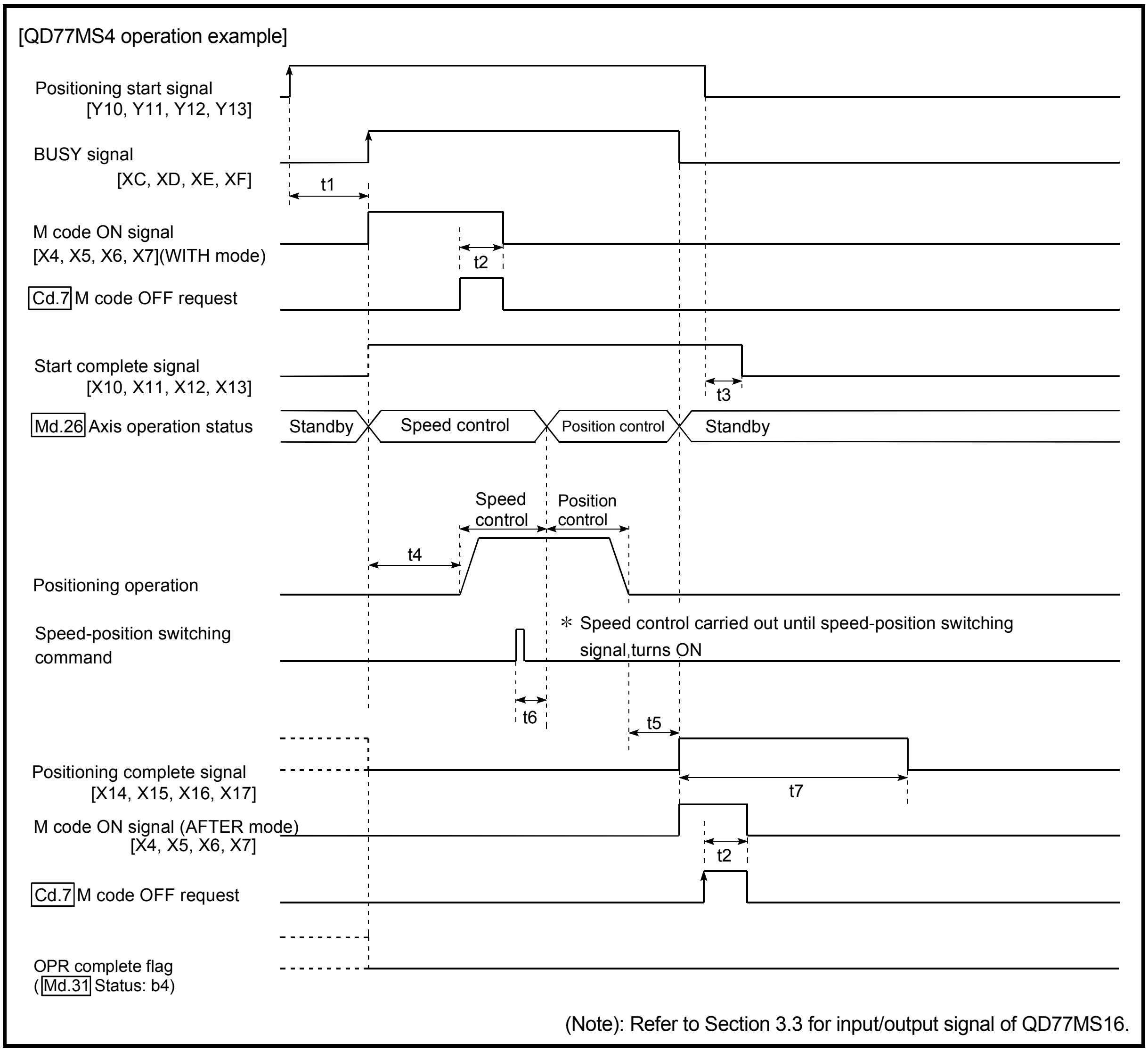


Fig. 9.17 Operation timing and processing time during speed-position switching control (ABS mode)

Normal timing time Unit: [ms]

	Operation cycle	t1	t2	t3	t4	t5	t6	t7
QD77MS2	0.88	0.2 to 0.3	0 to 0.9	0 to 0.9	1.8 to 2.7	0 to 0.9	0.2	Follows parameters
	1.77	0.2 to 0.3	0 to 1.8	0 to 1.8	2.5 to 3.9	0 to 1.8	0.2	Follows parameters
QD77MS4	0.88	0.2 to 0.3	0 to 0.9	0 to 0.9	1.8 to 2.7	0 to 0.9	0.2	Follows parameters
	1.77	0.2 to 0.3	0 to 1.8	0 to 1.8	2.5 to 3.9	0 to 1.8	0.2	Follows parameters
QD77MS16	0.88	0.3 to 1.4	0 to 0.9	0 to 0.9	1.8 to 2.7	0 to 0.9	0.2	Follows parameters
	1.77	0.3 to 1.4	0 to 1.8	0 to 1.8	3.2 to 3.9	0 to 1.8	0.2	Follows parameters

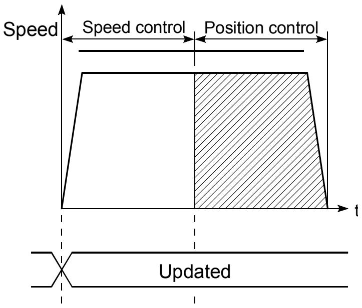
- The t1 timing time could be delayed by the operation state of other axes.
- When using the near-point dog signal and "Cd.46 Speed-position switching command", the t6 timing time could be delayed or vary influenced by the PLC scan time or communication with servo amplifier.

■ Current feed value during speed-position switching control (ABS mode)

The following table shows the "Md.20 Current feed value" during speed-position switching control (ABS mode) corresponding to the "Pr.21 Current feed value during speed control" settings.

"Pr.21 Current feed value during speed control" setting	Md.20 Current feed value
1: Update current feed value	The current feed value is updated during speed control and position control.

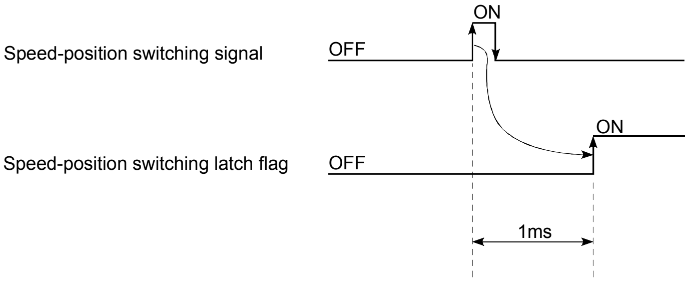
Only "1: Update current value" is valid for the setting of "Pr.21 Current feed value during speed control" in speed-position switching control (ABS mode).
An error (error code: 935) will occur if the "Pr.21 Current feed value during speed control" setting is other than 1.



Current feed value updated

■ Switching time from speed control to position control

There is 1ms from the time the speed-position switching signal is turned ON to the time the speed-position switching latch flag (Md.31 Status: b1) turns ON.



■ Speed-position switching signal setting

(1) The following table shows the items that must be set to use the external command signals [DI] as speed-position switching signals.

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Pr.42	External command function selection	2	Speed-position, position-speed switching request.	62+150n	
Cd.8	External command valid	1	Validates an external command.	1505+100n	4305+100n
Cd.45	Speed-position switching device selection	0	Use the external command signal for switching from speed control to position control.	1566+100n	4366+100n

(Note): Set the external command signal [DI] in "Pr.95 External command signal selection" at QD77MS16 use. Refer to Section 5.2 "List of parameters" and Section 5.7 "List of control data" for information on the setting details.

(2) The following table shows the items that must be set to use the near-point dog signal (DOG) as speed-position switching signals.

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Cd.45	Speed-position switching device selection	1	Use the near-point dog signal for switching from speed control to position control	1566+100n	4366+100n

(Note): The setting is not required for "Pr.42 External command function selection" and "Cd.8 External command valid".
Refer to Section 5.7 "List of control data" for information on the setting details.

(3) The following table shows the items that must be set to use "Cd.46 Speed-position switching command" as speed-position switching signals.

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Cd.45	Speed-position switching device selection	2	Use the "Cd.46 Speed-position switching command" for switching from speed control to position control	1566+100n	4366+100n

(Note): The setting is not required for "Pr.42 External command function selection" and "Cd.8 External command valid".
Refer to Section 5.7 "List of control data" for information on the setting details.

■ Restrictions

(1) An axis error (error code: 516) will occur and the operation cannot start if "continuous positioning control" or "continuous path control" is set in "Da.1 Operation pattern"

(2) "Speed-position switching control" cannot be set in "Da.2 Control system" of the positioning data when "continuous path control" has been set in "Da.1 Operation pattern" of the immediately prior positioning data. (For example, if the operation pattern of positioning data No. 1 is "continuous path control", "speed-position switching control" cannot be set in positioning data No. 2.) An axis error (error code: 516) will occur and the machine will carry out a deceleration stop if this type of setting is carried out.

(3) An error (error code: 503) will occur if "current speed (-1)" is set in "Da.8 Command speed".

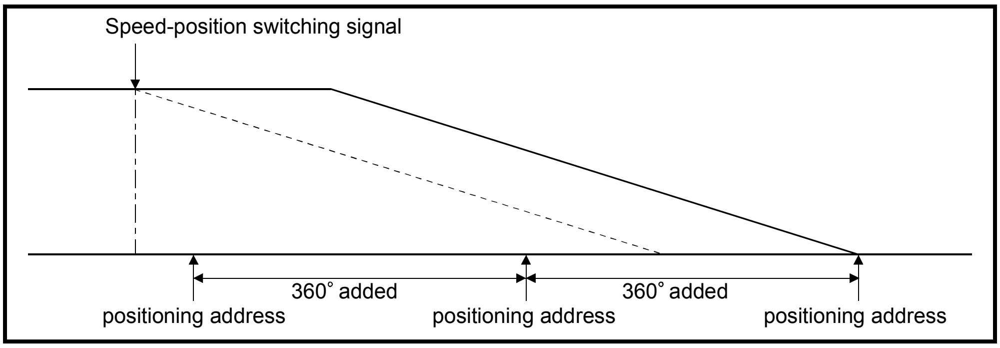
(4) If the value set in "Da.6 Positioning address/movement amount" is negative, an error (error code: 530) will occur.

(5) Even though the axis control data "Cd.23 Speed-position switching control movement amount change register" was set in speed-position switching control (ABS mode), it would not function. The set value is ignored.

(6) To exercise speed-position switching control (ABS mode), the following conditions must be satisfied:
   (a) "Pr.1 Unit setting" is "2: degree"
   (b) The software stroke limit function is invalid (upper limit value = lower limit value)
   (c) "Pr.21 Current feed value during speed control" is "1: Update current feed value"
   (d) The "Da.6 Positioning address/movement amount" setting range is 0 to 359.99999 (degree)
   If the value is outside of the range 0 to 359.99999 (degree), an error (error code: 530) will occur at a start.
   (e) The "Pr.81 Speed-position function selection" setting is "2: Speed-position switching control (ABS mode)".

(7) If any of the conditions in (6) (a) to (6) (c) is not satisfied in the case of (6) (e), an error (error code: 935) will occur when the PLC READY signal [Y0] turns from OFF to ON.

(8) If the axis reaches the positioning address midway through deceleration after automatic deceleration started at the input of the speed-position switching signal, the axis will not stop immediately at the positioning address. The axis will stop at the positioning address after N revolutions so that automatic deceleration can always be made. (N: Natural number)
In the following example, since making deceleration in the path of dotted line will cause the axis to exceed the positioning addresses twice, the axis will decelerate to a stop at the third positioning address.



■ Positioning data setting examples

[When "speed-position switching control (ABS mode) by forward run" is set in positioning data No. 1 of axis 1]

Setting item			Setting example		Setting details
			QD77MS2 QD77MS4	QD77MS16	
Axis 1 Positioning data No. 1	Da.1	Operation pattern	Positioning complete		Set "Positioning complete" assuming the next positioning data will not be executed. ("Continuous path control" cannot be set in "speed-position switching control (ABS mode)".)
	Da.2	Control system	Forward run: speed/position		Set speed-position switching control by forward run.
	Da.3	Acceleration time No.	1		Designate the value set in "Pr.25 Acceleration time 1" as the acceleration time at start.
	Da.4	Deceleration time No.	0		Designate the value set in "Pr.10 Deceleration time 0" as the deceleration time at deceleration.
	Da.5	Axis to be interpolated QD77MS2 QD77MS4	–		Setting not required. (Setting value is ignored.)
	Da.6	Positioning address/ movement amount	270.00000degree		ABS mode (Pr.81 = 2) Set the address after the switching to position control. (Assuming that the "Pr.1 Unit setting" is set to "degree".)
	Da.7	Arc address	–		Setting not required. (Setting value is ignored.)
	Da.8	Command speed	6000.000degree/min		Set the speed to be controlled.
	Da.9	Dwell time	500ms		Set a time from the positioning stop (command stop) by position control until the positioning complete signal is output. When the system is stopped by speed control, ignore the setting value.
	Da.10	M code	10		Set this when other sub operation commands are issued in combination with the No. 1 positioning data.
	Da.20	Axis to be interpolated No.1 QD77MS16		–	Setting not required (setting value is ignored).
	Da.21	Axis to be interpolated No.2 QD77MS16		–	
	Da.22	Axis to be interpolated No.3 QD77MS16		–	

(Note): Refer to Section 5.3 "List of positioning data" for information on the setting details.

9.2.18 Position-speed switching control

In "position-speed switching control" ("Da.2 Control system" = Forward run: position/speed, Reverse run: position/speed), before the position-speed switching signal is input, position control is carried out for the movement amount set in "Da.6 Positioning address/movement amount" in the axis direction in which the positioning data has been set. When the position-speed switching signal is input, the position control is carried out by continuously outputting the pulses for the speed set in "Da.8 Command speed" until the input of a stop command.
The two types of position-speed switching control are "Forward run: position/speed" in which the control starts in the forward run direction, and "Reverse run: position/speed" in which control starts in the reverse run direction.

■ Switching over from position control to speed control

(1) The control is selected the switching method from position control to speed control by the setting value of "Cd.45 Speed-position switching device selection".

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Cd.45	Speed-position switching device selection	→	The device used for speed-position switching is selected. 0: Use the external command signal for switching from position control to speed control 1: Use the near-point signal for switching from position control to speed control 2: Use the "Cd.46 Speed-position switching command" for switching from position control to speed control	1566+100n	4366+100n

The switching is performed by using the following device when "2" is set.

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Cd.46	Speed-position switching command	→	The speed-position control switching is performed when "2" is set in "Cd.45 Speed-position switching device selection".	1567+100n	4367+100n

(2) "Cd.26 Position-speed switching enable flag" must be turned ON to switch over from position control to speed control. (If the "Cd.26 Position-speed switching enable flag" turns ON after the position-speed switching signal turns ON, the control will continue as position control without switching over to speed control. The control will be switched over from position control to speed control when the position-speed switching signal turns from OFF to ON again. Only speed control will be carried out when the "Cd.26 Position-speed switching enable flag" and position-speed switching signal are ON at the operation start.)

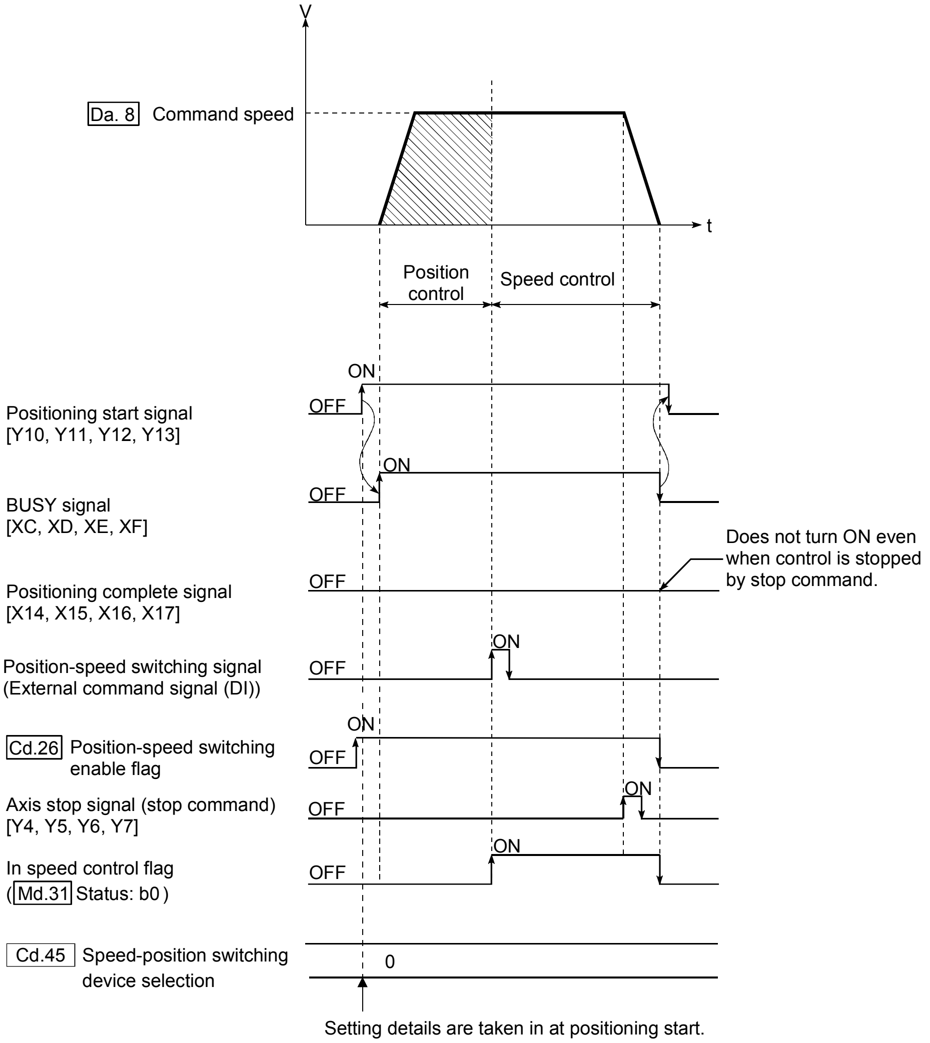
Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Cd.26	Position-speed switching enable flag	1	Position control will be taken over by speed control when the external command signal [DI] comes ON.	1532+100n	4332+100n

■ Operation chart

The following chart shows the operation timing for position-speed switching control. The "in speed control" flag (Md.31 Status: b0) is turned ON during speed control of position-speed switching control.

[QD77MS4 operation example]

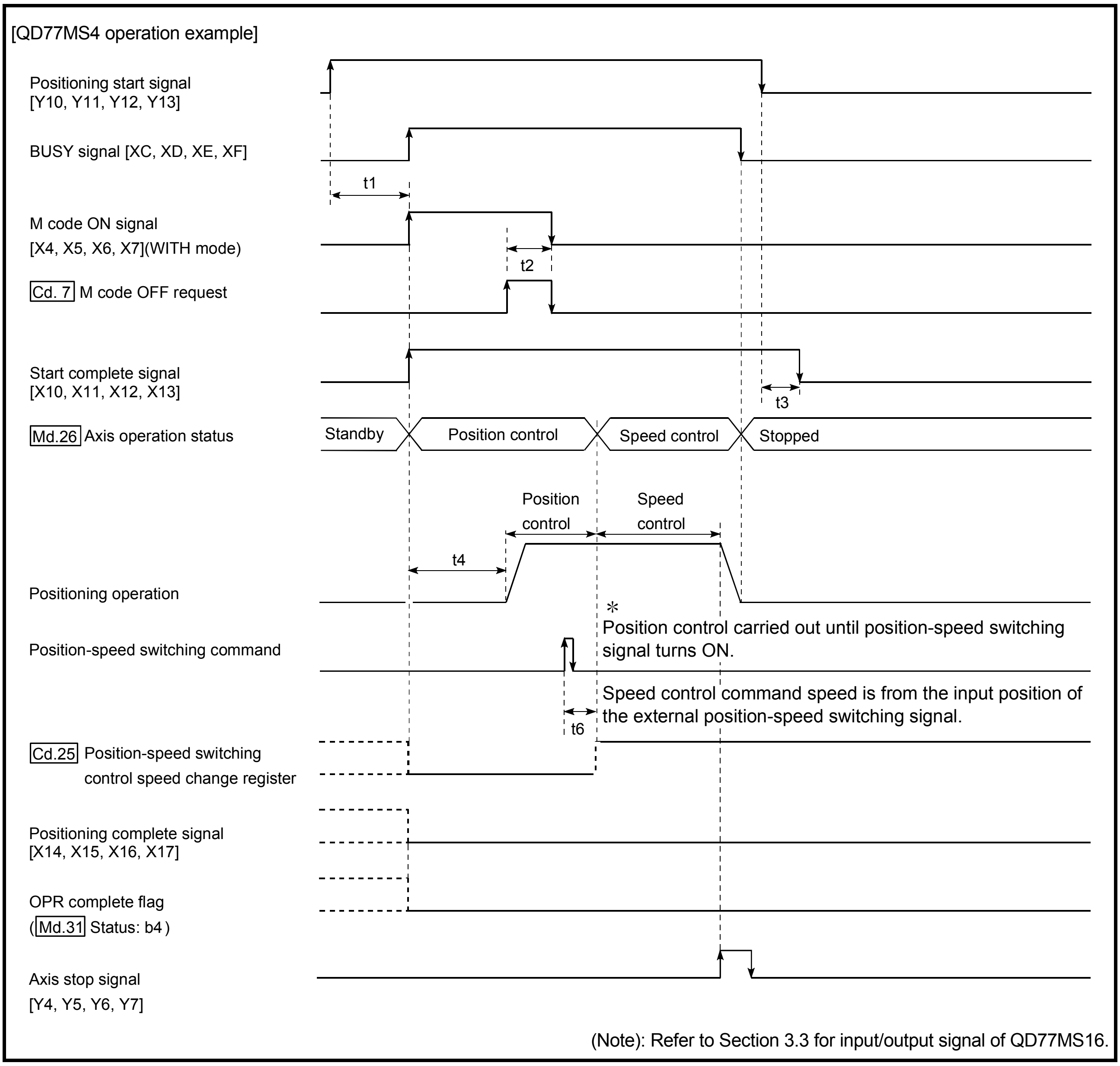
- When using the external command signal [DI] as position-speed switching signal



(Note): Refer to Section 3.3 for input/output signal of QD77MS16.

Fig. 9.18 Position-speed switching control operation timing

■ Operation timing and processing time during position-speed switching control



*
Position control carried out until position-speed switching signal turns ON.

Speed control command speed is from the input position of the external position-speed switching signal.

(Note): Refer to Section 3.3 for input/output signal of QD77MS16.

Fig. 9.19 Operation timing and processing time during position-speed switching control

Normal timing time Unit: [ms]

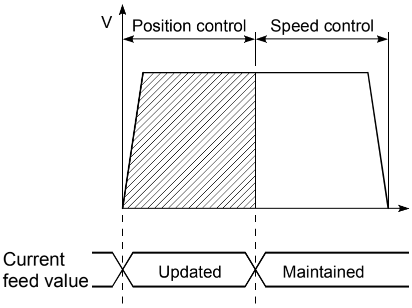
	Operation cycle	t1	t2	t3	t4	t5	t6
QD77MS2	0.88	0.2 to 0.3	0 to 0.9	0 to 0.9	1.8 to 2.7	–	0.2
	1.77	0.2 to 0.3	0 to 1.8	0 to 1.8	2.5 to 3.5	–	0.2
QD77MS4	0.88	0.2 to 0.3	0 to 0.9	0 to 0.9	1.8 to 2.7	–	0.2
	1.77	0.2 to 0.3	0 to 1.8	0 to 1.8	2.5 to 3.5	–	0.2
QD77MS16	0.88	0.3 to 1.4	0 to 0.9	0 to 0.9	1.8 to 2.7	–	0.2
	1.77	0.3 to 1.4	0 to 1.8	0 to 1.8	3.2 to 3.9	–	0.2

- The t1 timing time could be delayed by the operation state of other axes.
- When using the near-point dog signal and "Cd.46 Speed-position switching command", the t6 timing time could be delayed or vary influenced by the PLC scan time or communication with servo amplifier.

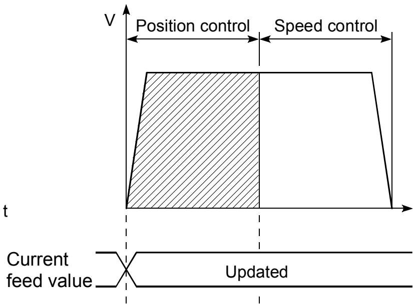
■ Current feed value during position-speed switching control

The following table shows the "Md.20 Current feed value" during position-speed switching control corresponding to the "Pr.21 Current feed value during speed control" settings.

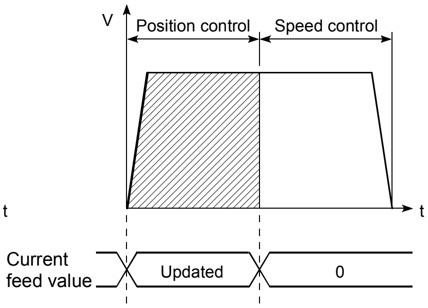
"Pr.21 Current feed value during speed control" setting	Md.20 Current feed value
0: Do not update current feed value	The current feed value is updated during position control, and the current feed value at the time of switching is maintained as soon as position control is switched to speed control.
1: Update current feed value	The current feed value is updated during position control and speed control.
2: Zero clear current feed value	The current feed value is updated during position control, and the current feed value is cleared (to "0") as soon as position control is switched to speed control.



(a) Current feed value not updated



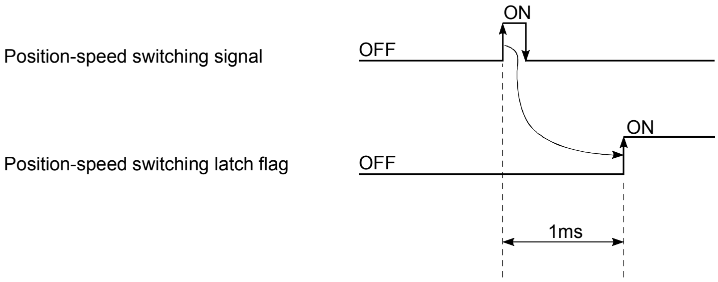
(b) Current feed value updated



(c) Current feed value zero cleared

■ Switching time from position control to speed control

There is 1ms from the time the position-speed switching signal is turned ON to the time the position-speed switching latch flag (Md.31 Status: b5) turns ON.



■ Position-speed switching signal setting

(1) The following table shows the items that must be set to use the external command signals [DI] as position-speed switching signals.

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Pr.42	External command function selection	2	Speed-position, position-speed switching request.	62+150n	
Cd.8	External command valid	1	Validates an external command.	1505+100n	4305+100n
Cd.45	Speed-position switching device selection	0	Use the external command signal for switching from position control to speed control.	1566+100n	4366+100n

(Note): Set the external command signal [DI] in "Pr.95 External command signal selection" at QD77MS16 use.
Refer to Section 5.2 "List of parameters" and Section 5.7 "List of control data" for information on the setting details.

(2) The following table shows the items that must be set to use the near-point dog signal (DOG) as position-speed switching signals.

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Cd.45	Speed-position switching device selection	1	Use the near-point dog signal for switching from position control to speed control.	1566+100n	4366+100n

(Note): The setting is not required for "Pr.42 External command function selection" and "Cd.8 External command valid".
Refer to Section 5.7 "List of control data" for information on the setting details.

(3) The following table shows the items that must be set to use "Cd.46 Speed-position switching command" as position-speed switching signals.

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Cd.45	Speed-position switching device selection	2	Use the "Cd.46 Speed-position switching command" for switching from position control to speed control.	1566+100n	4366+100n

(Note): The setting is not required for "Pr.42 External command function selection" and "Cd.8 External command valid".
Refer to Section 5.7 "List of control data" for information on the setting details.

■ Changing the speed control command speed

In "position-speed switching control", the speed control command speed can be changed during the position control.

(1) The speed control command speed can be changed during the position control of position-speed switching control.
A command speed change request will be ignored unless issued during the position control of the position-speed switching control.

(2) The "new command speed" is stored in "Cd.25 Position-speed switching control speed change register" by the sequence program during position control.
This value then becomes the speed control command speed when the position-speed switching signal turns ON.

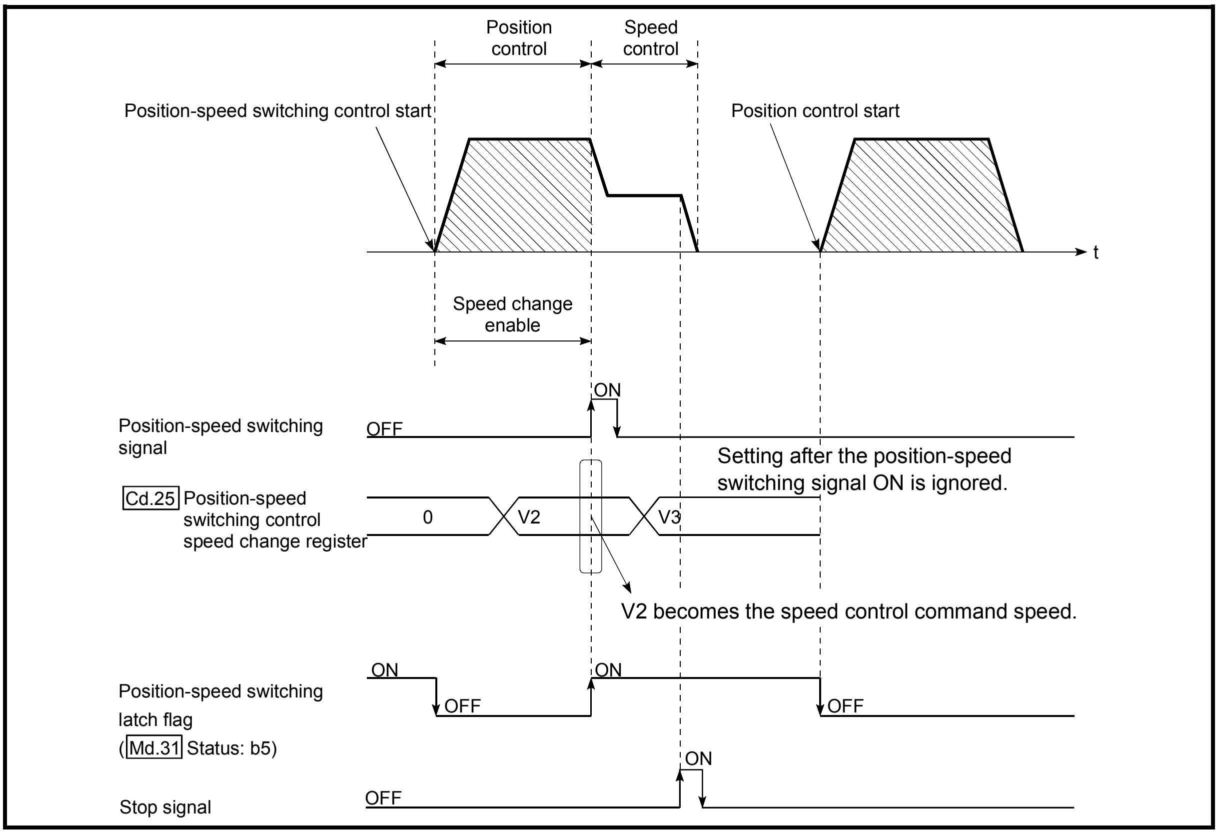


Fig. 9.20 Speed control speed change timing

POINTS

- The machine recognizes the presence of a command speed change request when the data is written to "Cd.25 Position-speed switching control speed change register" with the sequence program.
- The new command speed is validated after execution of the position-speed switching control before the input of the position-speed switching signal.
- The command speed change can be enabled/disabled with the interlock function in speed control using the "position-speed switching latch flag" (Md.31 Status: b5) of the axis monitor area.

■ Restrictions

(1) An axis error (error code: 516) will occur and the operation cannot start if "continuous positioning control" or "continuous path control" is set in "Da.1 Operation pattern".

(2) "Position-speed switching control" cannot be set in "Da.2 Control system" of the positioning data when "continuous path control" has been set in "Da.1 Operation pattern" of the immediately prior positioning data. (For example, if the operation pattern of positioning data No. 1 is "continuous path control", "position-speed switching control" cannot be set in positioning data No. 2.)
An axis error (error code: 516) will occur and the machine will carry out a deceleration stop if this type of setting is carried out.

(3) The software stroke limit range is only checked during speed control if the "1: Update current feed value" is set in "Pr.21 Current feed value during speed control".
The software stroke limit range is not checked when the control unit is set to "degree".

(4) An error (error code: 507 or 508) will occur and the operation cannot start if the start point address or end point address for position control exceeds the software stroke limit range.

(5) Deceleration stop will be carried out if the position-speed switching signal is not input before the machine is moved by a specified movement amount.
When the position-speed switching signal is input during automatic deceleration by positioning control, acceleration is carried out again to the command speed to continue speed control.
When the position-speed switching signal is input during deceleration to a stop with the stop signal, the control is switched to the speed control to stop the machine.
Restart is carried out by speed control using the restart command.

(6) A warning (warning code: 501) will occur and control is continued by "Pr.8 Speed limit value" if a new speed exceeds "Pr.8 Speed limit value" at the time of change of the command speed.

(7) If the value set in "Da.6 Positioning address/movement amount" is negative, an error (error code: 530) will occur.

(8) Set WITH mode in "Pr.18 M code ON signal output timing" at M code use. The M code will not be output, and the M code ON signal will not turn ON if the AFTER mode is set.

■ Positioning data setting examples

[When "position-speed switching control (forward run: position/speed)" is set in positioning data No. 1 of axis 1]

Setting item			Setting example		Setting details
			QD77MS2 QD77MS4	QD77MS16	
Axis 1 Positioning data No. 1	Da.1	Operation pattern	Positioning complete		Set "Positioning complete" assuming the next positioning data will not be executed. ("Continuous positioning control" and "Continuous path control" cannot be set in "position/speed changeover control".)
	Da.2	Control system	Forward run: position/speed		Set position-speed switching control.
	Da.3	Acceleration time No.	1		Designate the value set in "Pr.25 Acceleration time 1" as the acceleration time at start.
	Da.4	Deceleration time No.	0		Designate the value set in "Pr.10 Deceleration time 0" as the deceleration time at deceleration.
	Da.5	Axis to be interpolated QD77MS2 QD77MS4	–		Setting not required. (Setting value is ignored.)
	Da.6	Positioning address/ movement amount	10000.0μm		Set the movement amount at the time of position control before the switching to speed control. (Assuming that the "Pr.1 Unit setting" is set to "mm".)
	Da.7	Arc address	–		Setting not required. (Setting value is ignored.)
	Da.8	Command speed	6000.00mm/min		Set the speed to be controlled.
	Da.9	Dwell time	500ms		Set the time the machine dwells after the positioning stop (command stop) by position control to the output of the positioning complete signal. If the machine is stopped by speed control, the setting value is ignored.
	Da.10	M code	10		Set this when other sub operation commands are issued in combination with the No.1 positioning data.
	Da.20	Axis to be interpolated No.1 QD77MS16		–	Setting not required (setting value is ignored).
	Da.21	Axis to be interpolated No.2 QD77MS16		–	
	Da.22	Axis to be interpolated No.3 QD77MS16		–	

(Note): Refer to Section 5.3 "List of positioning data" for information on the setting details.

9.2.19 Current value changing

When the current value is changed to a new value, control is carried out in which the "Md.20 Current feed value" of the stopped axis is changed to a random address set by the user. (The "Md.21 Machine feed value" is not changed when the current value is changed.)

The two methods for changing the current value are shown below.
- [1] Changing to a new current value using the positioning data
- [2] Changing to a new current value using the start No. (No. 9003) for a current value changing

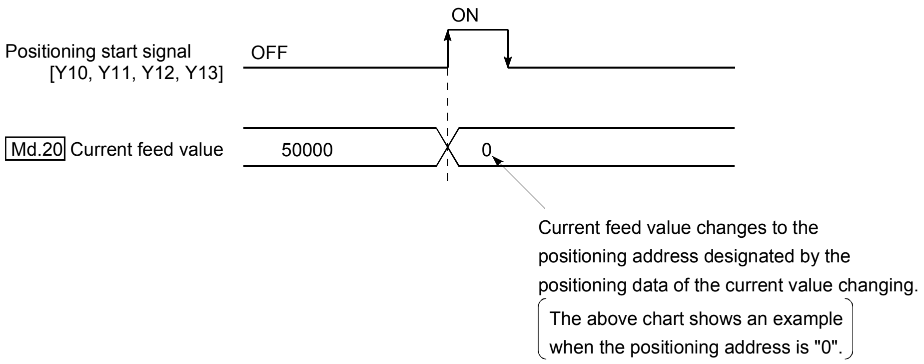
The current value changing using method [1] is used during continuous positioning of multiple blocks, etc.

[1] Changing to a new current value using the positioning data

■ Operation chart

The following chart shows the operation timing for a current value changing. The "Md.20 Current feed value" is changed to the value set in "Da.6 Positioning address/ movement amount" when the positioning start signal turns ON.

[QD77MS4 operation example]



(Note): Refer to Section 3.3 for input/output signal of QD77MS16.

■ Restrictions

(1) An axis error "New current value not possible (error code: 515)" will occur and the operation cannot start if "continuous path control" is set in "Da.1 Operation pattern". ("Continuous path control" cannot be set in current value changing.)

(2) "Current value changing" cannot be set in "Da.2 Control system" of the positioning data when "continuous path control" has been set in "Da.1 Operation pattern" of the immediately prior positioning data. (For example, if the operation pattern of positioning data No. 1 is "continuous path control", "current value changing" cannot be set in positioning data No. 2.) An axis error "New current value invalid (error code: 515)" will occur and the machine will carry out a deceleration stop if this type of setting is carried out.

(3) An axis error "Outside new current value range (error code: 514)" will occur and the operation cannot start if "degree" is set in "Pr.1 Unit setting" and the value set in "Da.6 Positioning address/movement amount (0 to 359.99999 [degree])" is outside the setting range.

(4) If the value set in "Da.6 Positioning address/movement amount" is outside the software stroke limit (Pr.12, Pr.13) setting range, an error "Software stroke limit +, - (error code: 507 or 508)" will occur at the positioning start, and the operation will not start.

(5) An error (error code: 507 or 508) will occur if the new current value is outside the software stroke limit range.

(6) The new current value using the positioning data (No.1 to 600) cannot be changed, if "0: Positioning control is not executed" is set in "Pr.55 Operation setting for incompletion of OPR" and "OPR request flag" ON. A warning "Operation setting for incompletion of OPR at positioning start error" (error code: 547) will occur.

■ Positioning data setting examples

[When "current value changing" is set in the positioning data No. 1 of axis 1]

<table>
<tr><th colspan="3" rowspan="2">Setting item</th><th colspan="2">Setting example</th><th rowspan="2">Setting details</th></tr>
<tr><th>QD77MS2
QD77MS4</th><th>QD77MS16</th></tr>
<tr><td rowspan="13">Axis 1 Positioning data No. 1</td><td>Da.1</td><td>Operation pattern</td><td colspan="2">Positioning complete</td><td>Set "Positioning complete" assuming that the next positioning data will be executed. ("Continuous path control" cannot be set by current value change.)</td></tr>
<tr><td>Da.2</td><td>Control system</td><td colspan="2">Current value changing</td><td>Set the current value changing.</td></tr>
<tr><td>Da.3</td><td>Acceleration time No.</td><td colspan="2">–</td><td rowspan="3">Setting not required (Setting value is ignored.)</td></tr>
<tr><td>Da.4</td><td>Deceleration time No.</td><td colspan="2">–</td></tr>
<tr><td>Da.5</td><td>Axis to be interpolated QD77MS2 QD77MS4</td><td>–</td><td></td></tr>
<tr><td>Da.6</td><td>Positioning address/ movement amount</td><td colspan="2">10000.0μm</td><td>Set the address to which address change is desired.
(Assuming that the "Pr.1 Unit setting" is set to "mm".)</td></tr>
<tr><td>Da.7</td><td>Arc address</td><td colspan="2">–</td><td rowspan="3">Setting not required (Setting value is ignored.)</td></tr>
<tr><td>Da.8</td><td>Command speed</td><td colspan="2">–</td></tr>
<tr><td>Da.9</td><td>Dwell time</td><td colspan="2">–</td></tr>
<tr><td>Da.10</td><td>M code</td><td colspan="2">10</td><td>Set this when other sub operation commands are issued in combination with the No.1 positioning data.</td></tr>
<tr><td>Da.20</td><td>Axis to be interpolated No.1 QD77MS16</td><td></td><td>–</td><td rowspan="3">Setting not required (setting value is ignored).</td></tr>
<tr><td>Da.21</td><td>Axis to be interpolated No.2 QD77MS16</td><td></td><td>–</td></tr>
<tr><td>Da.22</td><td>Axis to be interpolated No.3 QD77MS16</td><td></td><td>–</td></tr>
</table>

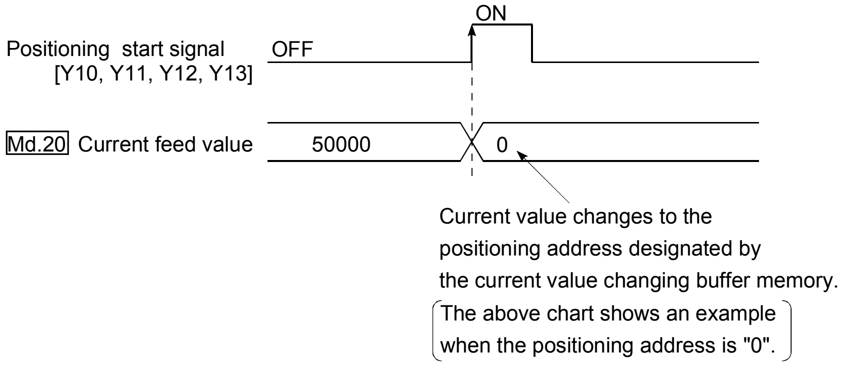
(Note): Refer to Section 5.3 "List of positioning data" for information on the setting details.

[2] Changing to a new current value using the current value changing start No. (No. 9003)

■ Operation chart

The current value is changed by setting the new current value in the current value changing buffer memory "Cd.9 New current value", setting "9003" in the "Cd.3 Positioning start No.", and turning ON the positioning start signal.

[QD77MS4 operation example]



(Note): Refer to Section 3.3 for input/output signal of QD77MS16.

■ Restrictions

(1) An axis error "Outside new current value range (error code: 514)" will occur if the designated value is outside the setting range when "degree" is set in "Unit setting".

(2) An error "Software stroke limit +, − (error code: 507 or 508)" will occur if the designated value is outside the software stroke limit range.

(3) The current value cannot be changed during stop commands and while the M code ON signal is ON.

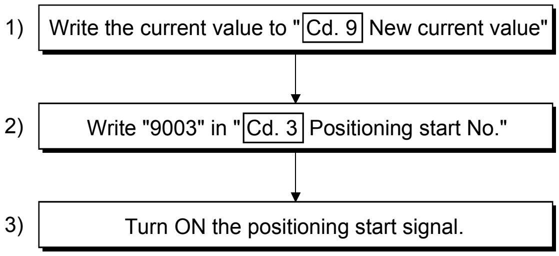
(4) The M code output function is made invalid.

POINTS

The new current value can be changed using the current value changing start No. (No. 9003) if "0: Positioning control is not executed" is set in "Pr.55 Operation setting for incompletion of OPR" and OPR request flag is ON.

■ Current value changing procedure

The following shows the procedure for changing the current value to a new value.



1) Write the current value to "Cd. 9 New current value"

2) Write "9003" in "Cd. 3 Positioning start No."

3) Turn ON the positioning start signal.

■ Setting method for the current value changing function

The following shows an example of a sequence program and data setting to change the current value to a new value with the positioning start signal. (The "Md.20 Current feed value" value is changed to "5000.0μm" in the example shown.)

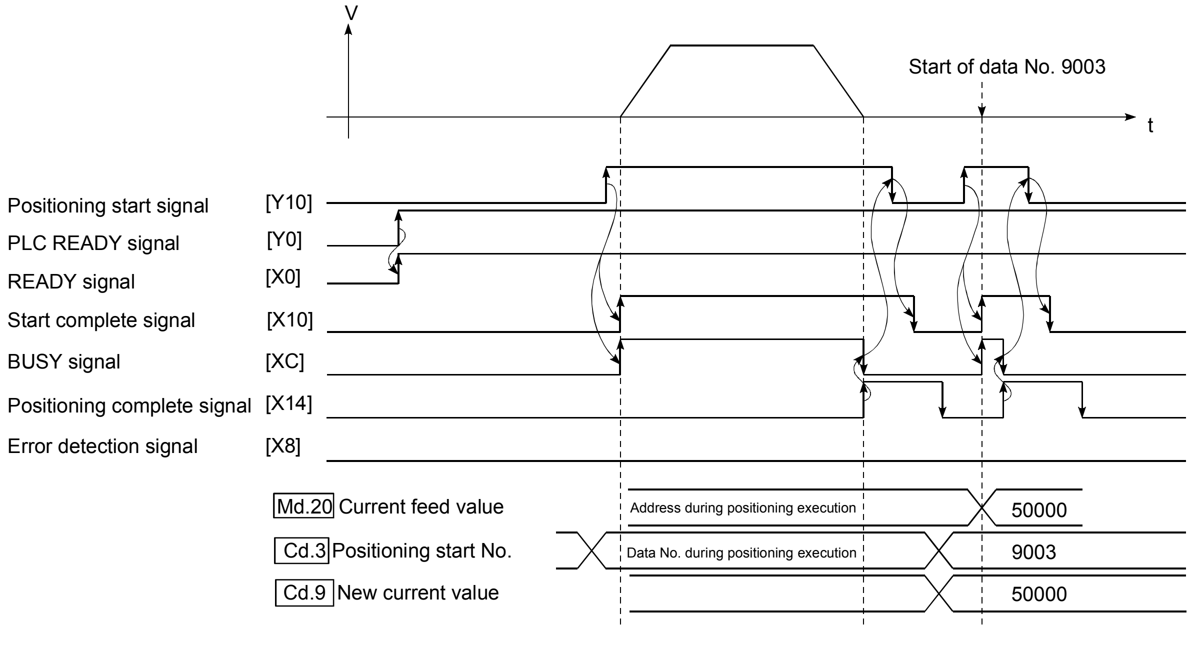
(1) Set the following data.
(Set with the sequence program shown in (3), while referring to the start time chart shown in (2).)

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Cd.3	Positioning start No.	9003	Set the start No. "9003" for the new current value.	1500+100n	4300+100n
Cd.9	New current value	50000	Set the new "Md.20 Current feed value".	1506+100n 1507+100n	4306+100n 4307+100n

(Note): Refer to Section 5.7 "List of control data" for details on the setting details.

(2) The following shows a start time chart.

[QD77MS4 operation example]

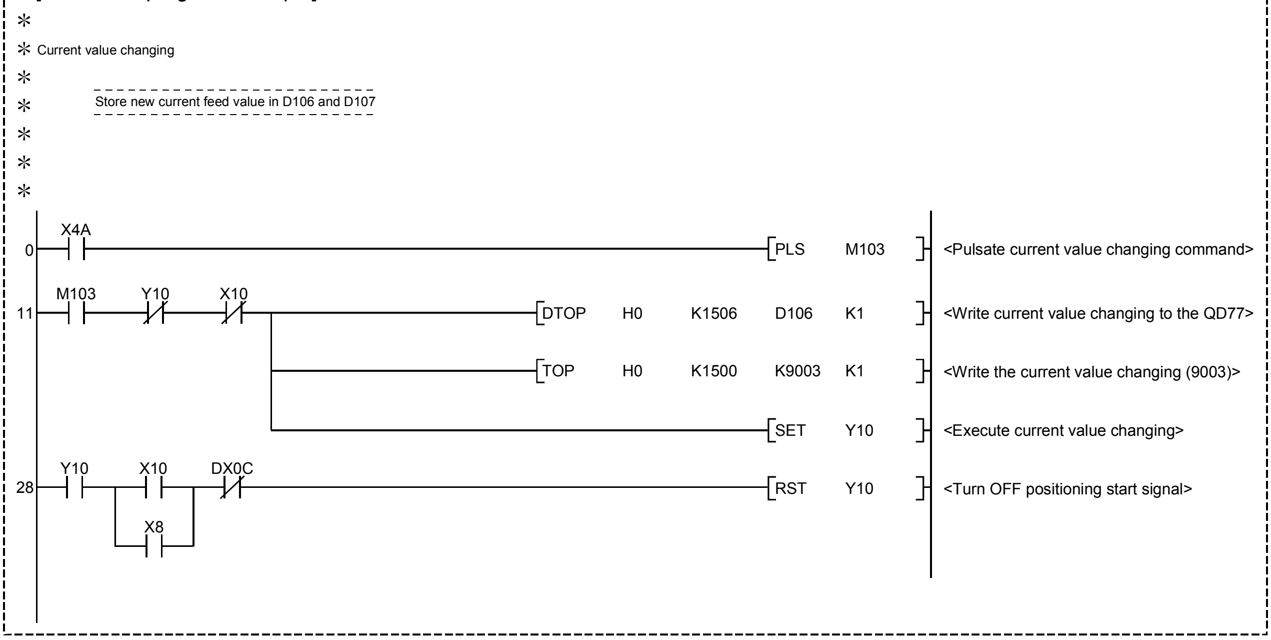


(Note): Refer to Section 3.3 for input/output signal of QD77MS16.

Fig. 9.21 Changing to a new current value using the current value changing start No. (No. 9003)

(3) Add the following sequence program to the control program, and write it to the PLC CPU.

[QD77MS4 program example]



9.2.20 NOP instruction

The NOP instruction is used for the nonexecutable control system.

■ Operation

The positioning data No. to which the NOP instruction is set transfers, without any processing, to the operation for the next positioning data No.

■ Positioning data setting examples

[When "NOP instruction" is set in positioning data No.1 of axis 1]

Setting item			Setting example		Setting details
			QD77MS2 QD77MS4	QD77MS16	
Axis 1 Positioning data No. 1	Da.1	Operation pattern	–		Setting not required (Setting value is ignored.)
	Da.2	Control system	NOP instruction		Set the NOP instruction
	Da.3	Acceleration time No.	–		Setting not required (Setting value is ignored.)
	Da.4	Deceleration time No.	–		
	Da.5	Axis to be interpolated QD77MS2 QD77MS4	–		
	Da.6	Positioning address/ movement amount	–		
	Da.7	Arc address	–		
	Da.8	Command speed	–		
	Da.9	Dwell time	–		
	Da.10	M code	–		
	Da.20	Axis to be interpolated No.1 QD77MS16		–	
	Da.21	Axis to be interpolated No.2 QD77MS16		–	
	Da.22	Axis to be interpolated No.3 QD77MS16		–	

(Note): Refer to Section 5.3 "List of positioning data" for information on the setting details.

■ Restrictions

An error "Control system setting error (error code: 524)" will occur if the "NOP instruction" is set for the control system of the positioning data No. 600.

POINT

<Use example of NOP instruction>

If there is a possibility of speed switching or temporary stop (automatic deceleration) at a point between two points during positioning, that data can be reserved with the NOP instruction to change the data merely by the replacement of the identifier.

9.2.21 JUMP instruction

The JUMP instruction is used to control the operation so it jumps to a positioning data No. set in the positioning data during "continuous positioning control" or "continuous path control".

JUMP instruction includes the following two types of JUMP.

(1) Unconditional JUMP
When execution conditions are not set for the JUMP instruction
(When "0" is set to the condition data No.)

(2) Conditional JUMP
When execution conditions are set for the JUMP instruction
(The conditions are set to the "condition data" used with "high-level positioning control".)

Using the JUMP instruction enables repeating of the same positioning control, or selection of positioning data by the execution conditions during "continuous positioning control" or "continuous path control".

■ Operation

(1) Unconditional JUMP
The JUMP instruction is unconditionally executed. The operation jumps to the positioning data No. set in "Da.9 Dwell time".

(2) Conditional JUMP
The block start condition data is used as the JUMP instruction execution conditions.

- When block positioning data No. 7000 to 7004 is started:
  Each block condition data is used.
- When positioning data No. 1 to 600 is started:
  Start block 0 condition data is used.
- When the execution conditions set in "Da.10 M code" of the JUMP instruction have been established:
  the JUMP instruction is executed to jump the operation to the positioning data No. set in "Da.9 Dwell time".
- When the execution conditions set in "Da.10 M code" of the JUMP instruction have not been established:
  the JUMP instruction is ignored, and the next positioning data No. is executed.

■ Restrictions

(1) When using a conditional JUMP instruction, establish the JUMP instruction execution conditions by the 4th positioning data No. before the JUMP instruction positioning data No..
If the JUMP instruction execution conditions are not established by the time the 4th positioning control is carried out before the JUMP instruction positioning data No., the operation will be processed as an operation without established JUMP instruction execution conditions.
(During execution of continuous path control/continuous positioning control, the Simple Motion module calculates the positioning data of the positioning data No. four items ahead of the current positioning data.)

(2) Set JUMP instruction to positioning data No. that "continuous positioning control" or "continuous path control" is set in operation pattern.
It cannot set to positioning data No. that "positioning complete" is set in operation pattern.

(3) Positioning control such as loops cannot be executed by conditional JUMP instructions alone until the conditions have been established.
When loop control is executed using JUMP instruction, an axis operation status is "analyzing" during loop control, and the positioning data analysis (start) for other axes are not executed. As the target of the JUMP instruction, specify a positioning data that is controlled by other than JUMP and NOP instructions.

■ Positioning data setting example

[When "JUMP instruction" is set in positioning data No. 1 of axis 1]

Setting item			Setting example		Setting details
			QD77MS2 QD77MS4	QD77MS16	
Axis 1 Positioning data No. 1	Da.1	Operation pattern	–		Setting not required. (Setting value is ignored.)
	Da.2	Control system	JUMP instruction		Set the JUMP instruction.
	Da.3	Acceleration time No.	–		Setting not required. (Setting value is ignored.)
	Da.4	Deceleration time No.	–		
	Da.5	Axis to be interpolated QD77MS2 QD77MS4	–		
	Da.6	Positioning address/ movement amount	–		
	Da.7	Arc address	–		
	Da.8	Command speed	–		
	Da.9	Dwell time	500		Set the positioning data No. 1 to 600 for the JUMP destination. (The positioning data No. of the JUMP instruction cannot be set. Setting its own positioning data No. will result in an error "Illegal data No." (error code: 502).)
	Da.10	M code	1		Set the JUMP instruction execution conditions with the condition data No. 0 : Unconditional JUMP 1 to 10 : Condition data No. ("Simultaneous start" condition data cannot be set.)
	Da.20	Axis to be interpolated No.1 QD77MS16		–	Setting not required (setting value is ignored).
	Da.21	Axis to be interpolated No.2 QD77MS16		–	
	Da.22	Axis to be interpolated No.3 QD77MS16		–	

(Note): Refer to Section 5.3 "List of positioning data" for information on the setting details.

9.2.22 LOOP

The LOOP is used for loop control by the repetition of LOOP to LEND.

■ Operation

The LOOP to LEND loop is repeated by set repeat cycles.

■ Positioning data setting examples

[When "LOOP" is set in positioning data No. 1 of axis 1]

Setting item			Setting example		Setting details
			QD77MS2 QD77MS4	QD77MS16	
Axis 1 Positioning data No. 1	Da.1	Operation pattern	–		Setting not required. (Setting value is ignored.)
	Da.2	Control system	LOOP		Set the LOOP.
	Da.3	Acceleration time No.	–		Setting not required. (Setting value is ignored.)
	Da.4	Deceleration time No.	–		
	Da.5	Axis to be interpolated QD77MS2 QD77MS4	–		
	Da.6	Positioning address/ movement amount	–		
	Da.7	Arc address	–		
	Da.8	Command speed	–		
	Da.9	Dwell time	–		
	Da.10	M code	5		Set the LOOP to LEND repeat cycles.
	Da.20	Axis to be interpolated No.1 QD77MS16		–	Setting not required (setting value is ignored).
	Da.21	Axis to be interpolated No.2 QD77MS16		–	
	Da.22	Axis to be interpolated No.3 QD77MS16		–	

(Note): Refer to Section 5.3 "List of positioning data" for information on the setting details.

■ Restrictions

(1) An error "Control system LOOP setting error (error code: 545)" will occur if a "0" is set for the repeat cycles.

(2) Even if LEND is absent after LOOP, no error will occur, but repeat processing will not be carried out.

(3) Nesting is not allowed between LOOP-LEND's. If such setting is made, only the inner LOOP-LEND is processed repeatedly.

POINT

The setting by this control system is easier than that by the special start "FOR loop" of "High-level Positioning Control" (refer to Chapter 10).

<Setting data>

- For special start: Positioning start data, special start data, condition data, and positioning data
- For control system: Positioning data

For the special start FOR to NEXT, the positioning data is required for each of FOR and NEXT points. For the control system, loop can be executed even only by one data.

Also, nesting is enabled by using the control system LOOP to LEND in combination with the special start FOR to NEXT.

However LOOP to LEND cannot be set across block. Always set LOOP to LEND so that the processing ends within one block.

(For details of the "block", refer to Section 10.1 "Outline of high-level positioning control".)

9.2.23 LEND

The LEND is used to return the operation to the top of the repeat (LOOP to LEND) loop.

■ Operation

When the repeat cycle designated by the LOOP becomes 0, the loop is terminated, and the next positioning data No. processing is started. (The operation pattern, if set to "Positioning complete", will be ignored.)
When the operation is stopped after the repeat operation is executed by designated cycles, the dummy positioning data (for example, incremental positioning without movement amount) is set next to LEND.

Positioning data No.	Operation pattern	Control system	Conditions	Operation
1	Continuous control	ABS2		Executed in the order of the positioning data No. 1 → 2 → 3 → 4 → 5 → 2 → 3 → 4 → 5 → 6. (The operation patterns of the positioning data Nos. 2 and 5 are ignored.)
2	Positioning complete	LOOP	Number of loop cycles: 2	
3	Continuous path control	ABS2		
4	Continuous control	ABS2		
5	Positioning complete	LEND		
6	Positioning complete	ABS2		

■ Positioning data setting examples

[When "LEND" is set in positioning data No. 8 of axis 1]

Setting item			Setting example		Setting details
			QD77MS2 QD77MS4	QD77MS16	
Axis 1 Positioning data No. 1	Da.1	Operation pattern	–		Setting not required. (Setting value is ignored.)
	Da.2	Control system	LEND		Set the LEND.
	Da.3	Acceleration time No.	–		Setting not required. (Setting value is ignored.)
	Da.4	Deceleration time No.	–		
	Da.5	Axis to be interpolated QD77MS2 QD77MS4	–		
	Da.6	Positioning address/ movement amount	–		
	Da.7	Arc address	–		
	Da.8	Command speed	–		
	Da.9	Dwell time	–		
	Da.10	M code	–		
	Da.20	Axis to be interpolated No.1 QD77MS16		–	
	Da.21	Axis to be interpolated No.2 QD77MS16		–	
	Da.22	Axis to be interpolated No.3 QD77MS16		–	

(Note): Refer to Section 5.3 "List of positioning data" for information on the setting details.

■ Restrictions

(1) Ignore the "LEND" before the "LOOP" is executed.

Chapter 10 High-Level Positioning Control

The details and usage of high-level positioning control (control functions using the "block start data") are explained in this chapter.

High-level positioning control is used to carry out applied control using the "positioning data". Examples of applied control are using conditional judgment to control "positioning data" set with the major positioning control, or simultaneously starting "positioning data" for several different axes.

Read the execution procedures and settings for each control, and set as required.

10.1 Outline of high-level positioning control

In "high-level positioning control" the execution order and execution conditions of the "positioning data" are set to carry out more applied positioning. (The execution order and execution conditions are set in the "block start data" and "condition data".)
The following applied positioning controls can be carried out with "high-level positioning control".

High-level positioning control	Details
Block [Note-1] start (Normal start)	With one start, executes the positioning data in a random block with the set order.
Condition start	Carries out condition judgment set in the "condition data" for the designated positioning data, and then executes the "block start data". • When the condition is established, the "block start data" is executed. • When not established, that "block start data" is ignored, and the next point's "block start data" is executed.
Wait start	Carries out condition judgment set in the "condition data" for the designated positioning data, and then executes the "block start data". • When the condition is established, the "block start data" is executed. • When not established, stops the control until the condition is established. (Waits.)
Simultaneous start (Note-2)	Simultaneously executes the positioning data having the No. for the axis designated with the "condition data". (Outputs command at the same timing.)
Repeated start (FOR loop)	Repeats the program from the "block start data" set with the "FOR loop" to the "block start data" set in "NEXT" for the designated number of times.
Repeated start (FOR condition)	Repeats the program from the "block start data" set with the "FOR condition" to the "block start data" set in "NEXT" until the conditions set in the "condition data" are established.

■ High-level positioning control sub functions

"High-level positioning control" uses the "positioning data" set with the "major positioning control". Refer to Section 3.2.5 "Combination of QD77MS main functions and sub functions" for details on sub functions that can be combined with the major positioning control.
Note that the sub function Section 13.7.7 "Pre-reading start function" cannot be used together with "high-level positioning control".

■ High-level positioning control from GX Works2

"High-level positioning control" (start of the "block start data") can be executed using the test function of GX Works2.
Refer to the "Simple Motion Module Setting Tool Help" of GX Works2 for details on starting of the "block start data" using GX Works2.

REMARK

(Note-1): Block
"1 block" is defined as all the data continuing from the positioning data in which "continuous positioning control" or "continuous path control" is set in the "Da.1 Operation pattern" to the positioning data in which "independent positioning control (Positioning complete)" is set.

(Note-2): Simultaneous start
Besides the simultaneous start of "block start data" system, the "simultaneous starts" include the "multiple axes simultaneous start control" of control system.
Refer to Section 10.5 "Multiple axes simultaneous start control" for details.

10.1.1 Data required for high-level positioning control

"High-level positioning control" is executed by setting the required items in the "block start data" and "condition data", then starting that "block start data". Judgment about whether execution is possible, etc., is carried out at execution using the "condition data" designated in the "block start data".

"Block start data" can be set for each No. from 7000 to 7004 (called "block Nos."), and up to 50 points can be set for each axis. (This data is controlled with Nos. called "points" to distinguish it from the positioning data. For example, the 1st block start data item is called the "1st point block start data" or "point No. 1 block start data".)
"Condition data" can be set for each No. from 7000 to 7004 (called "block Nos."), and up to 10 data items can be set for each axis.
The "block start data" and "condition data" are set as 1 set for each block No.

The following table shows an outline of the "block start data" and "condition data" stored in the Simple Motion module.

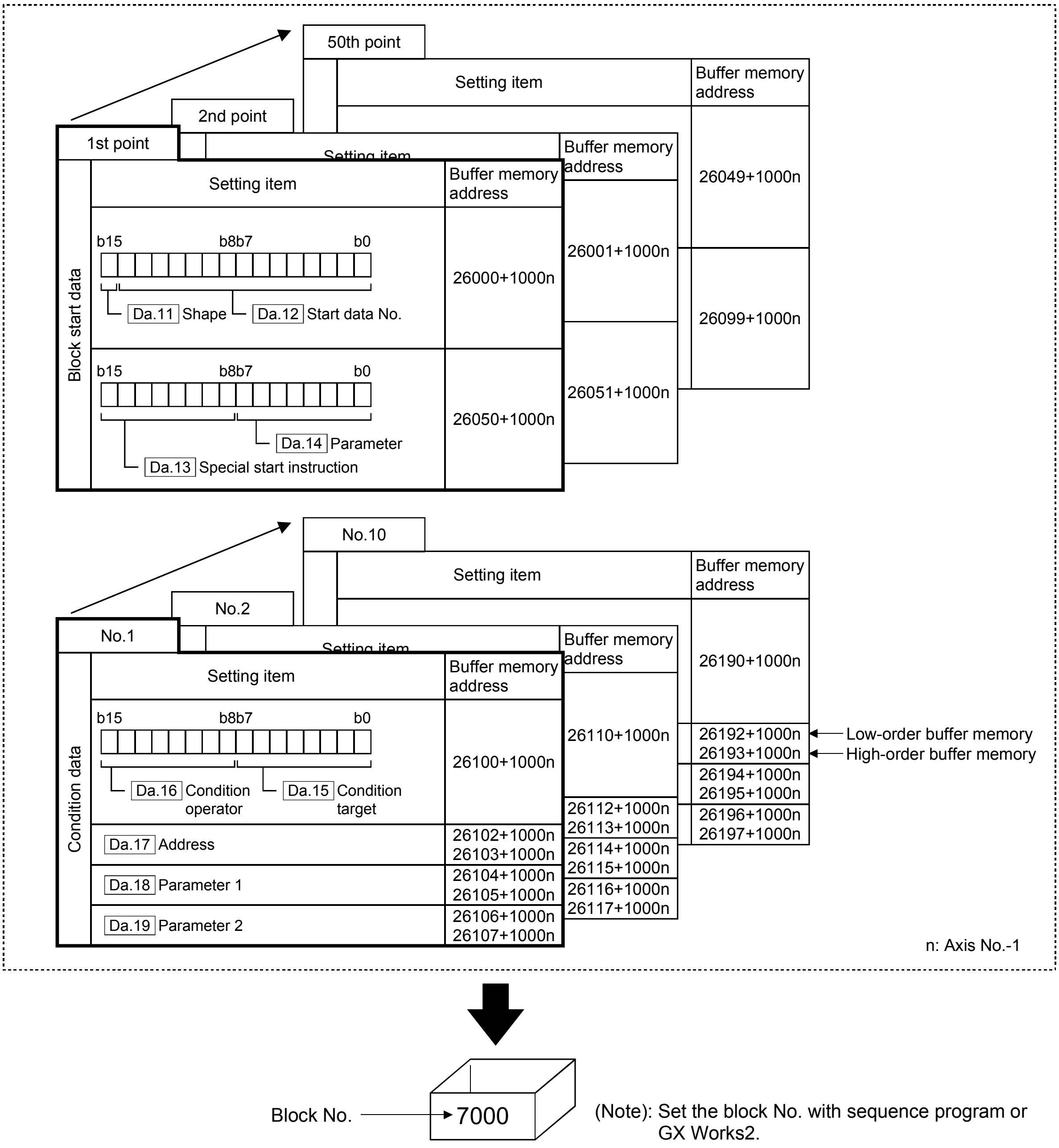
Setting item			Setting details
Block start data	Da.11	Shape	Set whether to end the control after executing only the "block start data" of the shape itself, or continue executing the "block start data" set in the next point.
	Da.12	Start data No.	Set the "positioning data No." to be executed.
	Da.13	Special start instruction	Set the method by which the positioning data set in Da.12 will be started.
	Da.14	Parameter	Set the conditions by which the start will be executed according to the commands set in Da.13. (Designate the "condition data No." and "Number of repetitions".)

Setting item				Setting details
Condition data	Da.15	Condition target		Designate the "device", "buffer memory storage details", and "positioning data No." elements for which the conditions are set.
	Da.16	Condition operator		Set the judgment method carried out for the target set in Da.15.
	Da.17	Address		Set the buffer memory address in which condition judgment is carried out (only when the details set in Da.15 are "buffer memory storage details").
	Da.18	Parameter 1		Set the required conditions according to the details set in Da.15, Da.16 and Da.23 QD77MS16.
	Da.19	Parameter 2		
	Da.23	Number of simultaneously starting axes	QD77MS16	Set the number of axes to be started simultaneously in the simultaneously start.
	Da.24	Simultaneously starting axis No.1		Set the simultaneously starting axis in the simultaneously start on 2 to 4 axes.
	Da.25	Simultaneously starting axis No.2		
	Da.26	Simultaneously starting axis No.3		

10.1.2 "Block start data" and "condition data" configuration

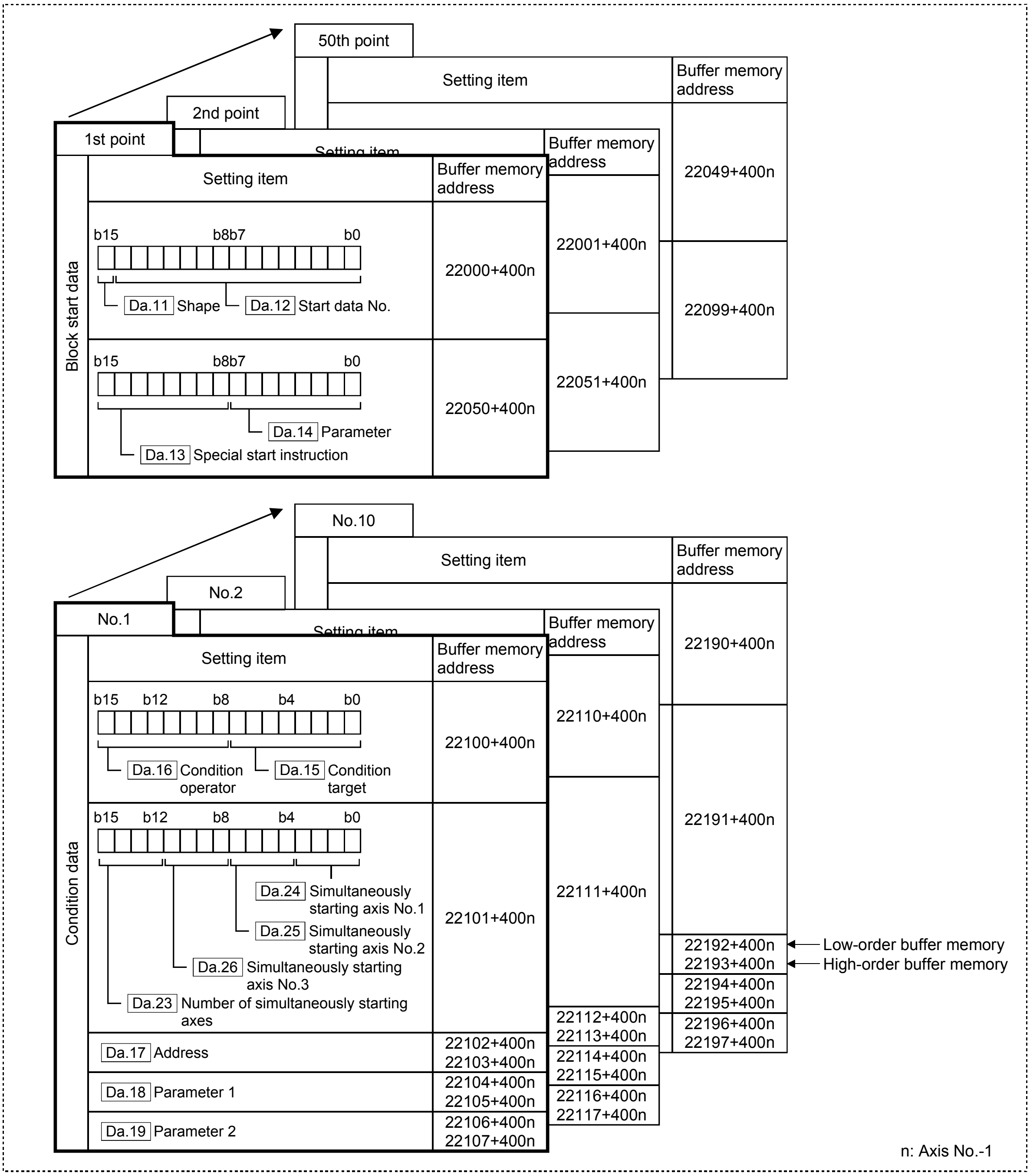
The "block start data" and "condition data" corresponding to "block No. 7000" can be stored in the buffer memory.

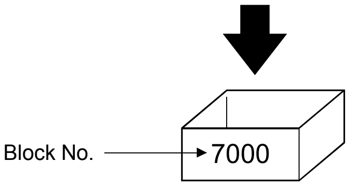
- QD77MS2/QD77MS4



(Note): Set the block No. with sequence program or GX Works2.

- QD77MS16





(Note): Set the block No. with sequence program or GX Works2.

Set the "block start data" and "condition data" corresponding to the following "block Nos. 7001 to 7004" using sequence program or GX Works2 to Simple Motion module. For QD77MS16, the "block start data" and "condition data" corresponding to "block No. 7002 to 7004" are not allocated. Set the data with GX Works2.

10.2 High-level positioning control execution procedure

High-level positioning control is carried out using the following procedure.

Preparation	STEP 1 Refer to Chapter 9	Carry out the "major positioning control" setting.	"High-level positioning control" executes each control ("major positioning control") set in the positioning data with the designated conditions, so first carry out preparations so that "major positioning control" can be executed.
	STEP 2 Refer to Section 10.3	Set the "block start data" corresponding to each control (Note-1). (Da. 11 to Da. 14) × required data amount	The "block start data" from 1 to 50 points can be set.
	STEP 3 Refer to Section 10.4	Set the "condition data" (Note-1). (Da. 15 to Da. 19 and Da.23 to Da.26) × required data amount	Set the "condition data" for designation with the "block start data". Up to 10 condition data items can be set.
	STEP 4 Refer to Section 10.6	Create a sequence program in which block No. is set in the "Cd. 3 Positioning start No." (Note-1) (Control data setting) Create a sequence program in which the "block start data point No. to be started" (1 to 50) is set in the "Cd. 4 Positioning starting point No." Create a sequence program in which the "positioning start signal" is turned ON by a positioning start command.	The Simple Motion module recognizes that the control is high-level positioning control using "block start data" by the "7000" designation. Use GX Works2 to create a sequence program to execute the "high-level positioning control".
	STEP 5 Refer to Chapter 6	Write the sequence programs created in STEP4 to the PLC CPU.	Write the sequence program created in STEP 4 to the PLC CPU using GX Works2.
Starting the control	STEP 6 Refer to Section 6.5.3	Turn ON the "positioning start command" of the axis to be started.	Same procedure as for the "major positioning control" start.
Monitoring the control	STEP 7	Monitor the high-level positioning control.	Monitor using GX Works2.
Stopping the control	STEP 8 Refer to Section 6.5.6	Stop when control is completed	Same procedure as for the "major positioning control" stop.
		Control termination	

REMARK

(Note-1): Five sets of "block start data (50 points)" and "condition data (10 items)" corresponding to "block No. 7000 to 7004" are set with GX Works2 or sequence program.
"7000 to 7004" can be set in "Cd.3 Positioning start No." on STEP4 when the above is set.

10.3 Setting the block start data

10.3.1 Relation between various controls and block start data

The "block start data" must be set to carry out "high-level positioning control". The setting requirements and details of each "block start data" item to be set differ according to the " Da.13 Special start instruction" setting.

The following shows the "block start data" setting items corresponding to various control systems. The operation details of each control type are explained starting in Section 10.3.2. Also refer to Section 10.4 "Setting the condition data" for details on "condition data" with which control execution is judged.
(The "block start data" settings in this chapter are assumed to be carried out using GX Works2.)

Block start data setting items \ High-level positioning control			Block start (Normal start)	Condition start	Wait start	Simulta-neous start	Repeated start (FOR loop)	Repeated start (FOR condition)	NEXT start ✻
Da.11	Shape	0 : End	◎	◎	◎	◎	×	×	◎
		1 : Continue	◎	◎	◎	◎	◎	◎	◎
Da.12	Start data No.		1 to 600						
Da.13	Special start instruction		0	1	2	3	4	5	6
Da.14	Parameter		–	Condition data No.			Number of repetitions	Condition data No.	–

◎ : One of the two setting items must be set.
○ : Set as required (Set to "–" when not used.)
× : Setting not possible
– : Setting not required (Setting value will be ignored. Use the initial value or a value within the setting range.)

✻ The "NEXT start" instruction is used in combination with "repeated start (FOR loop)" and "repeated start (FOR condition)". Control using only the "NEXT start" will not be carried out.

REMARK

It is recommended that the "block start data" be set whenever possible with GX Works2. Execution by sequence program uses many sequence programs and devices. The execution becomes complicated, and the scan times will increase.

10.3.2 Block start (normal start)

In a "block start (normal start)", the positioning data groups of a block are continuously executed in a set PLC starting from the positioning data set in " Da.12 Start data No." by one start.

Section [2] shows a control example where the "block start data" and "positioning data" are set as shown in section [1].

[1] Setting examples

(1) Block start data setting example

Axis 1 block start data	Da.11 Shape	Da.12 Start data No.	Da.13 Special start instruction	Da.14 Parameter
1st point	1: Continue	1	0: Block start	–
2nd point	1: Continue	2	0: Block start	–
3rd point	1: Continue	5	0: Block start	–
4th point	1: Continue	10	0: Block start	–
5th point	0: End	15	0: Block start	–
•				
•				

(2) Positioning data setting example

Axis 1 positioning data No.	Da.1 Operation pattern	
1	00: Positioning complete	
2	11: Continuous path control	1 block (Note-1)
3	01: Continuous positioning control	
4	00: Positioning complete	
5	11: Continuous path control	1 block
6	00: Positioning complete	
•		
10	00: Positioning complete	
•		
15	00: Positioning complete	
•		

REMARK

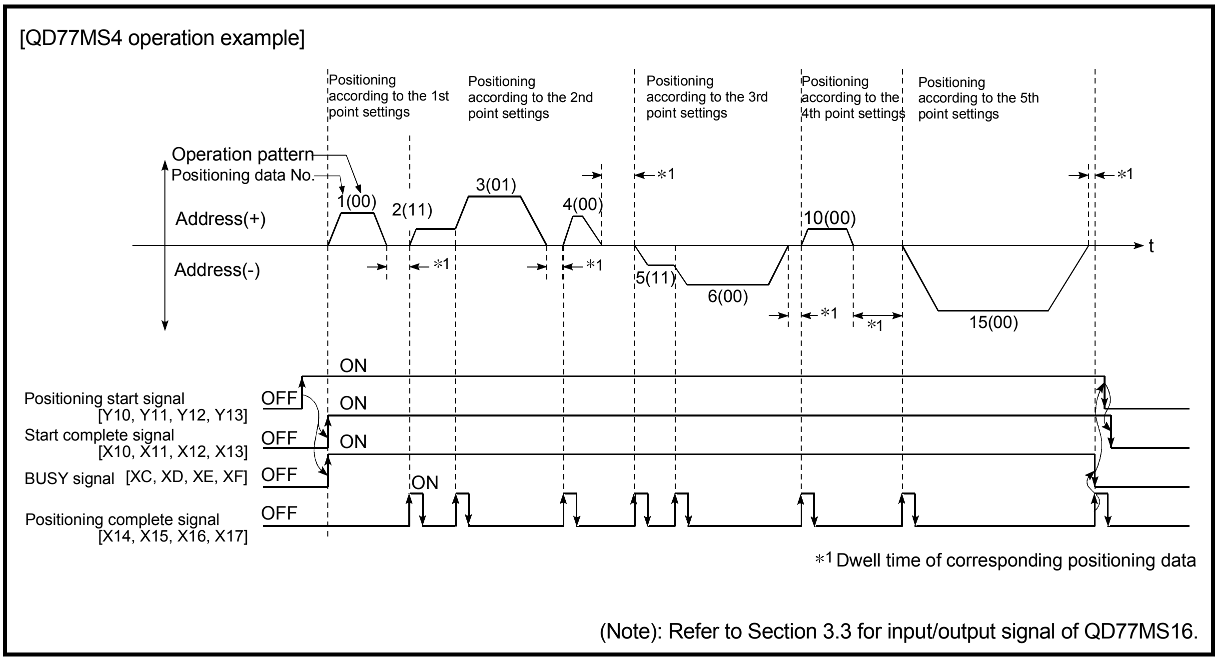
(Note-1): Block

"1 block" is defined as all the data continuing from the positioning data in which "continuous positioning control" or "continuous path control" is set in the " Da.1 Operation pattern" to the positioning data in which "independent positioning control (Positioning complete)" is set.

[2] Control examples

The following shows the control executed when the "block start data" of the 1st point of axis 1 is set as shown in section [1] and started.

<1> The positioning data is executed in the following order before stopping.
Axis 1 positioning data No. 1 → 2 → 3 → 4 → 5 → 6 → 10 → 15.



*1 Dwell time of corresponding positioning data

(Note): Refer to Section 3.3 for input/output signal of QD77MS16.

Fig. 10.1 Block start control example

10.3.3 Condition start

In a "condition start", the "condition data" conditional judgment designated in " Da.14 Parameter" is carried out for the positioning data set in " Da.12 Start data No.". If the conditions have been established, the "block start data" set in "1: condition start" is executed. If the conditions have not been established, that "block start data" will be ignored, and the "block start data" of the next point will be executed.

Section [2] shows a control example where the "block start data" and "positioning data" are set as shown in section [1].

[1] Setting examples

(1) Block start data setting example

Axis 1 block start data	Da.11 Shape	Da.12 Start data No.	Da.13 Special start instruction	Da.14 Parameter
1st point	1: Continue	1	1: Condition start	1
2nd point	1: Continue	10	1: Condition start	2
3rd point	0: End	50	0: Block start	–
•				
•				

(Note): The "condition data Nos." have been set in " Da.14 Parameter".

(2) Positioning data setting example

Axis 1 positioning data No.	Da.1 Operation pattern
1	01: Continuous positioning control
2	01: Continuous positioning control
3	00: Positioning complete
•	
10	11: Continuous path control
11	11: Continuous path control
12	00: Positioning complete
•	
50	00: Positioning complete
•	

[2] Control examples

The following shows the control executed when the "block start data" of the 1st point of axis 1 is set as shown in section [1] and started.

<1> The conditional judgment set in "condition data No. 1" is carried out before execution of the axis 1 "positioning data No.1".
→ Conditions established → Execute positioning data No. 1, 2, and 3 → Go to <2>.
→ Conditions not established → Go to <2>.

<2> The conditional judgment set in "condition data No.2" is carried out before execution of the axis 1 "positioning data No. 10".
→ Conditions established → Execute positioning data No.10, 11, and 12 → Go to <3>.
→ Conditions not established → Go to <3>.

<3> Execute axis 1 "positioning data No.50" and stop the control.

10.3.4 Wait start

In a "wait start", the "condition data" conditional judgment designated in " Da.14 Parameter" is carried out for the positioning data set in " Da.12 Start data No.". If the conditions have been established, the "block start data" is executed. If the conditions have not been established, the control stops (waits) until the conditions are established.

Section [2] shows a control example where the "block start data" and "positioning data" are set as shown in section [1].

[1] Setting examples

(1) Block start data setting example

Axis 1 block start data	Da.11 Shape	Da.12 Start data No.	Da.13 Special start instruction	Da.14 Parameter
1st point	1: Continue	1	2: Wait start	3
2nd point	1: Continue	10	0: Block start	–
3rd point	0: End	50	0: Block start	–
•				
•				

(Note): The "condition data Nos." have been set in " Da.14 Parameter".

(2) Positioning data setting example

Axis 1 positioning data No.	Da.1 Operation pattern
1	01: Continuous positioning control
2	01: Continuous positioning control
3	00: Positioning complete
•	
10	11: Continuous path control
11	11: Continuous path control
12	00: Positioning complete
•	
50	00: Positioning complete
•	

[2] Control examples

The following shows the control executed when the "block start data" of the 1st point of axis 1 is set as shown in section [1] and started.

<1> The conditional judgment set in "condition data No. 3" is carried out before execution of the axis 1 "positioning data No. 1".

→ Conditions established → Execute positioning data No. 1, 2, and 3 → Go to <2>.

→ Conditions not established → Control stops (waits) until conditions are established → Go to <1>.

<2> Execute the axis 1 "positioning data No. 10, 11, 12, and 50" and stop the control.

10.3.5 Simultaneous start

In a "simultaneous start", the positioning data set in the " Da.12 Start data No." and positioning data of other axes set in the "condition data" are simultaneously executed (commands are output with the same timing).
(The "condition data" is designated with " Da.14 Parameter".)
Section [2] shows a control example where the "block start data" and "positioning data" are set as shown in section [1].

[1] Setting examples

(1) Block start data setting example

Axis 1 block start data	Da.11 Shape	Da.12 Start data No.	Da.13 Special start instruction	Da.14 Parameter
1st point	0: End	1	3: Simultaneous start	4
•				
•				
•				
•				

(Note): It is assumed that the "axis 2 positioning data" for simultaneous starting is set in the "condition data" designated with " Da.14 Parameter".

(2) Positioning data setting example

Axis 1 positioning data No.	Da.1 Operation pattern
1	01: Continuous positioning control
2	01: Continuous positioning control
3	00: Positioning complete
•	
•	
•	
•	
•	

[2] Control examples

The following shows the control executed when the "block start data" of the 1st point of axis 1 is set as shown in section [1] and started.

<1> Check the axis operation status of axis 2 which is regarded as the simultaneously started axis.
→ Axis 2 is standing by → Go to <2>.
→ Axis 2 is carrying out positioning. → An error occurs and simultaneous start will not be carried out.

<2> Simultaneously start the axis 1 "positioning data No. 1" and axis 2 positioning data set in "condition data No. 4.

[3] Precautions

Positioning data No. executed by simultaneously started axes is set to condition data (" Da.18 Parameter 1", " Da.19 Parameter 2"), but the setting value of start axis (the axis which carries out positioning start) should be "0". If the setting value is set to other than "0", the positioning data set in " Da.18 Parameter 1", " Da.19 Parameter 2" is given priority to be executed rather than " Da.12 Start data No.".
(For details, refer to Section 5.5 "List of condition data".)

10.3.6 Repeated start (FOR loop)

In a "repeated start (FOR loop)", the data between the "block start data" in which "4: FOR loop" is set in " Da.13 Special start instruction" and the "block start data" in which "6: NEXT start" is set in " Da.13 Special start instruction " is repeatedly executed for the number of times set in " Da.14 Parameter". An endless loop will result if the number of repetitions is set to "0".
(The number of repetitions is set in " Da.14 Parameter" of the "block start data" in which "4: FOR loop" is set in " Da.13 Special start instruction".)

Section [2] shows a control example where the "block start data" and "positioning data" are set as shown in section [1].

[1] Setting examples

(1) Block start data setting example

Axis 1 block start data	Da.11 Shape	Da.12 Start data No.	Da.13 Special start instruction	Da.14 Parameter
1st point	1: Continue	1	4: FOR loop	2
2nd point	1: Continue	10	0: Block start	–
3rd point	0: End	50	6: NEXT start	–
•				
•				

(Note): The "condition data Nos." have been set in " Da.14 Parameter".

(2) Positioning data setting example

Axis 1 positioning data No.	Da.1 Operation pattern
1	01: Continuous positioning control
2	01: Continuous positioning control
3	00: Positioning complete
•	
10	11: Continuous path control
11	00: Positioning complete
•	
50	01: Continuous positioning control
51	00: Positioning complete
•	

[2] Control examples

The following shows the control executed when the "block start data" of the 1st point of axis 1 is set as shown in section [1] and started.

<1> Execute the axis 1 "positioning data No.1, 2, 3, 10, 11, 50, and 51".

<2> Return to the axis 1 "1st point block start data". Again execute the axis 1 "positioning data No.1, 2, 3, 10, 11, 50 and 51", and then stop the control.
(Repeat for the number of times (2 times) set in Da.14 .)

10.3.7 Repeated start (FOR condition)

In a "repeated start (FOR condition)", the data between the "block start data" in which "5: FOR condition" is set in " Da.13 Special start instruction" and the "block start data" in which "6: NEXT start" is set in " Da.13 Special start instruction" is repeatedly executed until the establishment of the conditions set in the "condition data".
Conditional judgment is carried out as soon as switching to the point of "6: NEXT start" (before positioning of NEXT start point).
(The "condition data" designation is set in " Da.14 Parameter" of the "block start data" in which "5: FOR condition" is set in " Da.13 Special start instruction".)

Section [2] shows a control example where the "block start data" and "positioning data" are set as shown in section [1].

[1] Setting examples

(1) Block start data setting example

Axis 1 block start data	Da.11 Shape	Da.12 Start data No.	Da.13 Special start instruction	Da.14 Parameter
1st point	1: Continue	1	5: FOR condition	5
2nd point	1: Continue	10	0: Block start	–
3rd point	0: End	50	6: NEXT start	–
•				
•				

(Note): The "condition data Nos." have been set in " Da.14 Parameter".

(2) Positioning data setting example

Axis 1 positioning data No.	Da.1 Operation pattern
1	01: Continuous positioning control
2	01: Continuous positioning control
3	00: Positioning complete
•	
10	11: Continuous path control
11	00: Positioning complete
•	
50	01: Continuous positioning control
51	00: Positioning complete
•	

[2] Control examples

The following shows the control executed when the "block start data" of the 1st point of axis 1 is set as shown in section [1] and started.

<1> Execute the axis 1 "positioning data No.1, 2, 3, 10, and 11".

<2> Carry out the conditional judgment set in axis 1 "condition data No.5" (Note-1).
- → Conditions not established → Execute "Positioning data No.50, 51". Go to <1>.
- → Conditions established → Execute "Positioning data No.50, 51" and complete the positioning.

(Note-1): Conditional judgment is carried out as soon as switching to NEXT start point (before positioning of NEXT start point).

10.3.8 Restrictions when using the NEXT start

The "NEXT start" is an instruction indicating the end of the repetitions when executing Section 10.3.6 "Repeated start (FOR loop)" and Section 10.3.7 "Repeated start (FOR condition)".

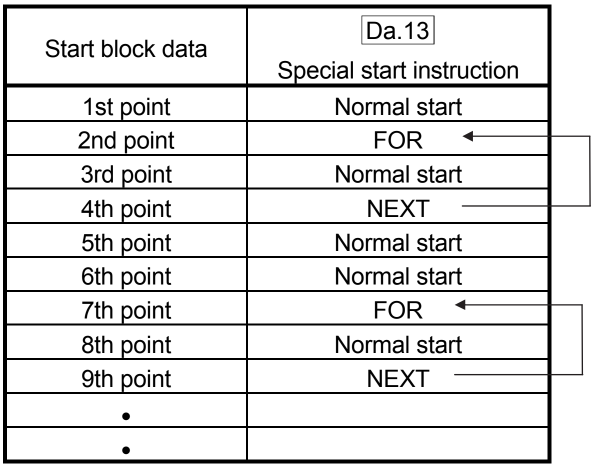
The following shows the restrictions when setting "6: NEXT start" in the "block start data".

(1) The processing when "6: NEXT start" is set before execution of "4: FOR loop" or "5: FOR condition" is the same as that for a "0: block start".

(2) Repeated processing will not be carried out if there is no "6: NEXT start" instruction after the "4: FOR loop" or "5: FOR condition" instruction. (Note that an "error" will not occur.)

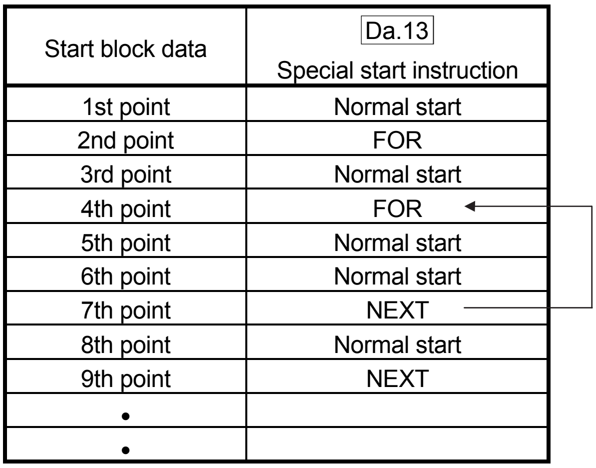
(3) Nesting is not possible between "4: FOR loop" and "6: NEXT start", or between "5: FOR condition" and "6: NEXT start". A warning "FOR to NEXT nest construction (warning code: 506)" will occur if nesting is attempted.

[Operating examples without nesting structure]



Start block data	Da.13 Special start instruction
1st point	Normal start
2nd point	FOR
3rd point	Normal start
4th point	NEXT
5th point	Normal start
6th point	Normal start
7th point	FOR
8th point	Normal start
9th point	NEXT
•	
•	

[Operating examples with nesting structure]



Start block data	Da.13 Special start instruction
1st point	Normal start
2nd point	FOR
3rd point	Normal start
4th point	FOR
5th point	Normal start
6th point	Normal start
7th point	NEXT
8th point	Normal start
9th point	NEXT
•	
•	

A warning will occur when starting the 4th point "FOR". The JUMP destination of the 7th point "NEXT" is the 4th point. The 9th point "NEXT" is processed as normal start.

10.4 Setting the condition data

10.4.1 Relation between various controls and the condition data

"Condition data" is set in the following cases.

(1) When setting conditions during execution of Section 9.2.21 "JUMP instruction" (major positioning control)
(2) When setting conditions during execution of "high-level positioning control"

The "condition data" to be set includes the setting items from Da.15 to Da.19 and Da.23 to Da.26, but the setting requirements and details differ according to the control system and setting conditions.

The following shows the "condition data" "Da.15 Condition target" corresponding to the different types of control.
(The "condition data" settings in this chapter are assumed to be carried out using GX Works2.)

Control type / Da.15 Setting item	High-level positioning control				Major positioning control
	Block start	Wait start	Simultaneous start	Repeated start (For condition)	JUMP instruction
01: Device X (Note-1)	◎	◎	×	◎	◎
02: Device Y (Note-1)	◎	◎	×	◎	◎
03: Buffer memory (1 word)	◎	◎	×	◎	◎
04: Buffer memory (2 words)	◎	◎	×	◎	◎
05: Positioning data No.	×	×	◎	×	×

◎ : One of the setting items must be set.
× : Setting not possible
(Note-1): Refer to devices X/Y which belongs to Simple Motion module.

REMARK

It is recommended that the "condition data" be set whenever possible with GX Works2. Execution by sequence program uses many sequence programs and devices. The execution becomes complicated, and the scan times will increase.

The setting requirements and details of the following "condition data" Da.16 to Da.19 and Da.23 setting items differ according to the "Da.15 Condition target" setting. The following shows the Da.16 to Da.19 and Da.23 setting items corresponding to the "Da.15 Condition target".

- QD77MS2/QD77MS4

Other setting item / Da.15 Condition target	Da.16 Condition operator	Da.17 Address	Da.18 Parameter 1	Da.19 Parameter 2
01H: Device X	07H: DEV=ON 08H: DEV=OFF	–	0 to 1FH (bit No.)	–
02H: Device Y			0 to 1FH (bit No.)	
03H: Buffer memory (1 word) (Note-1)	01H: ＊＊=P1 02H: ＊＊≠P1 03H: ＊＊≤P1 04H: ＊＊≥P1 05H: P1≤＊＊≤P2 06H: ＊＊≤P1, P2≤＊＊	Buffer memory address	P1 (numeric value)	P2 (numeric value) (Set only when "Da.16" is [05H] or [06H].)
04H: Buffer memory (2 words) (Note-1)				
05H: Positioning data No.	10H: Axis 1 selected 20H: Axis 2 selected 30H: Axis 1 and 2 selected 40H: Axis 3 selected 50H: Axis 1 and 3 selected 60H: Axis 2 and 3 selected 70H: Axis 1, 2, and 3 selected 80H: Axis 4 selected 90H: Axis 1 and 4 selected A0H: Axis 2 and 4 selected B0H: Axis 1, 2, and 4 selected C0H: Axis 3 and 4 selected D0H: Axis 1, 3, and 4 selected E0H: Axis 2, 3, and 4 selected	—	Low-order 16 bits: Axis 1 positioning data No. (Note-2) High-order 16 bits: Axis 2 positioning data No. (Note-2)	Low-order 16 bits: Axis 3 positioning data No. (Note-2) High-order 16 bits: Axis 4 positioning data No. (Note-2)

– : Setting not required (Setting value will be ignored. Use the initial value or a value within the setting range.)

＊＊ : Value stored in buffer memory designated in Da.17

(Note-1): Comparison of ≤ and ≥ is judged as signed values.
Refer to Section 5.5 "List of condition data" for the setting contents.

(Note-2): The setting value of start axis (the axis which executes positioning start) should be "0". If the setting value is set to other than "0", the positioning data set in "Da.18 Parameter 1", "Da.19 Parameter 2" is given priority to be executed rather than "Da.12 Start data No.".

- QD77MS16

Da.15 Condition target \ Other setting item	Da.16 Condition operator	Da.23 Number of simultaneously starting axes	Da.17 Address	Da.18 Parameter 1	Da.19 Parameter 2
01H: Device X	07H: DEV=ON	—	—	0 to 1FH (bit No.)	—
02H: Device Y	08H: DEV=OFF			0 to 1FH (bit No.)	
03H: Buffer memory (1 word) (Note-1)	01H: ＊＊=P1 02H: ＊＊≠P1 03H: ＊＊≤P1 04H: ＊＊≥P1 05H: P1≤＊＊≤P2 06H: ＊＊≤P1, P2≤＊＊		Buffer memory address	P1 (numeric value)	P2 (numeric value) (Set only when "Da.16" is [05H] or [06H].)
04H: Buffer memory (2 words) (Note-1)					
05H: Positioning data No.		2	—	Low-order 16 bits: "Da.24 Simultaneously starting axis No.1" positioning data No. High-order 16 bits: "Da.25 Simultaneously starting axis No.2" positioning data No.	—
		3			
		4			Low-order 16 bits: "Da.26 Simultaneously starting axis No.3" positioning data No. High-order 16 bits: Unusable (Set "0".)

– : Setting not required (Setting value will be ignored. Use the initial value or a value within the setting range.)

＊＊ : Value stored in buffer memory designated in Da.17

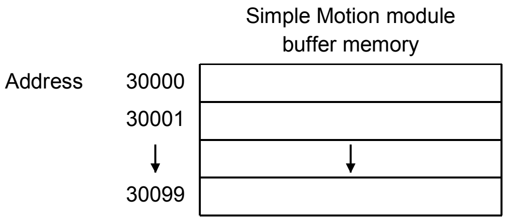
(Note-1): Comparison of ≤ and ≥ is judged as signed values.

Refer to Section 5.5 "List of condition data" for the setting contents.

Judgment whether the condition operator is "=" or "≠" at the start of wait.
Judgment on data is carried out for each operation cycle of the Simple Motion module.
Thus, in the judgment on the data such as current feed value which varies continuously, the operator "=" may not be detected. If this occurs, use a range operator.

REMARK

The "PLC CPU memo area" can be designated as the buffer memory address to be designated in Da.17. (Refer to Section 7.1.1 "Configuration and roles of QD77MS memory".)



10.4.2 Condition data setting examples

The following shows the setting examples for "condition data".

(1) QD77MS2/QD77MS4

(a) Setting the device ON/OFF as a condition

[Condition]
Device "XC" (Axis 1 BUSY signal) is OFF

Da.15 Condition target	Da.16 Condition operator	Da.17 Address	Da.18 Parameter 1	Da.19 Parameter 2
01H: Device X	08H: DEV=OFF	—	0CH	—

(b) Setting the numeric value stored in the "buffer memory" as a condition

[Condition]
The value stored in buffer memory addresses "800, 801" ("Md.20 Current feed value") is "1000" or larger.

Da.15 Condition target	Da.16 Condition operator	Da.17 Address	Da.18 Parameter 1	Da.19 Parameter 2
04H: Buffer memory (2 words)	04H: ＊＊ ≥ P1	800	1000	—

(c) Designating the axis and positioning data No. to be simultaneously started in "simultaneous start"

[Condition]
Simultaneously starting "axis 2 positioning data No.3"

Da.15 Condition target	Da.16 Condition operator	Da.17 Address	Da.18 Parameter 1	Da.19 Parameter 2
05H: Positioning data No.	20H: Axis 2 selected	—	High-order 16 bits "0003H" (Note-1)	— (Note-1)

(Note-1): The setting value of start axis (the axis which executes positioning start) should be "0000H".

(2) QD77MS16

(a) Setting the device ON/OFF as a condition

[Condition]
Device "X10" (Axis 1 BUSY signal) is OFF

Da.15 Condition target	Da.16 Condition operator	Da.17 Address	Da.18 Parameter 1	Da.19 Parameter 2	Da.23 Number of simultaneously starting axes	Da.24 Simultaneously starting axis No.1	Da.25 Simultaneously starting axis No.2	Da.26 Simultaneously starting axis No.3
01H: Device X	08H: DEV=OFF	—	10H	—	—	—	—	—

(b) Setting the numeric value stored in the "buffer memory" as a condition

[Condition]
The value stored in buffer memory addresses "2400, 2401" (Md.20 Current feed value) is "1000" or larger.

Da.15 Condition target	Da.16 Condition operator	Da.17 Address	Da.18 Parameter 1	Da.19 Parameter 2	Da.23 Number of simultaneously starting axes	Da.24 Simultaneously starting axis No.1	Da.25 Simultaneously starting axis No.2	Da.26 Simultaneously starting axis No.3
04H: Buffer memory (2 words)	04H: ∗∗ ≥ P1	2400	1000	—	—	—	—	—

(c) Designating the axis and positioning data No. to be simultaneously started in "simultaneous start"

[Condition]
Simultaneously starting "axis 2 positioning data No.3"

Da.15 Condition target	Da.16 Condition operator	Da.17 Address	Da.18 Parameter 1	Da.19 Parameter 2	Da.23 Number of simultaneously starting axes	Da.24 Simultaneously starting axis No.1	Da.25 Simultaneously starting axis No.2	Da.26 Simultaneously starting axis No.3
05H: Positioning data No.	—	—	Low-order 16 bits "0003H"	—	2H: 2 axes	1H: Axis 2	0H	0H

10.5 Multiple axes simultaneous start control

The "multiple axes simultaneous start control" starts and controls the multiple axes simultaneously by outputting command to the axis to be started at the same timing as the start axis.
The maximum of four axes can be started simultaneously.

[1] Control details

The multiple axes simultaneous start control is carried out by setting the simultaneous start setting data to the multiple axes simultaneous start control buffer memory of the axis control data, and the "9004" to "Cd.3 Positioning start No." of the start axis, and then turning ON the positioning start signal.

- QD77MS2 ....Set the start data No. of simultaneous starting axis (positioning data No. to be started simultaneously for each axis) in "Cd.30 Simultaneous starting axis start data No. (axis 1 start data No.)" and "Cd.31 Simultaneous starting axis start data No. (axis 2 start data No.)".
- QD77MS4 ....Set the start data No. of simultaneous starting axis (positioning data No. to be started simultaneously for each axis) in "Cd.30 Simultaneous starting axis start data No. (axis 1 start data No.)" to "Cd.33 Simultaneous starting axis start data No. (axis 4 start data No.)".
- QD77MS16 ....Set the number of axes to be started simultaneously and axis No. in "Cd.43 Simultaneous starting axis", and the start data No. of simultaneous starting axis (positioning data No. to be started simultaneously for each axis) in "Cd.30 Simultaneous starting own axis start data No." and "Cd.31 Simultaneous starting axis start data No.1" to "Cd.33 Simultaneous starting axis start data No.3".

[2] Restrictions

(1) An error will occur and all simultaneously started axes will not start (error code: 501) if the simultaneously started axis start data No. is not set to the axis control data on the start axis or set outside the setting range.

(2) An error will occur and all simultaneously started axes will not start (error code: 501) if either of the simultaneously started axes is BUSY.

(3) An error will occur and all simultaneously started axes will not start (error code: 501) if an error occurs during the analysis of the positioning data on the simultaneously started axes.

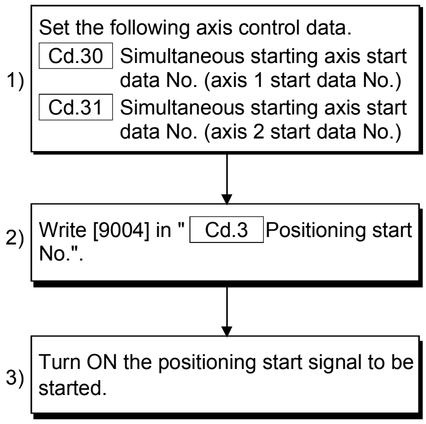
(4) No error or warning will occur if only the start axis is the simultaneously started axis.

(5) This function cannot be used with the sub function Section 13.7.7 "Pre-reading start function".

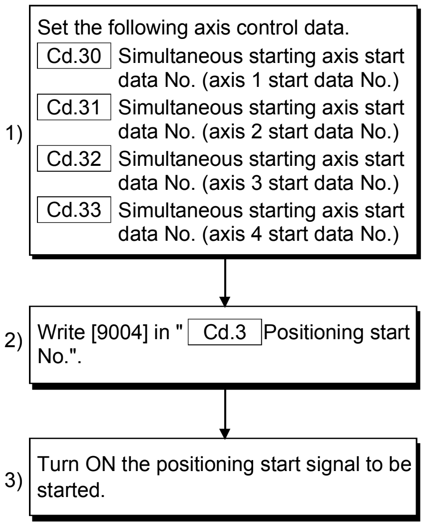
[3] Multiple axes simultaneous start control procedure

The procedure for multiple axes simultaneous start control is as follows.

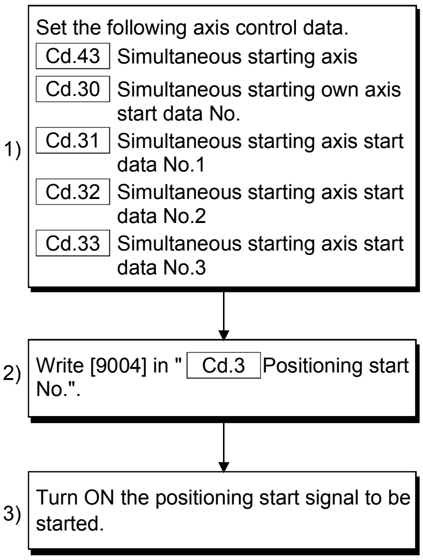
When QD77MS2



When QD77MS4



When QD77MS16



[4] Multiple axes simultaneous start control function setting method

The following shows the setting of the data used to execute the multiple axes simultaneous start control with positioning start signals (The axis control data on the start axis is set).

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Cd.3	Positioning start No.	9004	Set the multiple axes simultaneous start control start No. "9004".	1500+100n	4300+100n
Cd.43	Simultaneous starting axis QD77MS16	Set the number of simultaneous starting axes and target axis.			4339+100n
Cd.30	Simultaneous starting axis start data No. (axis 1 start data No.) QD77MS2 QD77MS4	Set the simultaneously started axis start data No. Set a "0" for the axis other than the simultaneously started axes.		1540+100n	
	Simultaneous starting own axis start data No. QD77MS16				4340+100n
Cd.31	Simultaneous starting axis start data No. (axis 2 start data No.) QD77MS2 QD77MS4			1541+100n	
	Simultaneous starting axis start data No.1 QD77MS16				4341+100n
Cd.32	Simultaneous starting axis start data No. (axis 3 start data No.) QD77MS4			1542+100n	
	Simultaneous starting axis start data No.2 QD77MS16				4342+100n
Cd.33	Simultaneous starting axis start data No. (axis 4 start data No.) QD77MS4			1543+100n	
	Simultaneous starting axis start data No.3 QD77MS16				4343+100n

n: Axis No.-1

(Note-1): Refer to Section 5.7 "List of control data" for information on setting details.
(Note-2): The signal of axis 3 and 4 cannot be used in the QD77MS2.

[5] Setting examples

(1) The following shows the setting examples in which the QD77MS4 [axis 1] is used as the start axis and the simultaneously started axes are used as the axes 2 and 4.

Setting item		Setting value	Setting details	Buffer memory address (Axis 1)
Cd.3	Positioning start No.	9004	Set the multiple axes simultaneous start control start No. "9004".	1500
Cd.30	Simultaneous starting axis start data No. (axis 1 start data No.)	100	The axis 1 starts the positioning data No. 100.	1540
Cd.31	Simultaneous starting axis start data No. (axis 2 start data No.)	200	Immediately after the start of the axis 1, the axis 2 starts the axis 2 positioning data No. 200.	1541
Cd.32	Simultaneous starting axis start data No. (axis 3 start data No.)	0	Will not start simultaneously.	1542
Cd.33	Simultaneous starting axis start data No. (axis 4 start data No.)	300	Immediately after the start of the axis 1, the axis 4 starts the axis 4 positioning data No. 300.	1543

(2) The following shows the setting examples in which the QD77MS16 [axis 10] is used as the start axis and the simultaneously started axes are used as the axes 12 and 14.

Setting item		Setting value	Setting details	Buffer memory address (Axis 10)
Cd.3	Positioning start No.	9004	Set the multiple axes simultaneous start control start No. "9004".	5200
Cd.43	Simultaneous starting axis	30DBH	Set the axis 12 (0BH) to the simultaneously starting axis No.1, and the axis 14 (0DH) to the simultaneously starting axis No.2.	5239
Cd.30	Simultaneous starting own axis start data No.	100	The axis 10 starts the positioning data No. 100.	5240
Cd.31	Simultaneous starting axis start data No.1	200	Immediately after the start of the axis 10, the axis 12 starts the axis 12 positioning data No. 200.	5241
Cd.32	Simultaneous starting axis start data No.2	300	Immediately after the start of the axis 10, the axis 14 starts the axis 14 positioning data No. 300.	5242
Cd.33	Simultaneous starting axis start data No.3	0	Will not start simultaneously.	5243

POINTS

(1) The "multiple axes simultaneous start control" carries out an operation equivalent to the "simultaneous start" using the "block start data".

(2) The setting of the "multiple axes simultaneous start control" is easier than that of the "simultaneous start" using the "block start data".

- Setting items for "simultaneous start" using "block start data"
  Positioning start data, block start data, condition data, and positioning data
- Setting items for "multiple axes simultaneous start control"
  Positioning data and axis control data

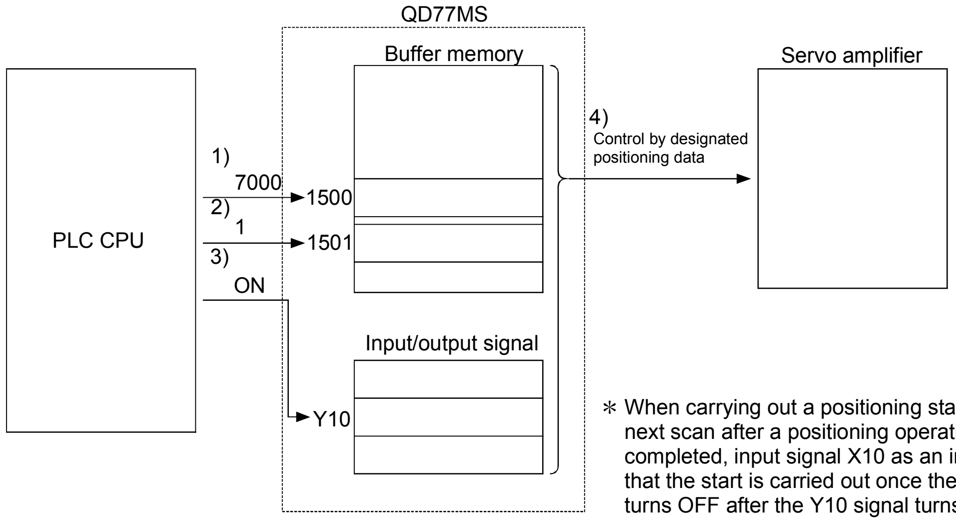
10.6 Start program for high-level positioning control

10.6.1 Starting high-level positioning control

To execute high-level positioning control, a sequence program must be created to start the control in the same method as for major positioning control.

The following shows the procedure for starting the "1st point block start data" (regarded as block No. 7000) set in axis 1.

[QD77MS4 use]



* When carrying out a positioning start with the next scan after a positioning operation is completed, input signal X10 as an interlock so that the start is carried out once the X10 signal turns OFF after the Y10 signal turns OFF.

1) Set "7000" in "Cd. 3 Positioning start No.".
   (This establishes that the control as "high-level positioning control" using block start data.)
2) Set the point No. of the "block start data" to be started. (In this case "1".)
3) Turn ON the start signal.
4) The positioning data set in the "1st point block start data" is started.

(Note): Refer to Chapter 5 for buffer memory address of QD77MS16.

Fig. 10.2 High-level positioning control start procedure

10.6.2 Example of a start program for high-level positioning control

The following shows an example of a start program for high-level positioning control in which the 1st point "block start data" of axis 1 is started. (The block No. is regarded as "7000".)

■ Control data that require setting

The following control data must be set to execute high-level positioning control. The setting is carried out using a sequence program.

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Cd.3	Positioning start No.	7000	Set "7000" to indicate control using "block start data".	1500+100n	4300+100n
Cd.4	Positioning starting point No.	1	Set the point No. of the "block start data" to be started.	1501+100n	4301+100n

n: Axis No.-1

(Note): Refer to Section 5.7 "List of control data" for details on the setting details.

■ Start conditions

The following conditions must be fulfilled when starting the control. The required conditions must also be integrated into the sequence program, and configured so the control does not start unless the conditions are fulfilled.

Signal name		Signal state		Device	
				QD77MS2 QD77MS4	QD77MS16
Interface signal	PLC READY signal	ON	PLC CPU preparation completed	Y0	
	READY signal	ON	QD77MS preparation completed	X0	
	All axis servo ON	ON	All axis servo ON	Y1	
	Synchronization flag	ON	QD77MS buffer memory The access is possible.	X1	
	Axis stop signal	OFF	Axis stop signal is OFF	Y4 to Y7	Cd.180 Axis stop
	Start complete signal	OFF	Start complete signal is OFF	X10 to X13	Md.31 Status: b14
	BUSY signal	OFF	BUSY signal is OFF	XC to XF	X10 to X1F
	Error detection signal	OFF	There is no error	X8 to XB	Md.31 Status: b13
	M code ON signal	OFF	M code ON signal is OFF	X4 to X7	Md.31 Status: b12
External signal	Forced stop input signal	ON	There is no forced stop input	–	
	Stop signal	OFF	Stop signal is OFF	–	
	Upper limit (FLS)	ON	Within limit range	–	
	Lower limit (RLS)	ON	Within limit range	–	

■ Start time chart

The following chart shows a time chart in which the positioning data No. 1, 2, 10, 11, and 12 of QD77MS4 [axis 1] are continuously executed as an example.

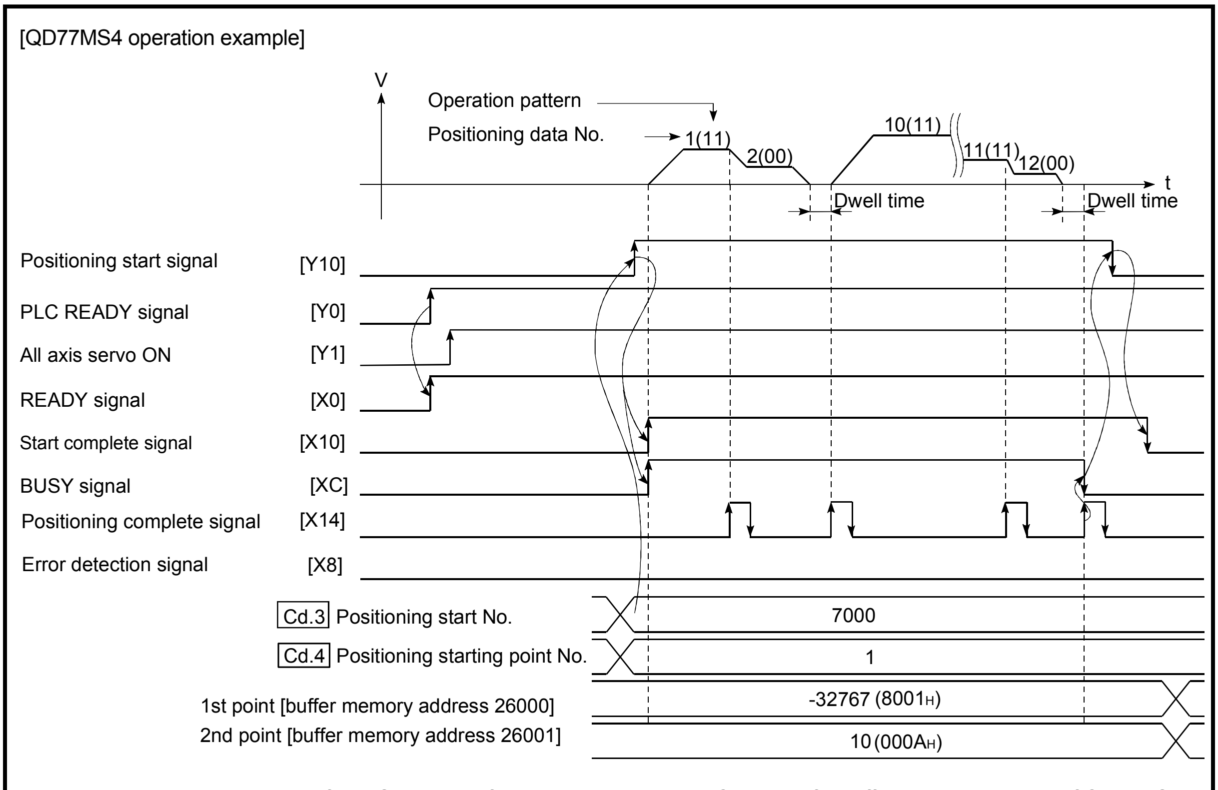
(1) Block start data setting example

Axis 1 block start data	Da.11 Shape	Da.12 Start data No.	Da.13 Special start instruction	Da.14 Parameter
1st point	1: Continue	1	0: Block start	–
2nd point	0: End	10	0: Block start	–
•				
•				

(2) Positioning data setting example

Axis 1 positioning data No.	Da.1 Operation pattern
1	11: Continuous path control
2	00: Positioning complete
•	
10	11: Continuous path control
11	11: Continuous path control
12	00: Positioning complete
•	

(3) Start time chart



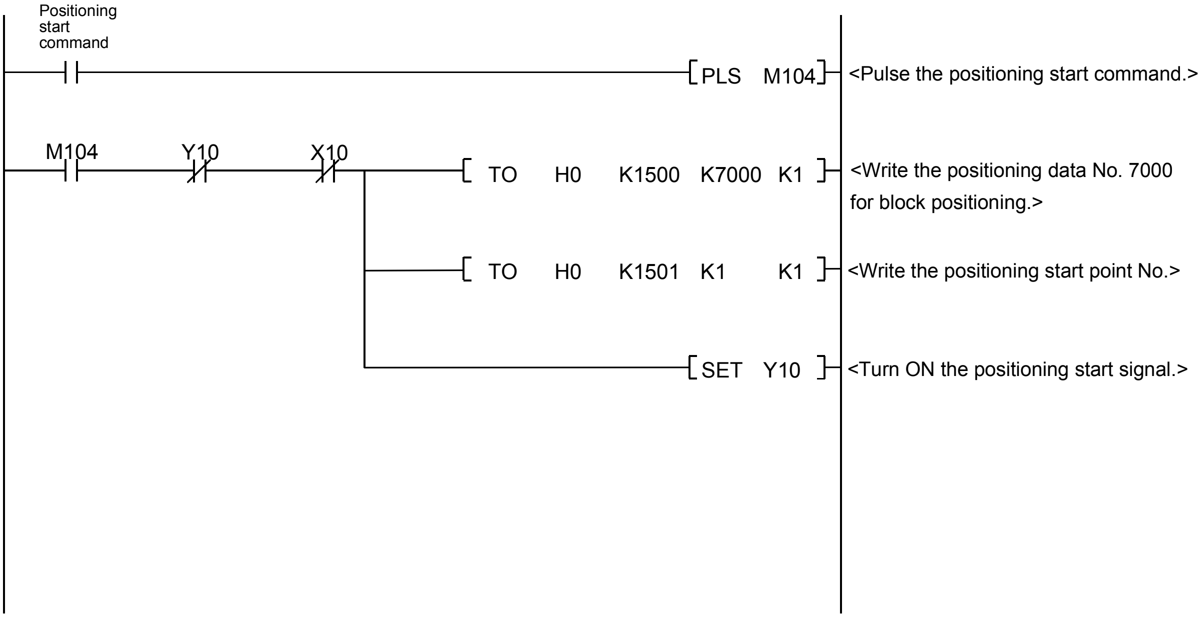
(Note): Refer to Section 3.3 for input/output signal or Chapter 5 for buffer memory address of QD77MS16.

Fig. 10.3 Start time chart for high-level positioning control (block start)

■ Creating the program

[QD77MS4 program example]

Set the block start data beforehand.



```
[PLS M104]                      <Pulse the positioning start command.>
[TO H0 K1500 K7000 K1]          <Write the positioning data No. 7000 for block positioning.>
[TO H0 K1501 K1 K1]             <Write the positioning start point No.>
[SET Y10]                       <Turn ON the positioning start signal.>
```

Y10: Positioning start signal
X10: Start complete signal
M104: Positioning start command pulse

MEMO

Chapter 11 Manual Control

The details and usage of manual control are explained in this chapter.
In manual control, commands are issued during a JOG operation and an inching operation executed by the turning ON of the JOG START signal, or from a manual pulse generator connected to the Simple Motion module.
Manual control using a sequence program from the PLC CPU is explained in this chapter.
Refer to the "Simple Motion Module Setting Tool Help" of GX Works2 for an explanation of manual control (JOG operation, inching operation and manual pulse generator operation) using the GX Works2.

11.1 Outline of manual control

11.1.1 Three manual control methods

"Manual control" refers to control in which positioning data is not used, and a positioning operation is carried out in response to signal input from an external device. The three types of this "manual control" are explained below.

[1] JOG operation

"JOG operation" is a control method in which the machine is moved by only a movement amount (commands are continuously output while the JOG START signal is ON). This operation is used to move the workpiece in the direction in which the limit signal is ON, when the operation is stopped by turning the limit signal OFF to confirm the positioning system connection and obtain the positioning data address (refer to Section 13.7.4 "Teaching function").

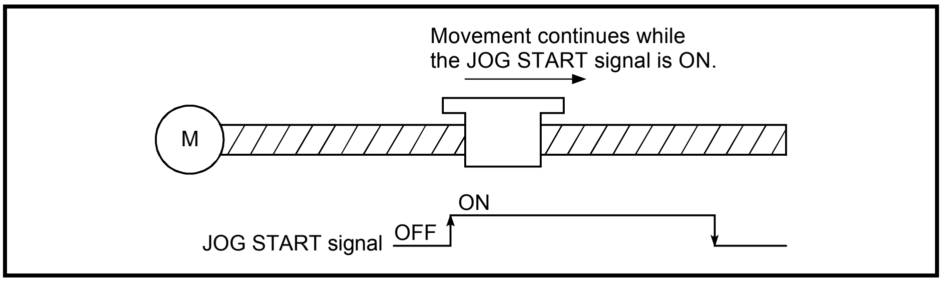


Fig. 11.1 JOG operation

[2] Inching operation

"Inching operation" is a control method in which a minute movement amount of command is output manually in operation cycle.
When the "inching movement amount" of the axis control data is set by JOG operation, the workpiece is moved by a set movement amount. (When the "inching movement amount" is set to "0", the machine operates as JOG operation.)

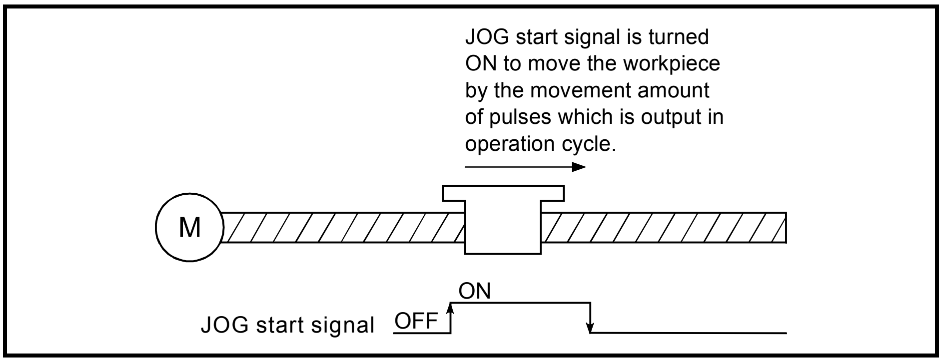


Fig. 11.2 Inching operation

[3] Manual pulse generator operation

"Manual pulse generator operation" is a control method in which positioning is carried out in response to the number of pulses input from a manual pulse generator (the number of input command is output). This operation is used for manual fine adjustment, etc., when carrying out accurate positioning to obtain the positioning address.

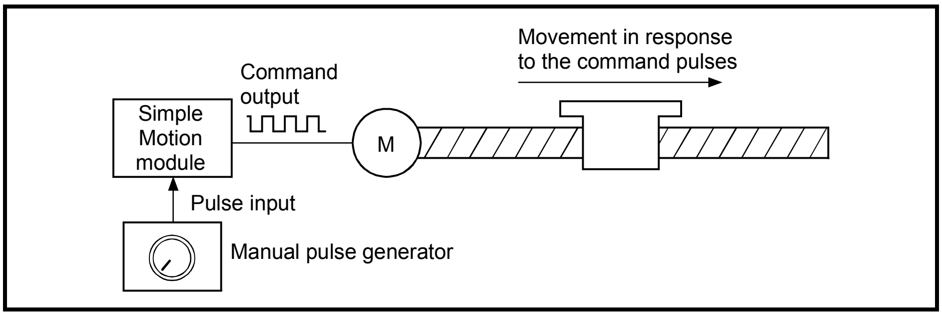


Fig. 11.3 Manual pulse generator control

■ Manual control sub functions

Refer to Section 3.2.5 "Combination of QD77MS main functions and sub functions" for details on "sub functions" that can be combined with manual control. Also refer to Chapter 13 "Control Sub Functions" for details on each sub function.

■ Carrying out manual control from GX Works2

"JOG operation", "Inching operation" and enabling/disabling of the "manual pulse generator operation" can be executed from GX Works2 test function.
Refer to the "Simple Motion Module Setting Tool Help" of GX Works2 for details on manual control from GX Works2.

■ Monitoring manual control

Refer to Section 5.6 "List of monitor data" when directly monitoring the buffer memory using GX Works2.
Also refer to the "Simple Motion Module Setting Tool Help" of GX Works2 when monitoring with the monitor functions of GX Works2.

11.2 JOG operation

11.2.1 Outline of JOG operation

■ JOG operation

In JOG operation, the forward run JOG start signal or reverse run JOG start signal turns ON, causing pulses to be output to the servo amplifier from the Simple Motion module while the signal is ON. The workpiece is then moved in the designated direction.

Signal	QD77MS2	QD77MS4	QD77MS16
Forward run JOG start signal	Y8, YA	Y8, YA, YC, YE	Cd.181 Forward run JOG start
Reverse run JOG start signal	Y9, YB	Y9, YB, YD, YF	Cd.182 Reverse run JOG start

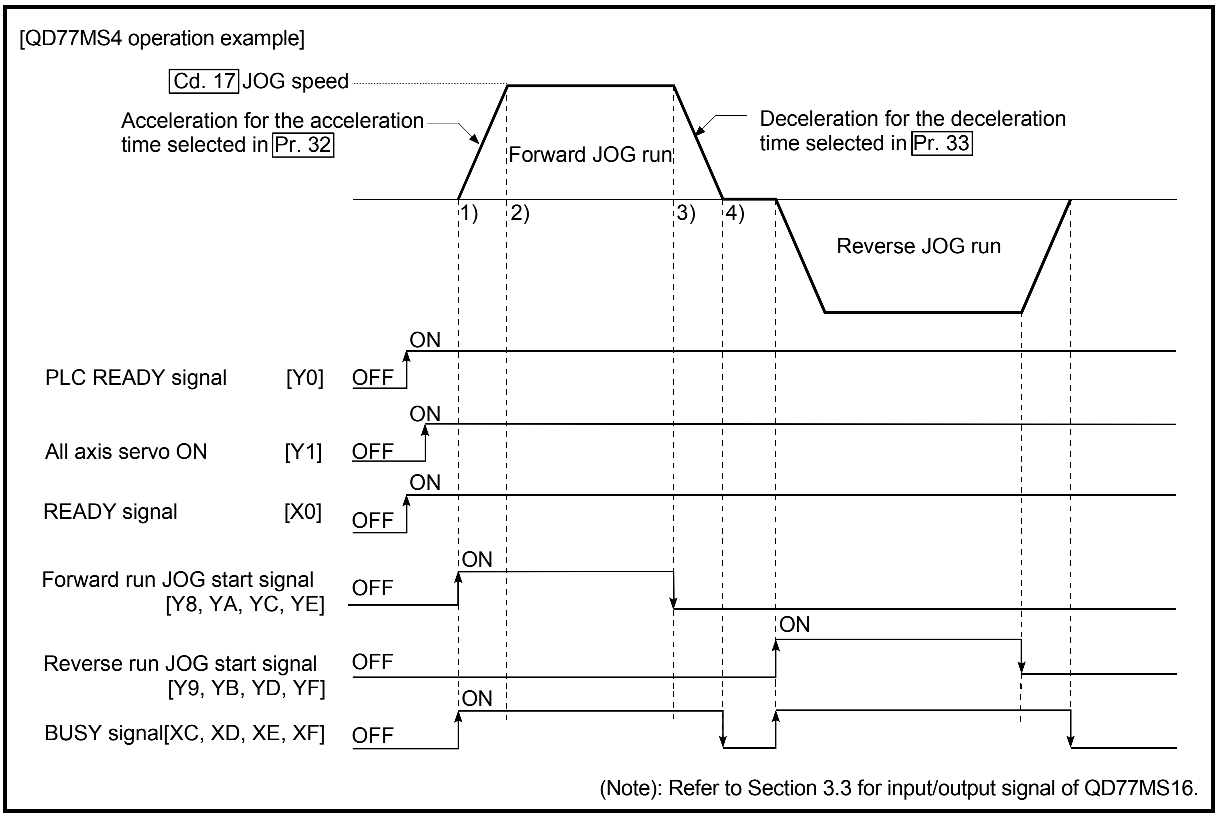
The following shows examples of JOG operation.

1) When the START signal turns ON, acceleration begins in the direction designated by the START signal, and continues for the acceleration time designated in "Pr.32 JOG operation acceleration time selection". At this time, the BUSY signal changes from OFF to ON.

2) When the workpiece being accelerated reaches the speed set in "Cd.17 JOG speed", the movement continues at this speed. The constant speed movement takes place at 2) and 3).

3) When the START signal is turned OFF, deceleration begins from the speed set in "Cd.17 JOG speed", and continues for the deceleration time designated in "Pr.33 JOG operation deceleration time selection".

4) The operation stops when the speed becomes "0". At this time, the BUSY signal changes from ON to OFF.



(Note): Refer to Section 3.3 for input/output signal of QD77MS16.

Fig. 11.4 JOG operation

Important

Use the hardware stroke limit function when carrying out JOG operation near the upper or lower limits. (Refer to Section "13.4.4".)
If the hardware stroke limit function is not used, the workpiece may exceed the moving range, causing an accident.

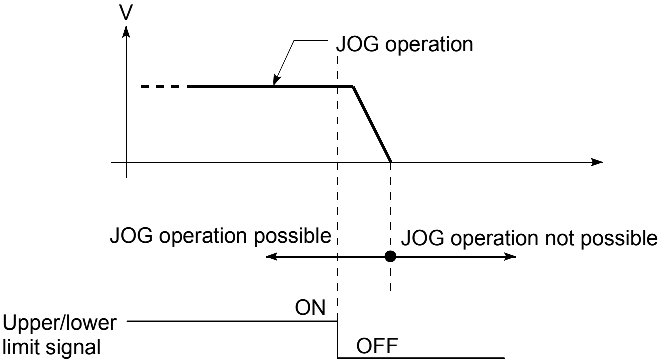
■ Precautions during operation

The following details must be understood before carrying out JOG operation.

(1) For safety, first set "Cd.17 JOG speed" to a smaller value and check the movement. Then gradually increase the value.
(2) An axis error will occur and the operation will not start (error code: 300) if the "JOG speed" is outside the setting range at the JOG start.
(3) An axis error will occur and the operation will not start (error code: 956) if "Pr.31 JOG speed limit value" is set to a value larger than "Pr.8 Speed limit value".
(4) If "Cd.17 JOG speed" exceeds the speed set in "Pr.31 JOG speed limit value", the workpiece will move at the "Pr.31 JOG speed limit value" and an "Axis warning" will occur in the Simple Motion module (warning code: 301).
(5) The JOG operation can be continued even if an "Axis warning" has occurred.
(6) Set a "0" in "Cd.16 Inching movement amount". If a value other than "0" is set, the operation will become an inching operation (Refer to Section 11.3 "Inching operation").

■ Operations when stroke limit error occurs

When the operation is stopped by hardware stroke limit error or software stroke limit error, the JOG operation can execute in an opposite way (direction within normal limits) after an error reset. (An error will occur again if JOG start signal is turned ON in a direction to outside the stroke limit.)



■ JOG operation timing and processing time

The following drawing shows details of the JOG operation timing and processing time.

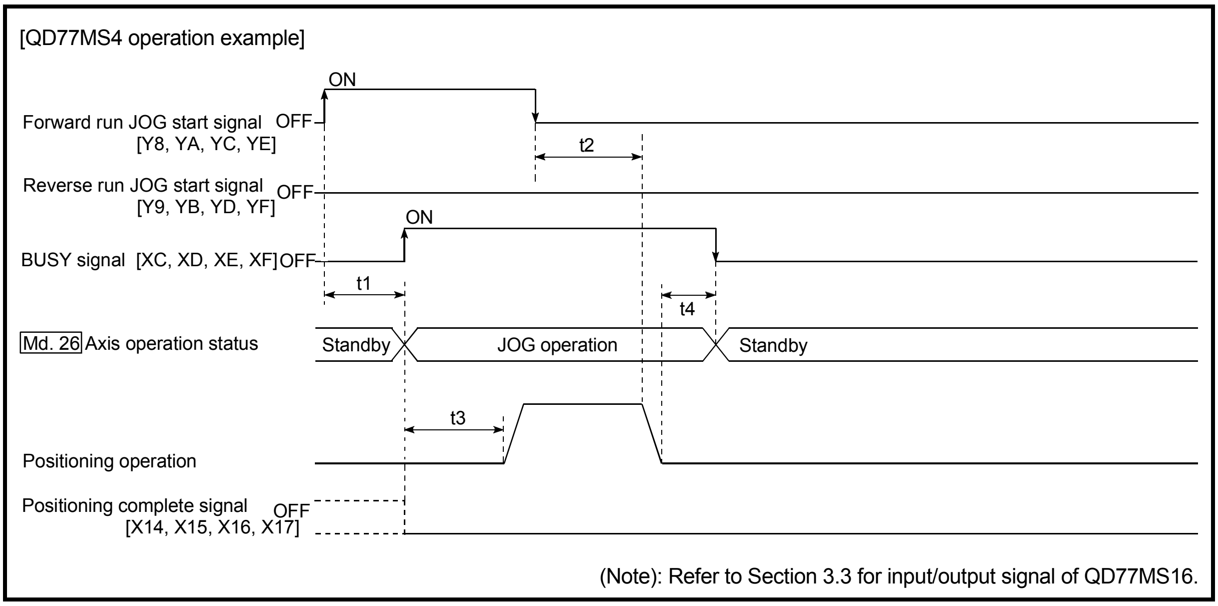


Fig. 11.5 JOG operation timing and processing times

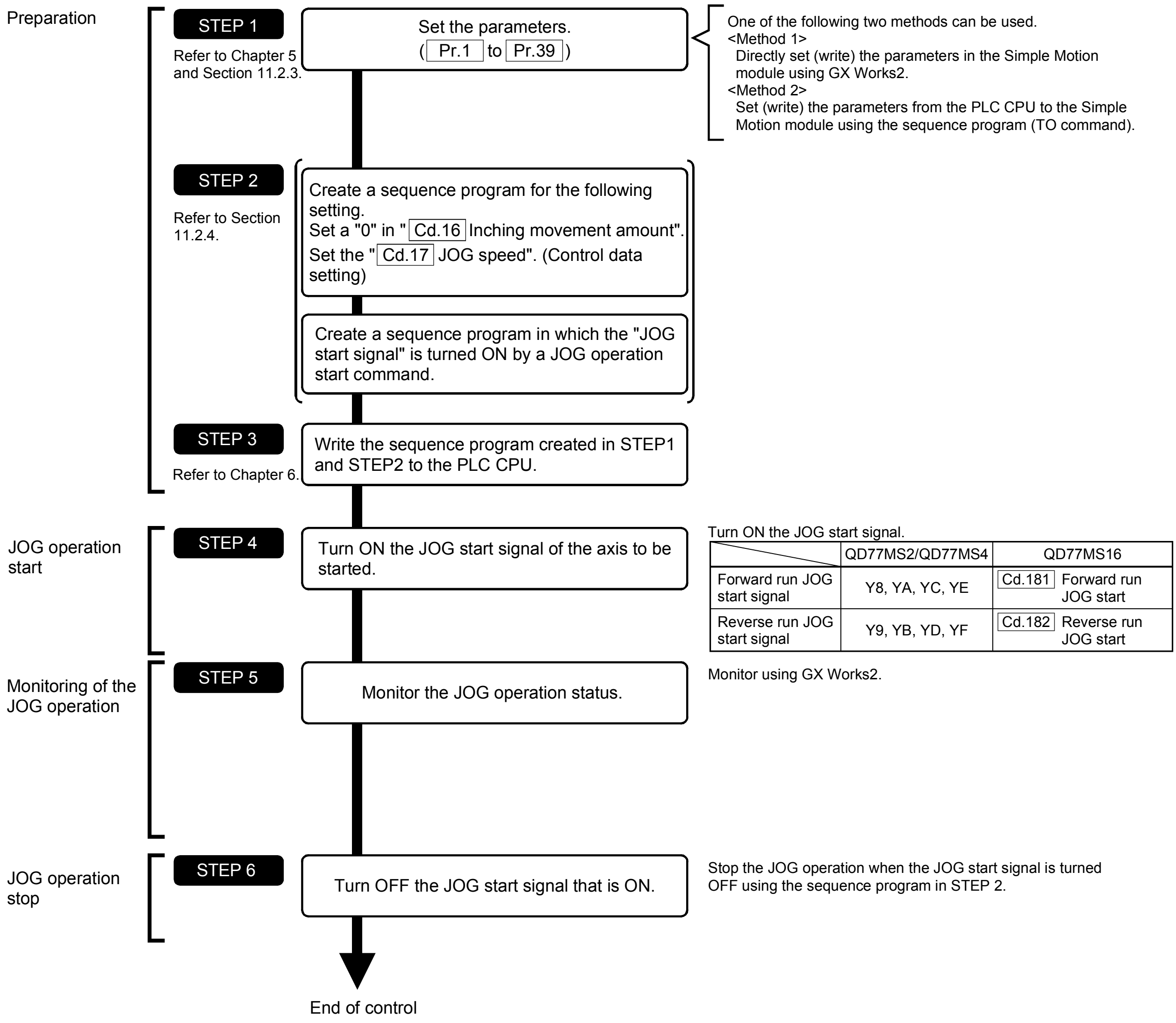
Normal timing times Unit: [ms]

	Operation cycle	t1	t2	t3	t4
QD77MS2	0.88	0.4 to 0.9	0 to 0.9	1.8 to 2.7	0 to 0.9
	1.77	0.4 to 1.4	0 to 1.8	3.2 to 3.9	0 to 1.8
QD77MS4	0.88	0.4 to 0.9	0 to 0.9	1.8 to 2.7	0 to 0.9
	1.77	0.4 to 1.4	0 to 1.8	3.2 to 3.9	0 to 1.8
QD77MS16	0.88	0.4 to 0.9	0 to 0.9	1.8 to 2.7	0 to 0.9
	1.77	0.8 to 1.4	0 to 1.8	3.2 to 3.9	0 to 1.8

- Delays may occur in the t1 timing time due to the operation status of other axes.

11.2.2 JOG operation execution procedure

The JOG operation is carried out by the following procedure.



Preparation

STEP 1 Refer to Chapter 5 and Section 11.2.3.

Set the parameters. (Pr.1 to Pr.39)

One of the following two methods can be used.
<Method 1>
Directly set (write) the parameters in the Simple Motion module using GX Works2.
<Method 2>
Set (write) the parameters from the PLC CPU to the Simple Motion module using the sequence program (TO command).

STEP 2 Refer to Section 11.2.4.

Create a sequence program for the following setting.
Set a "0" in " Cd.16 Inching movement amount".
Set the " Cd.17 JOG speed". (Control data setting)

Create a sequence program in which the "JOG start signal" is turned ON by a JOG operation start command.

STEP 3 Refer to Chapter 6.

Write the sequence program created in STEP1 and STEP2 to the PLC CPU.

JOG operation start

STEP 4

Turn ON the JOG start signal of the axis to be started.

Turn ON the JOG start signal.

	QD77MS2/QD77MS4	QD77MS16
Forward run JOG start signal	Y8, YA, YC, YE	Cd.181 Forward run JOG start
Reverse run JOG start signal	Y9, YB, YD, YF	Cd.182 Reverse run JOG start

Monitoring of the JOG operation

STEP 5

Monitor the JOG operation status.

Monitor using GX Works2.

JOG operation stop

STEP 6

Turn OFF the JOG start signal that is ON.

Stop the JOG operation when the JOG start signal is turned OFF using the sequence program in STEP 2.

End of control

REMARK

- Mechanical elements such as limit switches are considered as already installed.
- Parameter settings work in common for all control using the Simple Motion module.

11.2.3 Setting the required parameters for JOG operation

The "Positioning parameters" must be set to carry out JOG operation.
The following table shows the setting items of the required parameters for carrying out JOG operation. Parameters not shown below are not required to be set for carrying out only JOG operation. (Use the initial values or setting values within a range where no error occurs for trouble-free operation.)

Setting item			Setting requirement	Factory-set initial value (setting details)
Positioning parameters	Pr.1	Unit setting	◎	3 (PLS)
	Pr.2	Number of pulses per rotation (AP) (Unit: PLS)	◎	20000
	Pr.3	Movement amount per rotation (AL) (Unit: PLS)	◎	20000
	Pr.4	Unit magnification (AM)	◎	1 (1 times)
	Pr.7	Bias speed at start (Unit: PLS/s)	○	0
	Pr.8	Speed limit value (Unit: PLS/s)	◎	200000
	Pr.9	Acceleration time 0 (Unit: PLS/s)	◎	1000
	Pr.10	Deceleration time 0 (Unit: PLS/s)	◎	1000
	Pr.11	Backlash compensation amount (Unit: PLS)	○	0
	Pr.12	Software stroke limit upper limit value (Unit: PLS)	○	2147483647
	Pr.13	Software stroke limit lower limit value (Unit: PLS)	○	–2147483648
	Pr.14	Software stroke limit selection	○	0 (current feed value)
	Pr.15	Software stroke limit valid/invalid setting	○	0 (valid)
	Pr.17	Torque limit setting value (Unit: %)	○	300
	Pr.25	Acceleration time 1 (Unit: ms)	○	1000
	Pr.26	Acceleration time 2 (Unit: ms)	○	1000
	Pr.27	Acceleration time 3 (Unit: ms)	○	1000
	Pr.28	Deceleration time 1 (Unit: ms)	○	1000
	Pr.29	Deceleration time 2 (Unit: ms)	○	1000
	Pr.30	Deceleration time 3 (Unit: ms)	○	1000
	Pr.31	JOG speed limit value (Unit: PLS/s)	◎	20000
	Pr.32	JOG operation acceleration time selection	◎	0 (acceleration time 0)
	Pr.33	JOG operation deceleration time selection	◎	0 (deceleration time 0)
	Pr.34	Acceleration/deceleration process selection	○	0 (trapezoidal acceleration/ deceleration processing)
	Pr.35	S-curve ratio (Unit: %)	○	100
	Pr.36	Sudden stop deceleration time (Unit: ms)	○	1000
	Pr.37	Stop group 1 sudden stop selection	○	0 (deceleration stop)
	Pr.38	Stop group 2 sudden stop selection	○	0 (deceleration stop)
	Pr.39	Stop group 3 sudden stop selection	○	0 (deceleration stop)

◎ : Setting always required.
○ : Set according to requirements (Leave set to the initial value when not used.)

REMARK

- Parameter settings work in common for all controls using the Simple Motion module. When carrying out other controls ("major positioning control", "high-level positioning control", "OPR positioning control"), set the respective setting items as well.
- Parameters are set for each axis.
- Refer to Chapter 5 "Data Used for Positioning Control" for the setting details.

11.2.4 Creating start programs for JOG operation

A sequence program must be created to execute a JOG operation. Consider the "required control data setting", "start conditions" and "start time chart" when creating the program.
The following shows an example when a JOG operation is started for axis 1.
(" Cd.17 JOG speed" is set to "100.00mm/min" in the example shown.)

■ Required control data setting

The control data shown below must be set to execute a JOG operation. The setting is carried out with the sequence program.

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Cd.16	Inching movement amount	0	Set "0".	1517+100n	4317+100n
Cd.17	JOG speed	10000	Set a value equal to or below the " Pr.31 JOG speed limit value".	1518+100n 1519+100n	4318+100n 4319+100n

n: Axis No.-1

*: Refer to Section 5.7 "List of control data" for details on the setting details.

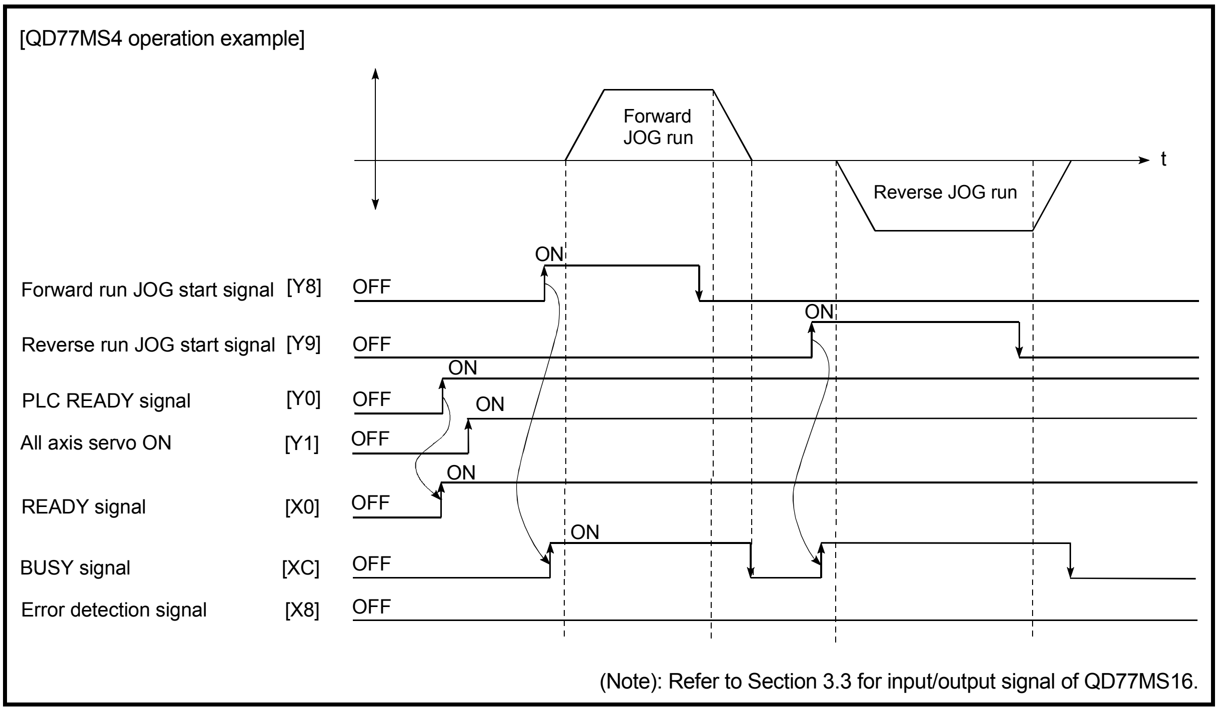
■ Start conditions

The following conditions must be fulfilled when starting. The required conditions must also be assembled in the sequence program, and the sequence program must be configured so the operation will not start if the conditions are not fulfilled.

Signal name		Signal state		Device	
				QD77MS2 QD77MS4	QD77MS16
Interface signal	PLC READY signal	ON	PLC CPU preparation completed	Y0	
	READY signal	ON	QD77MS preparation completed	X0	
	All axis servo ON	ON	All axis servo ON	Y1	
	Synchronization flag *	ON	QD77MS buffer memory The access is possible.	X1	
	Axis stop signal	OFF	Axis stop signal is OFF	Y4 to Y7	Cd.180 Axis stop
	Start complete signal	OFF	Start complete signal is OFF	X10 to X13	Md.31 Status: b14
	BUSY signal	OFF	QD77MS is not operating	XC to XF	X10 to X1F
	Error detection signal	OFF	There is no error	X8 to XB	Md.31 Status: b13
	M code ON signal	OFF	M code ON signal is OFF	X4 to X7	Md.31 Status: b12
External signal	Forced stop input signal	ON	There is no forced stop input	–	
	Stop signal	OFF	Stop signal is OFF	–	
	Upper limit (FLS)	ON	Within limit range	–	
	Lower limit (RLS)	ON	Within limit range	–	

*: If the PLC CPU is set to the asynchronous mode in the synchronization setting, this must be inserted in the program for interlocking. If it is set to the synchronous mode, it must not be inserted in the program for interlocking because it is turned ON when the PLC CPU executes calculation.

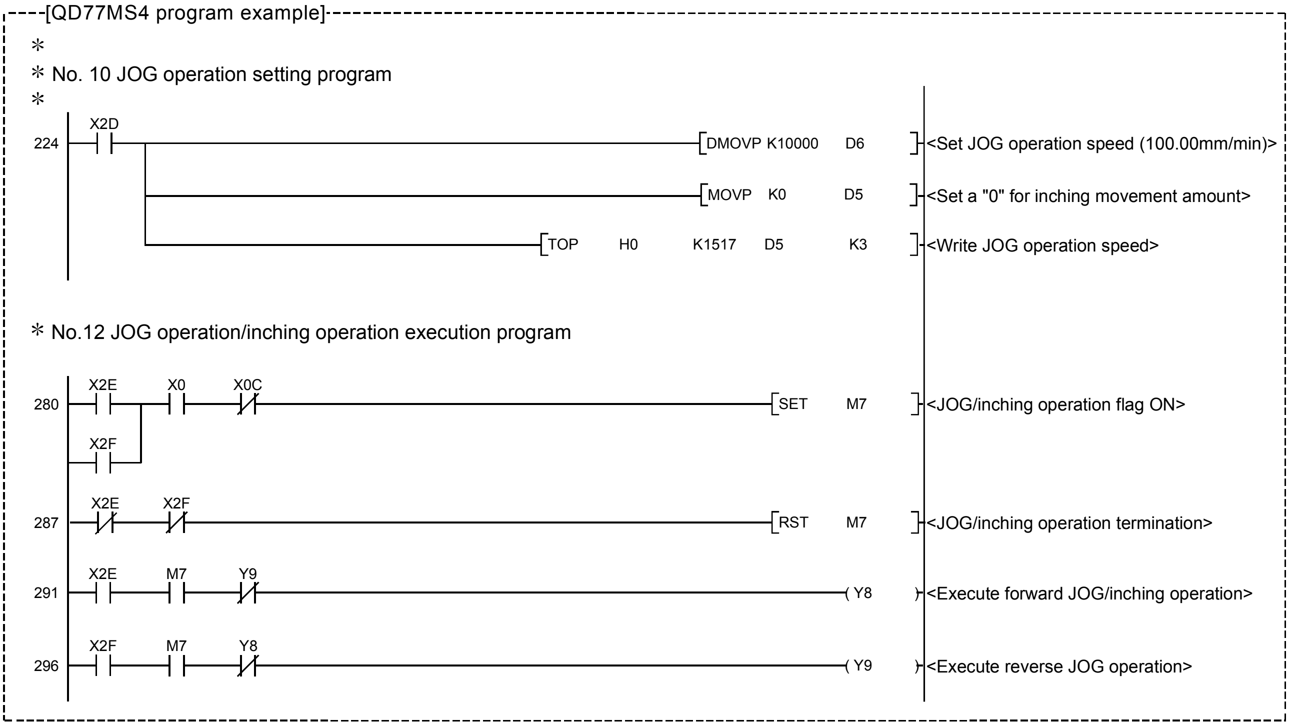
■ Start time chart



(Note): Refer to Section 3.3 for input/output signal of QD77MS16.

Fig. 11.6 JOG operation start time chart

■ Creating the program



11.2.5 JOG operation example

■ When the "stop signal" is turned ON during JOG operation

When the "stop signal" is turned ON during JOG operation, the JOG operation will stop by the "deceleration stop" method.
If the JOG start signal is turned ON while the stop signal is ON, an error "Stop signal ON at start" (error code: 106) will occur.
The operation can be started by turning the stop signal OFF, and turning the JOG start signal from OFF to ON again.

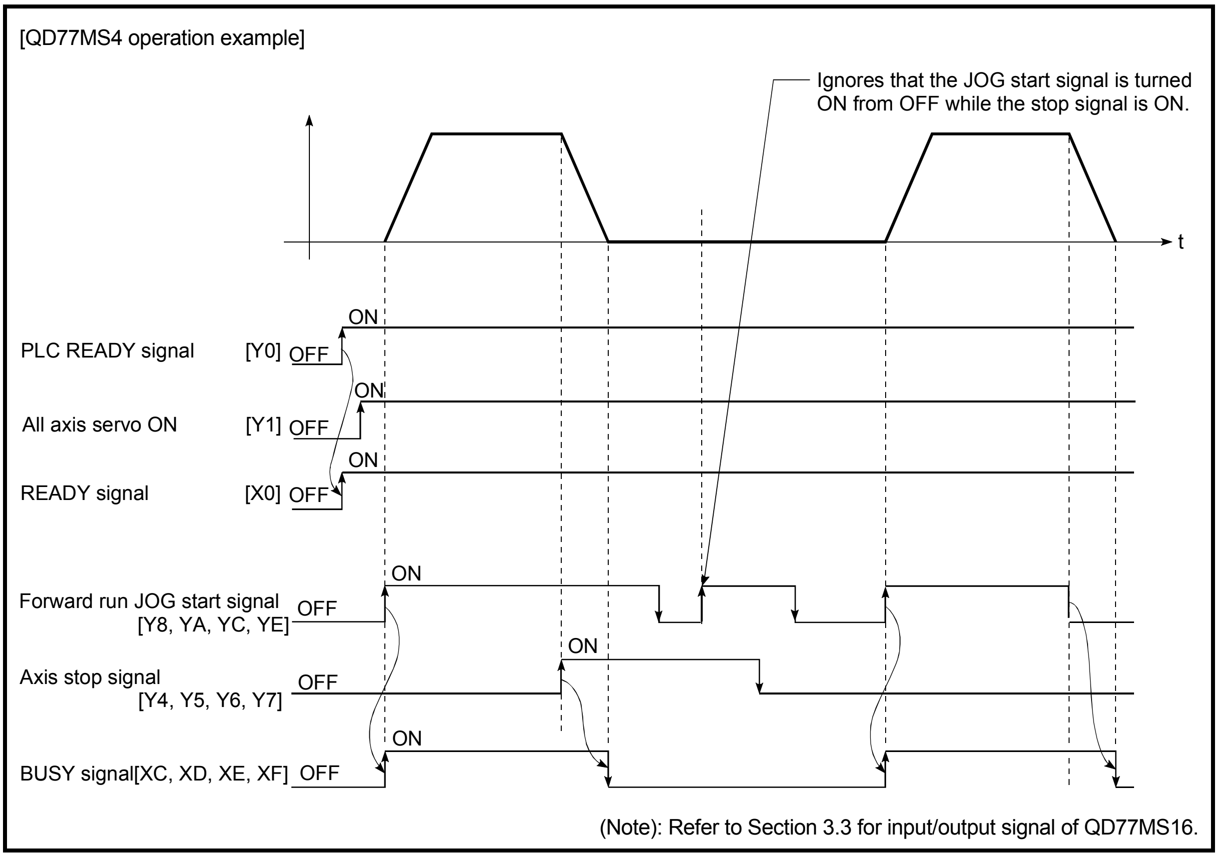


Fig. 11.7 Operation when the stop signal is turned ON during JOG operation

■ When both the "forward run JOG start signal" and "reverse run JOG start signal" are turned ON simultaneously for one axis

When both the "forward run JOG start signal" and "reverse run JOG start signal" are turned ON simultaneously for one axis, the "forward run JOG start signal" is given priority. In this case, the "reverse run JOG start signal" is validated when the BUSY signal of Simple Motion module is turned OFF.
If the forward run JOG operation is stopped due to stop by a stop signal or axis error, the reverse run JOG operation will not be executed even if the "reverse run JOG start signal" turns ON.

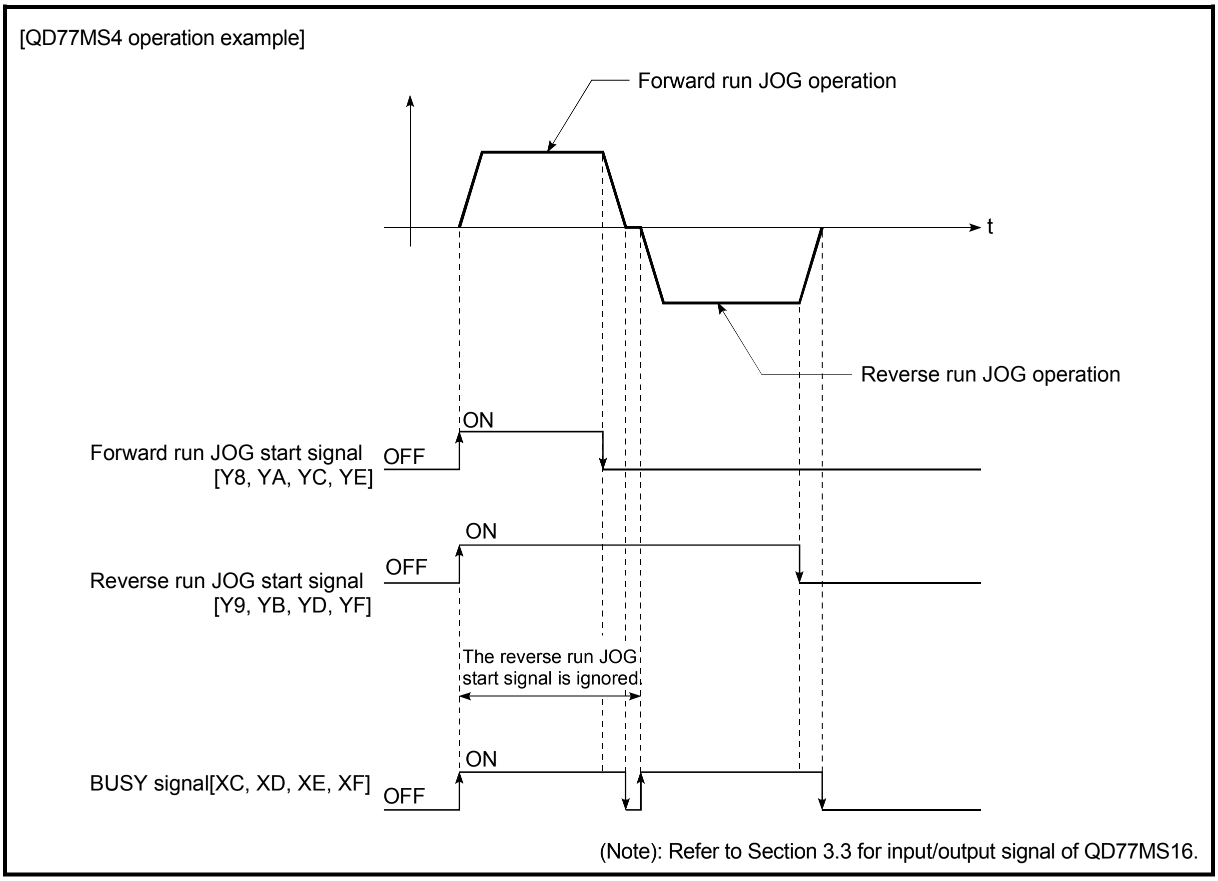
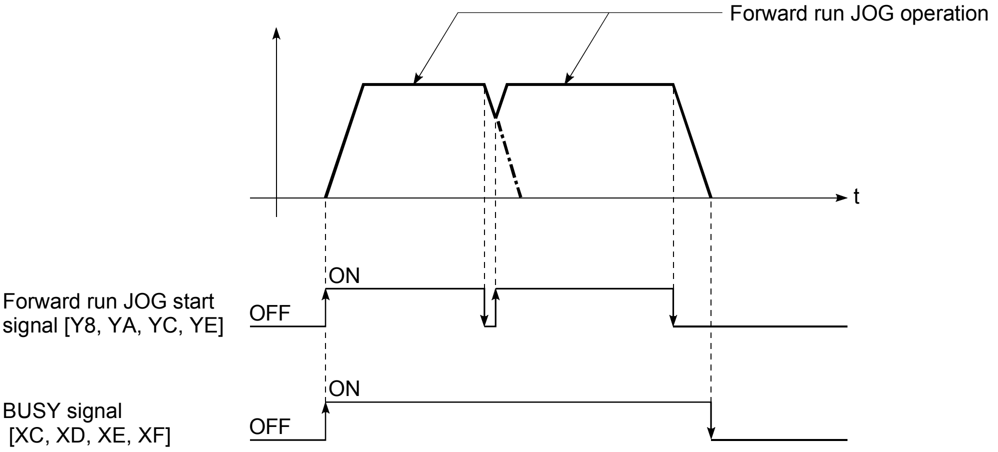


Fig. 11.8 Operation when both the forward run JOG start signal and reverse run JOG start signal are turned ON simultaneously

■ When the "JOG start signal" is turned ON again during deceleration caused by the ON → OFF of the "JOG start signal"

When the "JOG start signal" is turned ON again during deceleration caused by the ON → OFF of the "JOG start signal", the JOG operation will be carried out from the time the "JOG start signal" is turned ON.

[QD77MS4 operation example]



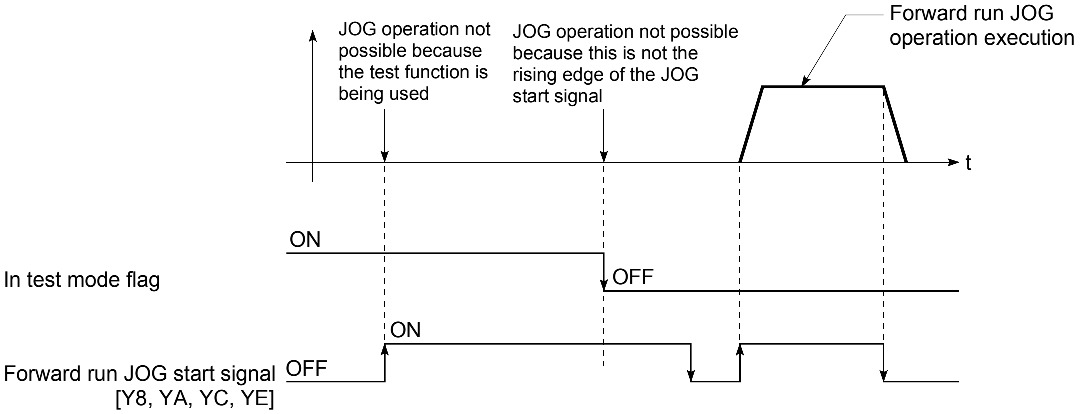
(Note): Refer to Section 3.3 for input/output signal of QD77MS16.

Fig. 11.9 Operation when the JOG start signal is turned ON during deceleration

■ When the "JOG start signal" is turned ON while the test function of GX Works2 is used

When the "JOG start signal" is turned ON while the test function of GX Works2 is used, it will be ignored and the JOG operation will not be carried out.

[QD77MS4 operation example]



(Note): Refer to Section 3.3 for input/output signal of QD77MS16.

Fig. 11.10 Operation when the JOG start signal is turned ON while the test function is used

11.3 Inching operation

11.3.1 Outline of inching operation

■ Inching operation

In inching operation, pulses are output to the servo amplifier at operation cycle to move the workpiece by a designated movement amount after the forward run JOG start signal or reverse JOG start signal is turned ON.

Signal	QD77MS2	QD77MS4	QD77MS16
Forward run JOG start signal	Y8, YA	Y8, YA, YC, YE	Cd.181 Forward run JOG start
Reverse run JOG start signal	Y9, YB	Y9, YB, YD, YF	Cd.182 Reverse run JOG start

The following shows the example of inching operation.

1)	When the start signal is turned ON, inching operation is carried out in the direction designated by the start signal. In this case, BUSY signal is turned from OFF to ON.
2)	The workpiece is moved by a movement amount set in "Cd.16 Inching movement amount".
3)	The workpiece movement stops when the speed becomes "0". In this case, BUSY signal is turned from ON to OFF. The positioning complete signal is turned from OFF to ON.
4)	The positioning complete signal is turned from ON to OFF after a time set in "Pr.40 Positioning complete signal output time" has been elapsed.

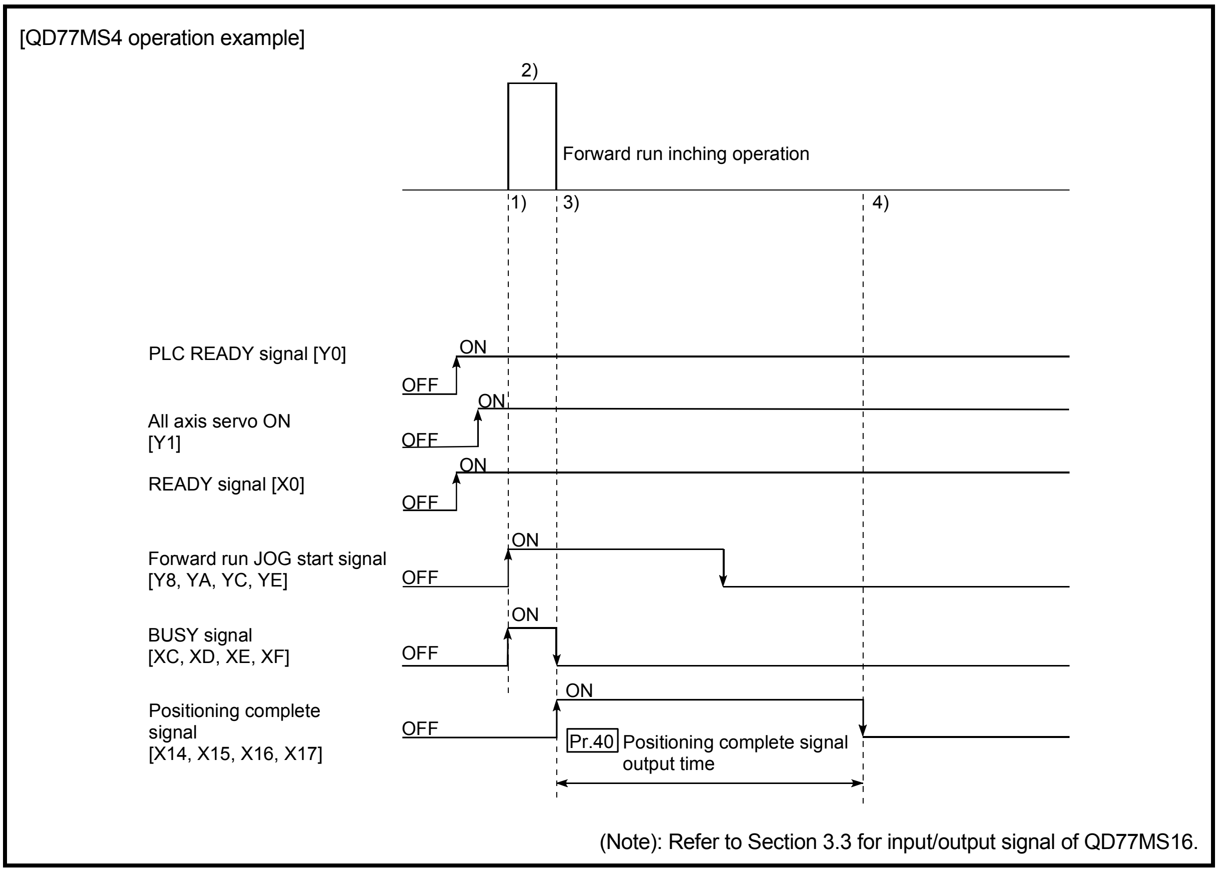


Fig. 11.11 Inching operation

Important

When the inching operation is carried out near the upper or lower limit, use the hardware stroke limit function (Refer to Section 13.4.4).
If the hardware stroke limit function is not used, the workpiece may exceed the movement range, and an accident may result.

■ Precautions during operation

The following details must be understood before inching operation is carried out.

(1) Acceleration/deceleration processing is not carried out during inching operation.
(Commands corresponding to the designated inching movement amount are output at operation cycle. When the movement direction of inching operation is reversed and backlash compensation is carried out, commands corresponding to the backlash amount are output at operation cycle at first. Then, commands corresponding to the designated inching movement amount are output in the subsequent operation cycles.)
The "Cd.17 JOG speed" is ignored even if it is set. An error will occur in the following cases (error code: 301).
(Cd.16 Inching movement amount) x (A) > (Pr.31 JOG speed limit value)

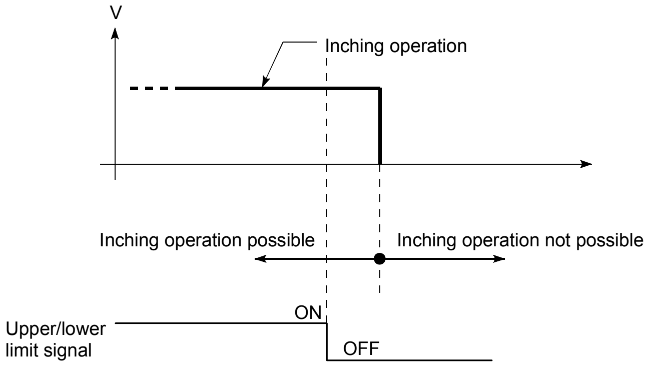
However, (A) is as follows.

	Operation cycle	
	0.88	1.77
When the unit setting is PLS	1125	562.5
When the unit setting is degree and the "Pr.83 Speed control 10 x multiplier setting for degree axis" is valid	67.5	33.75
When the unit setting is other than the above	675	337.5

(2) Set a value other than a "0" in "Cd.16 Inching movement amount".
If a "0" is set, the operation will become JOG operation (Refer to Section 11.2 "JOG operation").

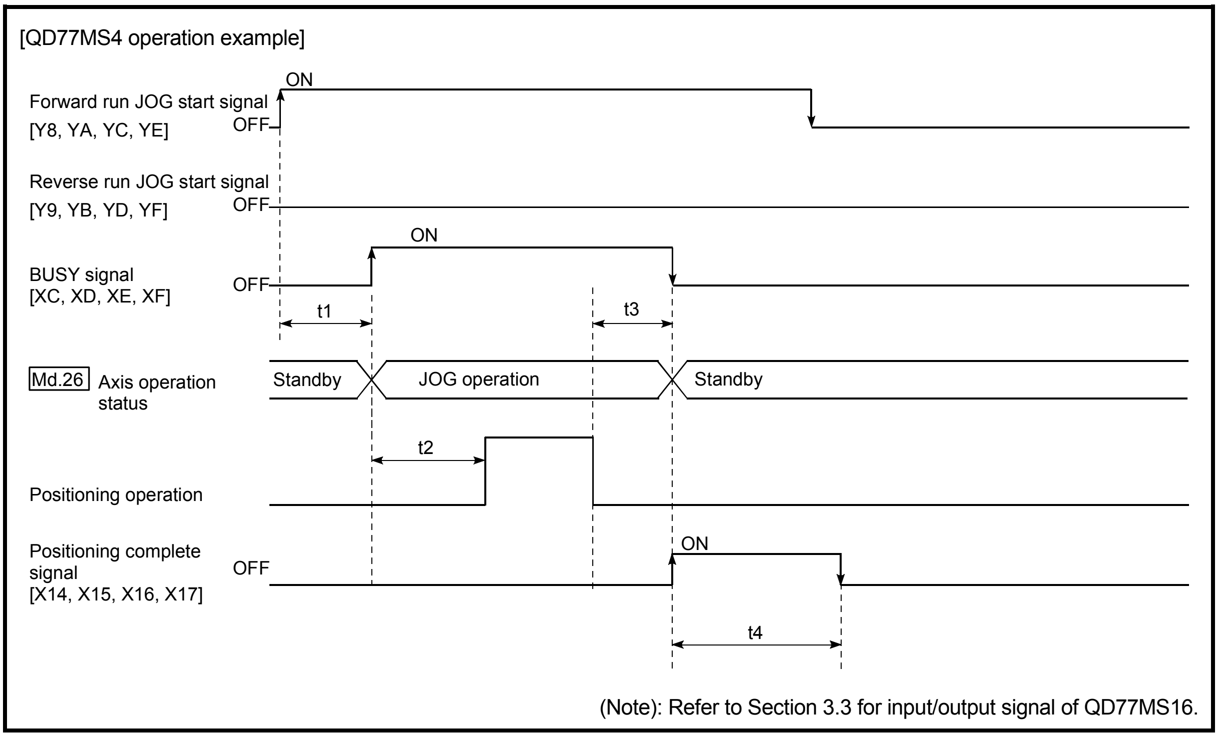
■ Operations when stroke limit error occurs

When the operation is stopped by hardware stroke limit error or software stroke limit error, the inching operation can be performed in an opposite way (direction within normal limits) after an error reset.
(An error will occur again if JOG start signal is turned ON in a direction to outside the stroke limit.)



■ Inching operation timing and processing times

The following drawing shows the details of the inching operation timing and processing time.



(Note): Refer to Section 3.3 for input/output signal of QD77MS16.

Fig. 11.12 Inching operation timing and processing times

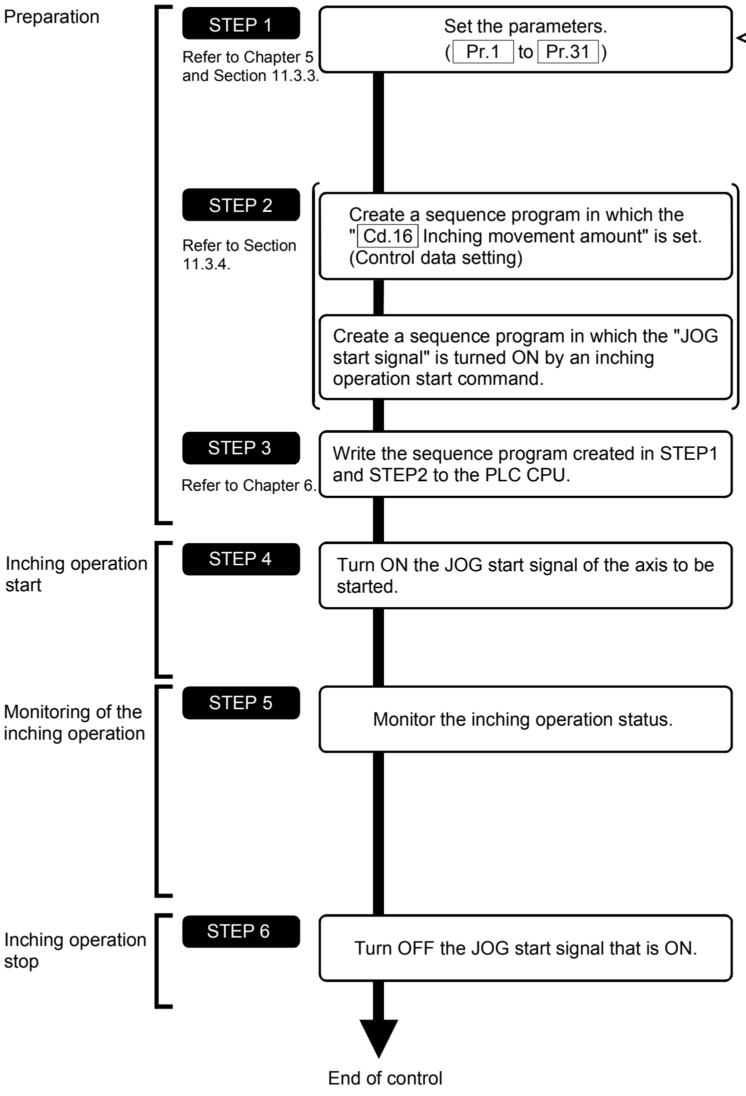
Normal timing times Unit : [ms]

	Operation cycle	t1	t2	t3	t4
QD77MS2	0.88	0.4 to 0.9	1.8 to 2.7	0 to 0.9	Follows parameters
	1.77	0.4 to 1.4	3.2 to 3.9	0 to 1.8	Follows parameters
QD77MS4	0.88	0.4 to 0.9	1.8 to 2.7	0 to 0.9	Follows parameters
	1.77	0.4 to 1.4	3.2 to 3.9	0 to 1.8	Follows parameters
QD77MS16	0.88	0.4 to 0.9	1.8 to 2.7	0 to 0.9	Follows parameters
	1.77	0.8 to 1.4	3.2 to 3.9	0 to 1.8	Follows parameters

- Depending on the operating statuses of the other axes, delay may occur in the t1 timing time.

11.3.2 Inching operation execution procedure

The inching operation is carried out by the following procedure.



One of the following two methods can be used.
<Method 1>
Directly set (write) the parameters in the Simple Motion module using GX Works2.
<Method 2>
Set (write) the parameters from the PLC CPU to the Simple Motion module using the sequence program (TO command).

Turn ON the JOG start signal.

	QD77MS2/QD77MS4	QD77MS16
Forward run JOG start signal	Y8, YA, YC, YE	Cd.181 Forward run JOG start
Reverse run JOG start signal	Y9, YB, YD, YF	Cd.182 Reverse run JOG start

Monitor using GX Works2.

End the inching operation after moving a workpiece by an inching movement amount with the sequence program created in STEP 2.

REMARK

- Mechanical elements such as limit switches are considered as already installed.
- Parameter settings work in common for all control using the Simple Motion module.

11.3.3 Setting the required parameters for inching operation

The "Positioning parameters" must be set to carry out inching operation.
The following table shows the setting items of the required parameters for carrying out inching operation. Parameters not shown below are not required to be set for carrying out only inching operation. (Use the initial values or setting values within a range where no error occurs for trouble-free operation.)

Setting item			Setting requirement	Factory-set initial value (setting details)
Positioning parameters	Pr.1	Unit setting	◎	3 (PLS)
	Pr.2	Number of pulses per rotation (AP) (Unit: PLS)	◎	20000
	Pr.3	Movement amount per rotation (AL) (Unit: PLS)	◎	20000
	Pr.4	Unit magnification (AM)	◎	1 (1 times)
	Pr.11	Backlash compensation amount (Unit: PLS)	○	0
	Pr.12	Software stroke limit upper limit value (Unit: PLS)	○	2147483647
	Pr.13	Software stroke limit lower limit value (Unit: PLS)	○	–2147483648
	Pr.14	Software stroke limit selection	○	0 (current feed value)
	Pr.15	Software stroke limit valid/invalid setting	○	0 (valid)
	Pr.17	Torque limit setting value (Unit: %)	○	300
	Pr.31	JOG speed limit value (Unit: PLS/s)	◎	20000

◎ : Setting always required.
○ : Set according to requirements (Leave set to the initial value when not used.)

REMARK

- Positioning parameter settings work in common for all controls using the Simple Motion module. When carrying out other controls ("major positioning control", "high-level positioning control", and "OPR control"), set the respective setting items as well.
- Parameters are set for each axis.
- Refer to Chapter 5 "Data Used for Positioning Control" for the setting details.

11.3.4 Creating a program to enable/disable the inching operation

A sequence program must be created to execute an inching operation. Consider the "required control data setting", "start conditions", and "start time chart" when creating the program.
The following shows an example when an inching operation is started for axis 1. (The example shows the inching operation when a "10.0 μm" is set in " Cd.16 Inching movement amount".)

■ Required control data setting

The control data shown below must be set to execute an inching operation. The setting is carried out with the sequence program.

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Cd.16	Inching movement amount	100	Set the setting value so that the JOG speed limit value is not increased larger than the maximum output pulse	1517+100n	4317+100n

n: Axis No.-1

＊: Refer to Section 5.7 "List of control data" for information on setting details.

■ Start conditions

The following conditions must be fulfilled when starting. The required conditions must also be assembled in the sequence program, and the sequence program must be configured so the operation will not start if the conditions are not fulfilled.

Signal name		Signal state		Device	
				QD77MS2 QD77MS4	QD77MS16
Interface signal	PLC READY signal	ON	PLC CPU preparation completed	Y0	
	READY signal	ON	QD77MS preparation completed	X0	
	All axis servo ON	ON	All axis servo ON	Y1	
	Synchronization flag ＊	ON	Accessible to QD77MS buffer memory	X1	
	Axis stop signal	OFF	Axis stop signal is OFF	Y4 to Y7	Cd.180 Axis stop
	Start complete signal	OFF	Start complete signal is OFF	X10 to X13	Md.31 Status: b14
	BUSY signal	OFF	QD77MS is not operating	XC to XF	X10 to X1F
	Positioning complete signal	OFF	Positioning complete signal is OFF	X14 to X17	Md.31 Status: b15
	Error detection signal	OFF	There is no error	X8 to XB	Md.31 Status: b13
	M code ON signal	OFF	M code ON signal is OFF	X4 to X7	Md.31 Status: b12
External signal	Forced stop input signal	ON	There is no forced stop input	–	
	Stop signal	OFF	Stop signal is OFF	–	
	Upper limit (FLS)	ON	Within limit range	–	
	Lower limit (RLS)	ON	Within limit range	–	

＊: If the PLC CPU is set to the asynchronous mode in the synchronization setting, this must be inserted in the program for interlocking. If it is set to the synchronous mode, it must not be inserted in the program for interlocking because it is turned ON when the PLC CPU executes calculation.

■ Start time chart

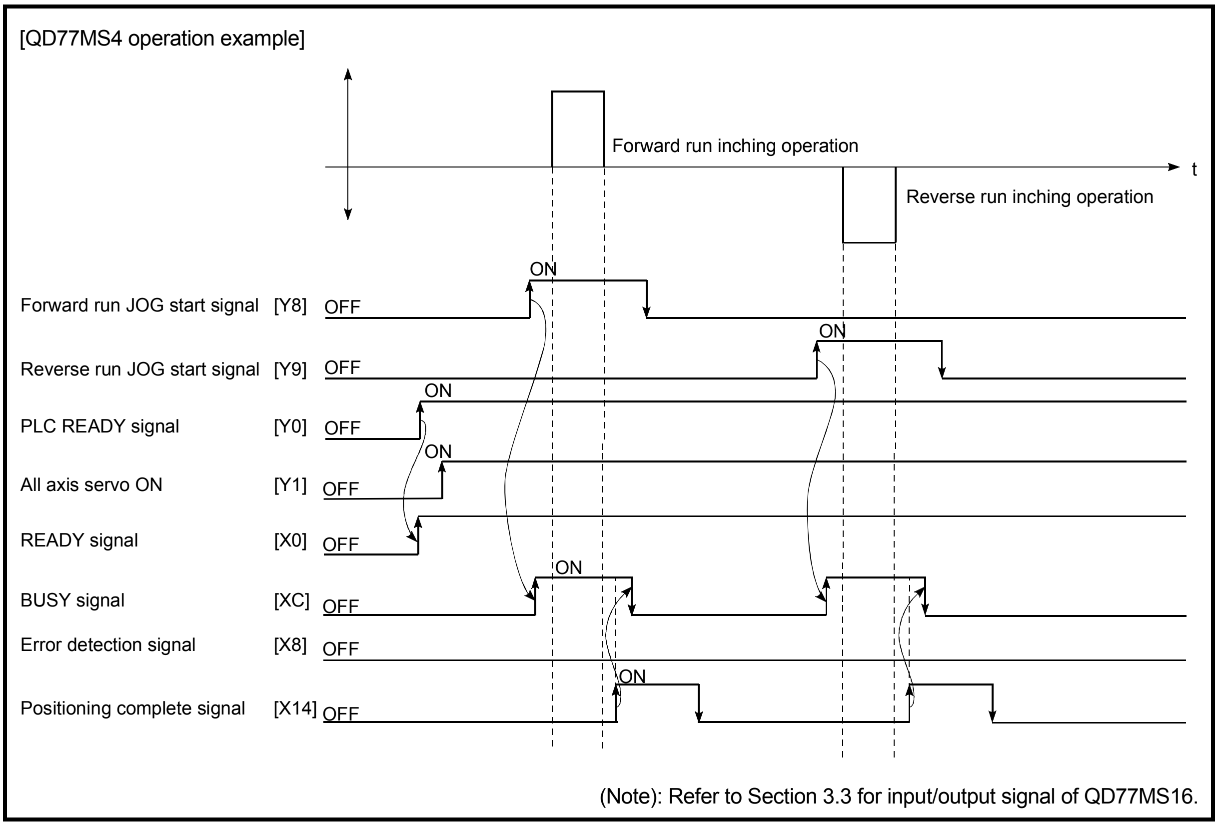
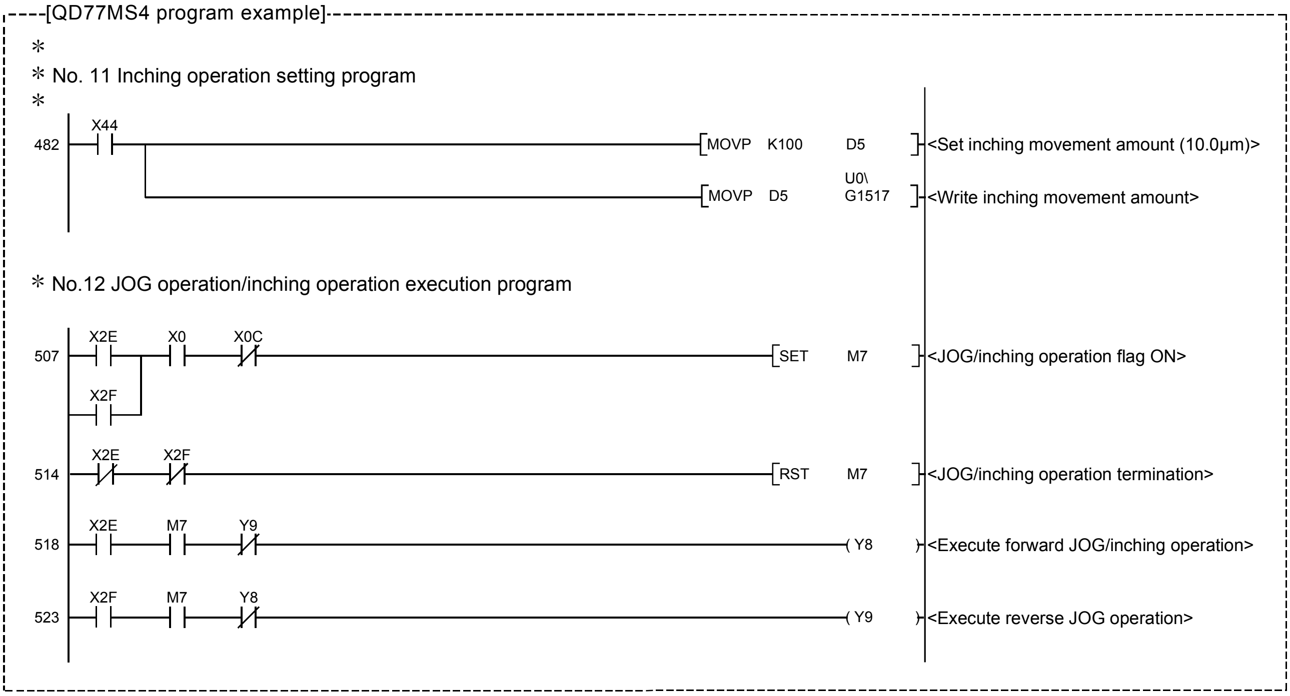


Fig. 11.13 Inching operation start time chart

■ Creating the program

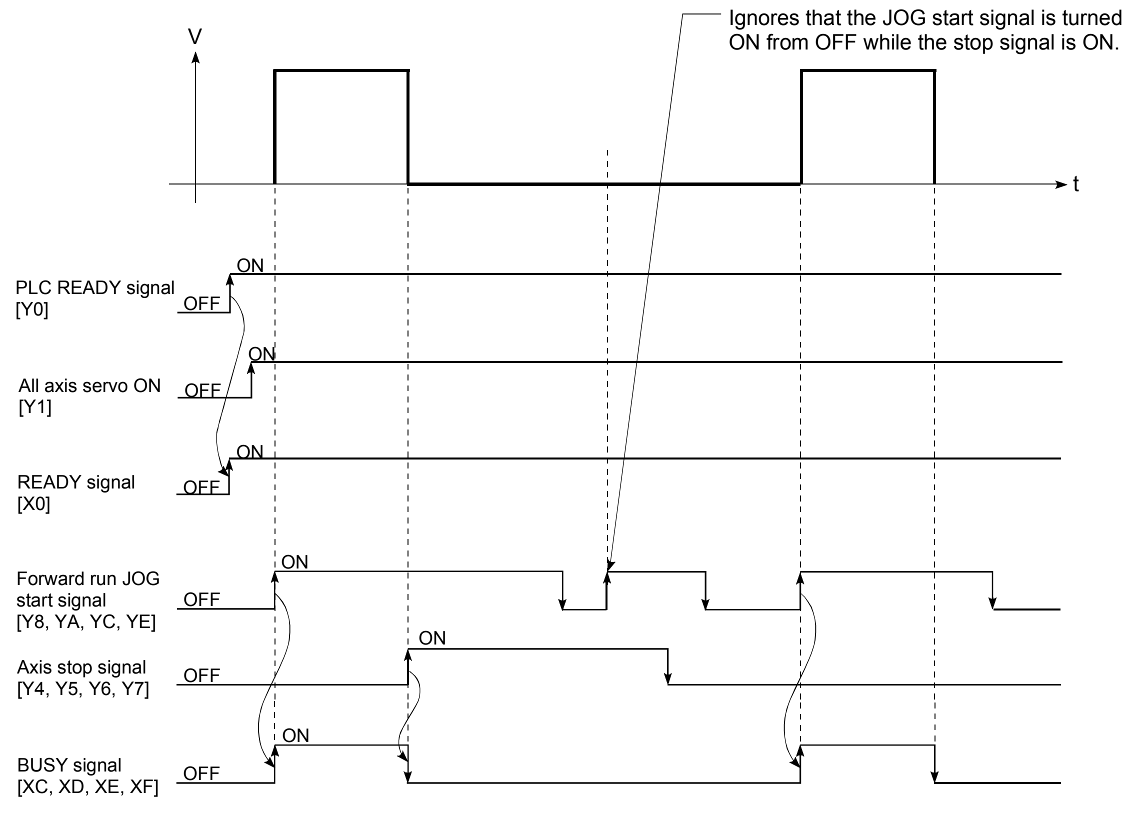


11.3.5 Inching operation example

■ When executing inching operation while stop signal is turned ON

If the JOG start signal is turned ON while the stop signal is ON, an error "Stop signal ON at start" (error code: 106) will occur.
The inching operation can be re-started when the stop signal is turned OFF and then re-turned ON.

[QD77MS4 operation example]



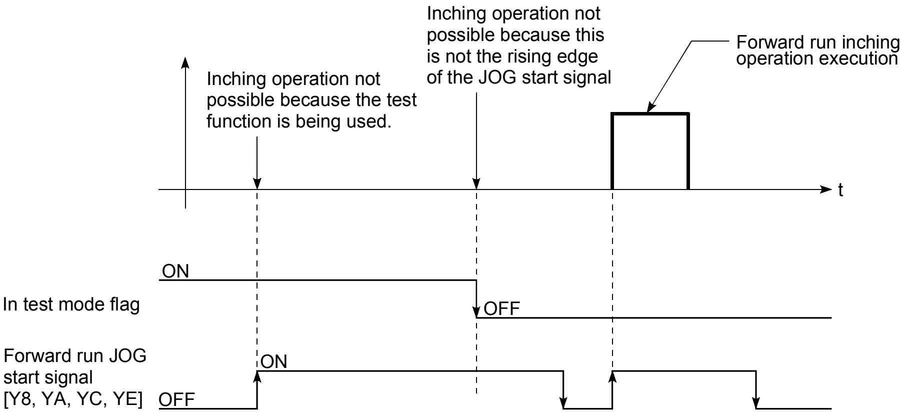
(Note): Refer to Section 3.3 for input/output signal of QD77MS16.

Fig. 11.14 Operation when executing inching operation while stop signal is turned ON

■ When the "JOG start signal" is turned ON while the test function of GX Works2 is used

When the "JOG star signal" is turned ON while the test function is used, it will be ignored and the inching operation will not be carried out.

[QD77MS4 operation example]



(Note): Refer to Section 3.3 for input/output signal of QD77MS16.

Fig. 11.15 Operation when the JOG start signal is turned ON while the test function is used

11.4 Manual pulse generator operation

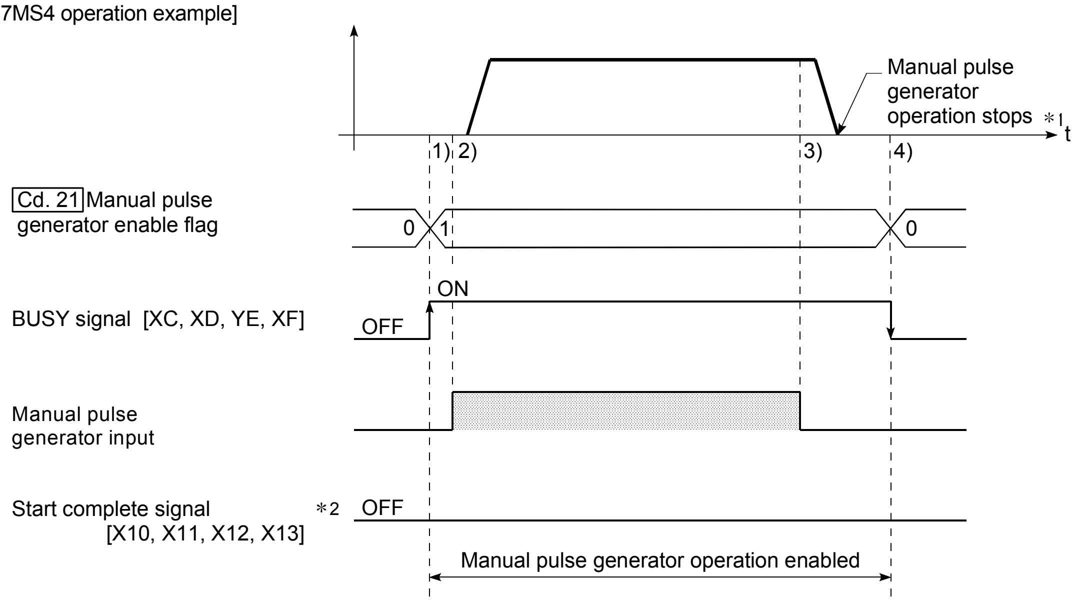
11.4.1 Outline of manual pulse generator operation

■ Manual pulse generator operation

In manual pulse generator operations, pulses are input to the Simple Motion module from the manual pulse generator. This causes the same number of input command to be output from the Simple Motion module to the servo amplifier, and the workpiece is moved in the designated direction.
The following shows an example of manual pulse generator operation.

1)	When the "Cd.21 Manual pulse generator enable flag" is set to "1", the BUSY signal turns ON and the manual pulse generator operation is enabled.
2)	The workpiece is moved corresponding to the number of pulses input from the manual pulse generator.
3)	The workpiece movement stops when no more pulses are input from the manual pulse generator.
4)	When the "Cd.21 Manual pulse generator enable flag" is set to "0", the BUSY signal turns OFF and the manual pulse generator operation is disabled.

[QD77MS4 operation example]



(Note): Refer to Section 3.3 for input/output signal of QD77MS16.

[Precautions]

*1: If the input from the manual pulse generator stops, the machine will decelerate to a stop within 25 ms.
*2: The start complete signal does not turn ON in manual pulse generator operation.

Fig. 11.16 Manual pulse generator operation

Important

Create the sequence program so that "Cd.21 Manual pulse generator enable flag" is always set to "0" (disabled) when a manual pulse generator operation is not carried out.
Mistakenly touching the manual pulse generator when the "manual pulse generator enable flag" is set to "1" (enable) can cause accidents or incorrect positioning.

■ Restricted items

A manual pulse generator is required to carry out manual pulse generator operation.

■ Precautions during operation

The following details must be understood before carrying out manual pulse generator operation.

(1) The speed during manual pulse generator operation is not limited by the "Pr.8 Speed limit value".

(2) If the "Cd.21 Manual pulse generator enable flag" is turned ON while the Simple Motion module is BUSY (BUSY signal ON), a warning will occur (warning code 100: start during operation).

(3) If a stop factor occurs during manual pulse generator operation, the operation will stop, and the BUSY signal will turn OFF.
At this time, the "Cd.21 Manual pulse generator enable flag" will be left ON, but manual pulse generator operation will not be possible. To carry out manual pulse generator operation again, measures must be carried out to eliminate the stop factor. Once eliminated, the operation can be carried out again by turning the "Cd.21 Manual pulse generator enable flag" ON → OFF → ON.
(Note that this excludes hardware/software stroke limit error.)

(4) Command will not be output if an error occurs when the manual pulse generator operation starts.

Important

The speed command is issued according to the input from the manual pulse generator irrelevant of the speed limit setting.
When the speed command is larger than 62914560pps (63Mpps), a servo error "Command frequency error (error code: 2035)" will occur.
The following calculation formula is used to judge whether or not an error will occur.

$$\text{(Speed command)} = \left(\begin{array}{l}\text{Number of}\\ \text{input pulses}\\ \text{for one}\\ \text{second}\end{array}\right) \times \left(\begin{array}{l}\text{Manual pulse}\\ \text{generator 1}\\ \text{pulse input}\\ \text{magnification}\end{array}\right) \times \left(\begin{array}{l}\text{Manual pulse}\\ \text{generator 1}\\ \text{pulse movement}\\ \text{amount}\end{array}\right) \times \left(\frac{\text{Number of pulses per rotation}}{\text{Movement amount per rotation}}\right)$$

If a large value is set to the manual pulse generator 1 pulse input magnification, there is a high possibility of a servo error "Command frequency error (error code: 2035)" occurrence. Note that the servomotor does not work rapidly by sudden pulse input even if the servo error will not occur.

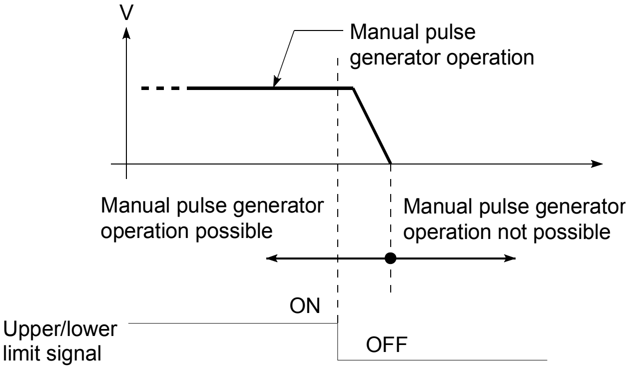
REMARK

- One Simple Motion module can be connected to one manual pulse generator.
- The Simple Motion module can simultaneously command to servo amplifier (QD77MS2: Axis 1 to 2, QD77MS4: Axis 1 to 4, QD77MS16: Axis 1 to 16) by one manual pulse generator.
  (Simultaneous operation (QD77MS2: 1 axis to 2 axes, QD77MS4: 1 axis to 4 axes, QD77MS16: 1 axis to 16 axes) is possible.)

■ Operations when stroke limit error occurs

When the hardware stroke limit error or the software stroke limit error is detected (Note-1) during operation, the operation will decelerate to a stop. However, in case of "Md.26 Axis operation status", "Manual pulse generator operation" will continue (Note-1). After stopping, manual pulse generator input pulses to the outside direction of the limit range are not accepted, but operation can be executed within the range.

(Note-1): Only when the current feed value or the machine feed value overflows or underflows during deceleration, the manual pulse generator operation will terminate as "error occurring". To carry out manual pulse generator operation again, "Cd.21 Manual pulse generator enable flag" must be turned OFF once and turn ON.



■ Manual pulse generator operation timing and processing time

The following drawing shows details of the manual pulse generator operation timing and processing time.

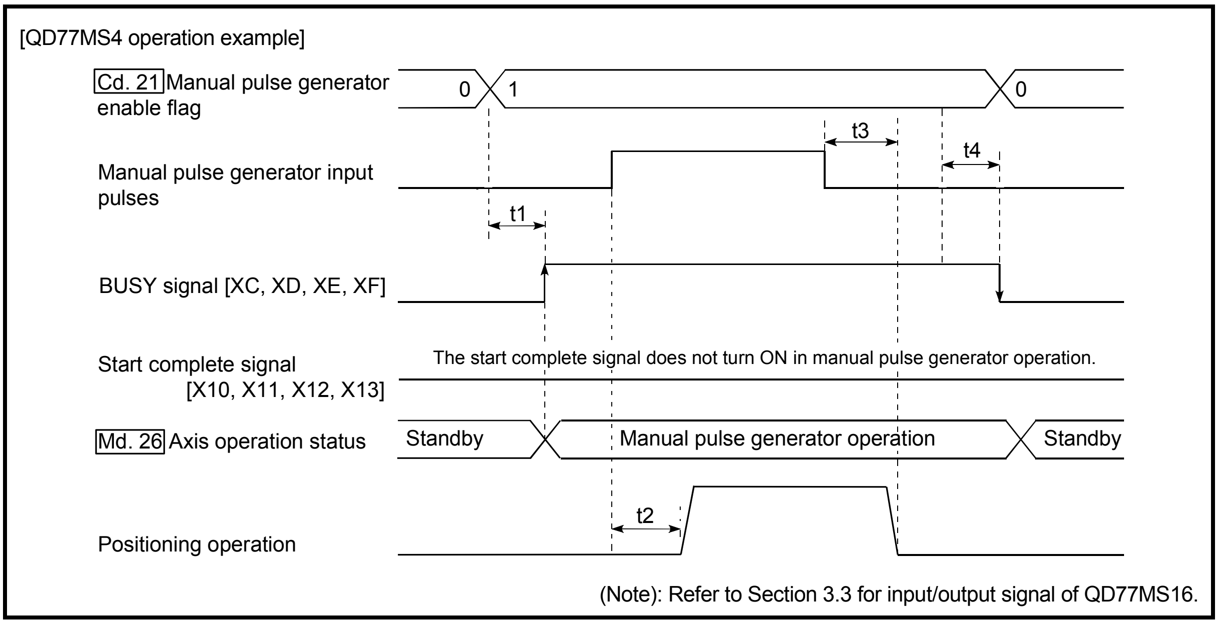


Fig. 11.17 Manual pulse generator operation timing and processing times

Normal timing times Unit : [ms]

	Operation cycle	t1	t2	t3	t4
QD77MS2	0.88	0.6 to 0.9	10.0 to 15.0	18.0 to 25.0	9.6
	1.77	0.6 to 1.8	10.0 to 15.0	18.0 to 25.0	9.6
QD77MS4	0.88	0.6 to 0.9	10.0 to 15.0	18.0 to 25.0	9.6
	1.77	0.6 to 1.8	10.0 to 15.0	18.0 to 25.0	9.6
QD77MS16	0.88	0.6 to 0.9	10.0 to 15.0	18.0 to 25.0	9.6
	1.77	0.8 to 1.8	10.0 to 15.0	18.0 to 25.0	9.6

- Delays may occur in the t1 timing time due to the operation status of other axes.

■ Position control by manual pulse generator operation

In manual pulse generator operation, the position is moved by a "manual pulse generator 1 pulse movement amount" per pulse.
The current feed value in the positioning control by manual pulse generator operation can be calculated using the expression shown below.

Current feed value = Number of input pulses
× Cd.20 Manual pulse generator 1 pulse input magnification
× Manual pulse generator 1 pulse movement amount

Pr.1 Unit setting	mm	inch	degree	PLS
Manual pulse generator 1 pulse movement amount	0.1μm	0.00001inch	0.00001degree	1PLS

For example, when "Pr.1 Unit setting" is mm and "Cd.20 Manual pulse generator 1 pulse input magnification" is 2, and 100 pulses are input from the manual pulse generator, the current feed value is as follows.

100 × 2 × 0.1 = 20 [μm] ("Md.20 Current feed value"=200)

The number of pulses output actually to the servo amplifier is "Manual pulse generator 1pulse movement amount/movement amount per pulse (Note)". For example, when "Pr.1 Unit setting" is mm and the movement amount per pulse is 1μm, 0.1/1 = 1/10, i.e., the output to the servo amplifier per pulse from the manual pulse generator is 1/10pulse. Thus, the Simple Motion module outputs 1pulse to the servo amplifier after receiving 10pulses from the manual pulse generator.

$$\text{(Note): Movement amount per pulse} = \frac{\text{"Pr.3 Movement amount per rotation(AL)"}}{\text{"Pr.2 Number of pulses per rotation(AP)"}} \times \text{"Pr.4 Unit magnification(AM)"}$$

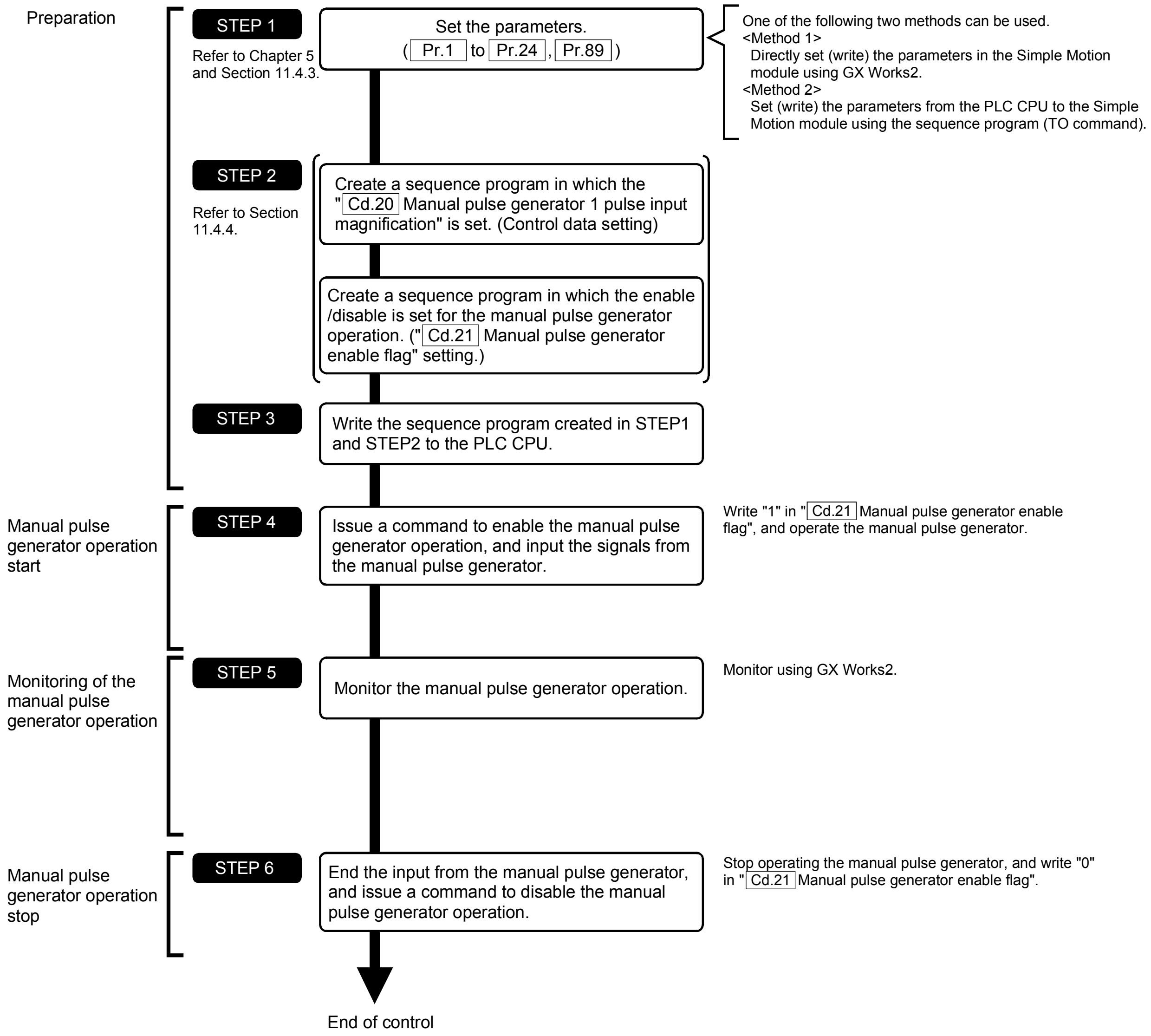
■ Speed control by manual pulse generation operation

The speed during positioning control by manual pulse generator operation is a speed corresponding to the number of input pulses per unit time, and can be obtained using the following equation.

Output command frequency = Input frequency × Cd.20 Manual pulse generator 1 pulse input magnification

11.4.2 Manual pulse generator operation execution procedure

The manual pulse generator operation is carried out by the following procedure.



Preparation

STEP 1
Refer to Chapter 5 and Section 11.4.3.

Set the parameters. (Pr.1 to Pr.24 , Pr.89)

One of the following two methods can be used.
<Method 1>
Directly set (write) the parameters in the Simple Motion module using GX Works2.
<Method 2>
Set (write) the parameters from the PLC CPU to the Simple Motion module using the sequence program (TO command).

STEP 2
Refer to Section 11.4.4.

Create a sequence program in which the " Cd.20 Manual pulse generator 1 pulse input magnification" is set. (Control data setting)

Create a sequence program in which the enable /disable is set for the manual pulse generator operation. (" Cd.21 Manual pulse generator enable flag" setting.)

STEP 3

Write the sequence program created in STEP1 and STEP2 to the PLC CPU.

Manual pulse generator operation start

STEP 4

Issue a command to enable the manual pulse generator operation, and input the signals from the manual pulse generator.

Write "1" in " Cd.21 Manual pulse generator enable flag", and operate the manual pulse generator.

Monitoring of the manual pulse generator operation

STEP 5

Monitor the manual pulse generator operation.

Monitor using GX Works2.

Manual pulse generator operation stop

STEP 6

End the input from the manual pulse generator, and issue a command to disable the manual pulse generator operation.

Stop operating the manual pulse generator, and write "0" in " Cd.21 Manual pulse generator enable flag".

End of control

REMARK

- Mechanical elements such as limit switches are considered as already installed.
- Parameter settings work in common for all control using the Simple Motion module.

11.4.3 Setting the required parameters for manual pulse generator operation

The "Positioning parameters" must be set to carry out manual pulse generator operation.
The following table shows the setting items of the required parameters for carrying out manual pulse generator operation. Parameters not shown below are not required to be set for carrying out only manual pulse generator operation. (Use the initial values or setting values within a range where no error occurs for trouble-free operation.)

Setting item			Setting requirement	Factory-set initial value (setting details)
Positioning parameters	Pr.1	Unit setting	◎	3 (PLS)
	Pr.2	Number of pulses per rotation (AP) (Unit: PLS)	◎	20000
	Pr.3	Movement amount per rotation (AL) (Unit: PLS)	◎	20000
	Pr.4	Unit magnification (AM)	◎	1 (1 times)
	Pr.8	Speed limit value (Unit: PLS/s)	◎	200000
	Pr.11	Backlash compensation amount (Unit: PLS)	○	0
	Pr.12	Software stroke limit upper limit value (Unit: PLS)	○	2147483647
	Pr.13	Software stroke limit lower limit value (Unit: PLS)	○	–2147483648
	Pr.14	Software stroke limit selection	○	0 (current feed value)
	Pr.15	Software stroke limit valid/invalid setting	○	0 (valid)
	Pr.17	Torque limit setting value (Unit: %)	○	300
	Pr.22	Input signal logic selection	○	0 (Manual pulse generator input is negative logic.)
	Pr.24	Manual pulse generator/Incremental synchronous encoder input selection	○	0 (4 times multiplication of A phase/B phase)
	Pr.89	Manual pulse generator/Incremental synchronous encoder input type selection	◎	0 (Differential output type)

◎ : Setting always required.
○ : Set according to requirements (Leave set to the initial value when not used.)

REMARK

- Positioning parameter settings work in common for all controls using the Simple Motion module. When carrying out other controls ("major positioning control", "high-level positioning control", "OPR control"), set the respective setting items as well.
- Parameters are set for each axis. But Pr.22 Manual pulse generator input (b8), Pr.24, Pr.89 is set only for axis 1. (The setting for other than axis 1 is ignored.)
- Refer to Chapter 5 "Data Used for Positioning Control" for the setting details.

11.4.4 Creating a program to enable/disable the manual pulse generator operation

A sequence program must be created to execute a manual pulse generator operation. Consider the "required control data setting", "start conditions" and "start time chart" when creating the program.

The following shows an example when a manual pulse generator operation is started for axis 1.

■ Required control data setting

The control data shown below must be set to execute a manual pulse generator operation. The setting is carried out with the sequence program.

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Cd.20	Manual pulse generator 1 pulse input magnification	1	Set the manual pulse generator 1 pulse input magnification. (1 to 10000 times)	1522+100n 1523+100n	4322+100n 4323+100n
Cd.21	Manual pulse generator enable flag	1 (0)	Set "1: Enable manual pulse generator operation". (Set "0: Disable manual pulse generator operation" when finished with the manual pulse generator operation.)	1524+100n	4324+100n

n: Axis No.-1

＊: Refer to Section 5.7 "List of control data" for details on the setting details.

■ Start conditions

The following conditions must be fulfilled when starting. The required conditions must also be assembled in the sequence program, and the sequence program must be configured so the operation will not start if the conditions are not fulfilled.

Signal name		Signal state		Device	
				QD77MS2 QD77MS4	QD77MS16
Interface signal	PLC READY signal	ON	PLC CPU preparation completed	Y0	
	READY signal	ON	QD77MS preparation completed	X0	
	All axis servo ON	ON	All axis servo ON	Y1	
	Synchronization flag ＊	ON	QD77MS buffer memory The access is possible.	X1	
	Axis stop signal	OFF	Axis stop signal is OFF	Y4 to Y7	Cd.180 Axis stop
	Start complete signal	OFF	Start complete signal is OFF	X10 to X13	Md.31 Status: b14
	BUSY signal	OFF	QD77MS is not operating	XC to XF	X10 to X1F
	Error detection signal	OFF	There is no error	X8 to XB	Md.31 Status: b13
	M code ON signal	OFF	M code ON signal is OFF	X4 to X7	Md.31 Status: b12
External signal	Forced stop input signal	ON	There is no forced stop input	–	
	Stop signal	OFF	Stop signal is OFF	–	
	Upper limit (FLS)	ON	Within limit range	–	
	Lower limit (RLS)	ON	Within limit range	–	

＊: If the PLC CPU is set to the asynchronous mode in the synchronization setting, this must be inserted in the program for interlocking. If it is set to the synchronous mode, it must not be inserted in the program for interlocking because it is turned ON when the PLC CPU executes calculation.

■ Start time chart

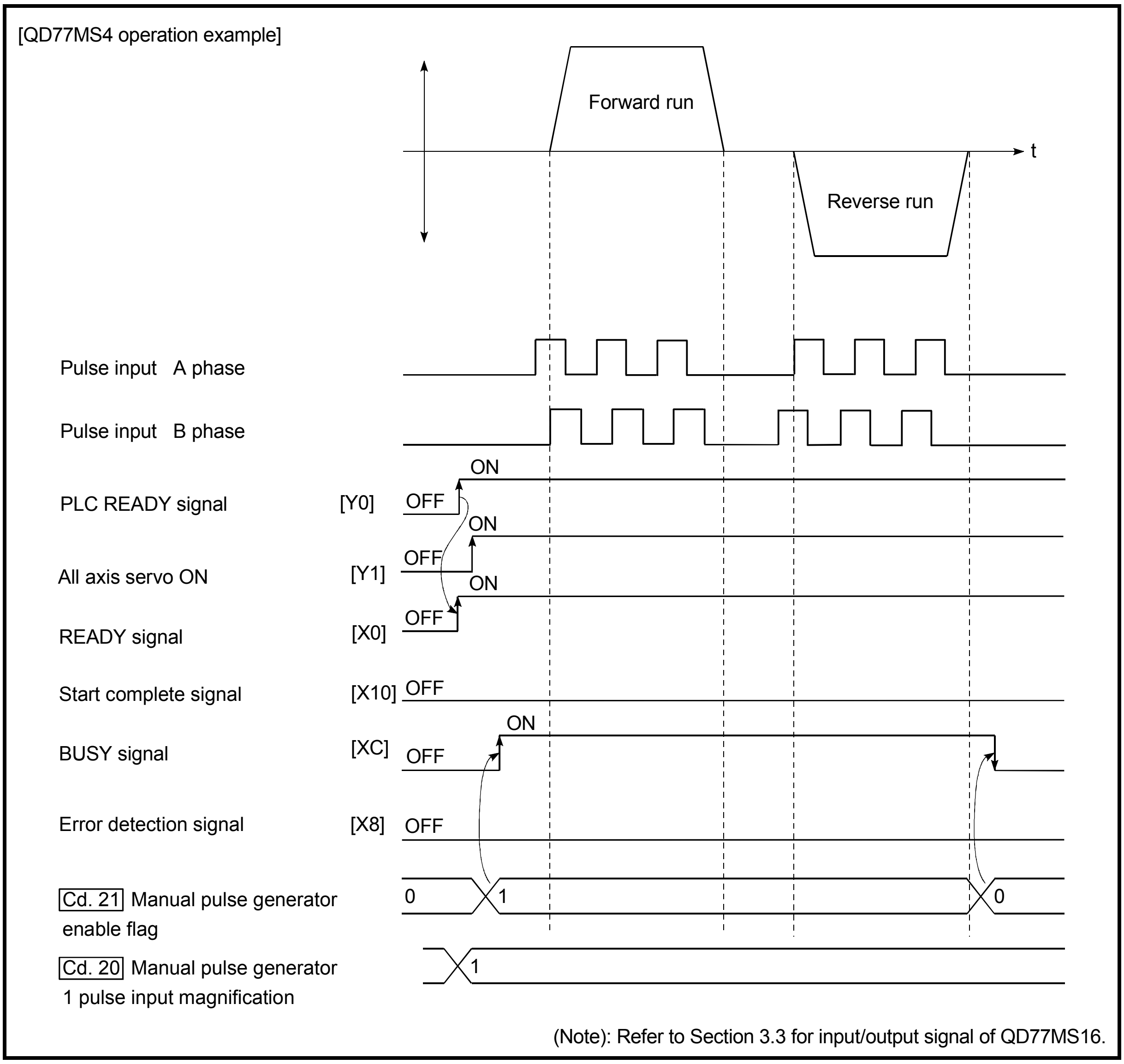
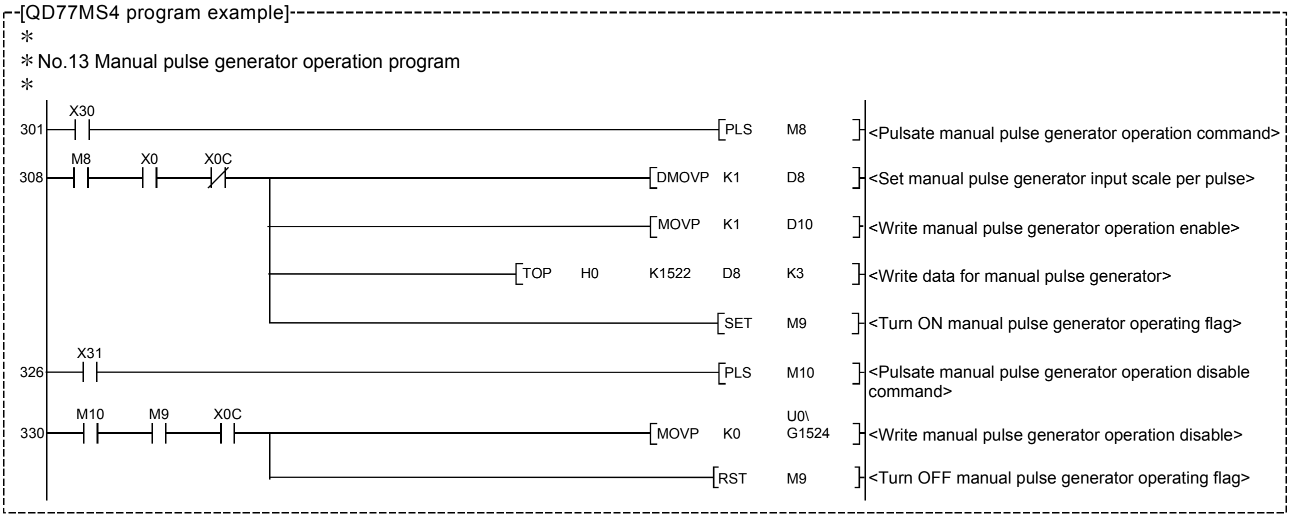


Fig. 11.18 Manual pulse generator operation start time chart

■ Creating the program



```
[QD77MS4 program example]
*
*No.13 Manual pulse generator operation program
*
301  X30                                   [PLS   M8                     ]<Pulsate manual pulse generator operation command>
308  M8  X0  X0C(b)                        [DMOVP K1     D8              ]<Set manual pulse generator input scale per pulse>
                                           [MOVP  K1     D10             ]<Write manual pulse generator operation enable>
                                           [TOP   H0     K1522  D8  K3   ]<Write data for manual pulse generator>
                                           [SET   M9                     ]<Turn ON manual pulse generator operating flag>
326  X31                                   [PLS   M10                    ]<Pulsate manual pulse generator operation disable command>
330  M10  M9  X0C                          [MOVP  K0     U0\G1524        ]<Write manual pulse generator operation disable>
                                           [RST   M9                     ]<Turn OFF manual pulse generator operating flag>
```

MEMO

Chapter 12 Expansion Control

The details and usage of expansion control are explained in this chapter.

Expansion control includes the speed-torque control to execute the speed control and torque control not including position loop and the synchronous control to synchronize with input axis using software with "synchronous control parameter" instead of controlling mechanically with gear, shaft, speed change gear or cam, etc.

Execute the required settings to match each control.

12.1 Speed-torque control

12.1.1 Outline of speed-torque control

This function is used to execute the speed control or torque control that does not include the position loop for the command to servo amplifier.
"Continuous operation to torque control mode" that switches the control mode to torque control mode without stopping the servomotor during positioning operation is also available for tightening a bottle cap or a screw.
Switch the control mode from "position control mode" to "speed control mode", "torque control mode" or "continuous operation to torque control mode" to execute the "Speed-torque control".

Control mode	Control	Remark
Position control mode	Positioning control, OPR control, JOG operation, Inching operation and Manual pulse generator operation	Control that include the position loop for the command to servo amplifier
Speed control mode	Speed-torque control	Control that does not include the position loop for the command to servo amplifier
Torque control mode		
Continuous operation to torque control mode		Control that does not include the position loop for the command to servo amplifier Control mode can be switched during positioning control or speed control.

Use the servo amplifiers whose software versions are compatible with each control mode to execute the "Speed-torque control".
Servo amplifier software versions that are compatible with each control mode are shown below.

Servo amplifier model	Software version		
	Speed control	Torque control	Continuous operation to torque control ∗1
MR-J4(W)-B	—	—	—
MR-J3-□B	—	B3 or later	C7 or later
MR-J3W-□B	—	—	Not compatible
MR-J3-□BS	—	—	C7 or later

—: There is no restriction by the version.

∗1: The torque generation direction of servomotor can be changed by setting the servo parameter "Function selection C-B POL reflection selection at torque control (PC29)" for the servo amplifier that is compatible with the continuous operation to torque control. (Refer to Section 12.1.4 "Operation of speed-torque control".)
For the servo amplifier that is not compatible with the continuous operation to torque control, the operation is the same as that of when "0: Enabled" is set in servo parameter "Function selection C-B POL reflection selection at torque control (PC29)".

⚠CAUTION

- If operation that generates torque more than 100% of the rating is performed with an abnormally high frequency in a servomotor stop status (servo lock status) or in a 30r/min or less low-speed operation status, the servo amplifier may malfunction regardless of the electronic thermal relay protection.

12.1.2 Setting the required parameters for speed-torque control

The "Positioning parameters" must be set to carry out speed-torque control.
The following table shows the setting items of the required parameters for carrying out speed-torque control. Parameters not shown below are not required to be set for carrying out only speed-torque control. (Use the initial values or setting values within a range where no error occurs for trouble-free operation.)

Setting item			Setting requirement
Positioning parameters	Pr.1	Unit setting	◎
	Pr.2	Number of pulses per rotation (AP)	◎
	Pr.3	Movement amount per rotation (AL)	◎
	Pr.4	Unit magnification (AM)	◎
	Pr.8	Speed limit value	◎
	Pr.12	Software stroke limit upper limit value	○
	Pr.13	Software stroke limit lower limit value	○
	Pr.14	Software stroke limit selection	○
	Pr.22	Input signal logic selection	◎
	Pr.82	Forced stop valid/invalid selection	○
	Pr.83	Speed control 10 x multiplier setting for degree axis	○
	Pr.90	Operation setting for speed-torque control mode	○

◎ : Setting always required.
○ : Set according to requirements (Leave set to the initial value when not used.)

REMARK

- Positioning parameter settings work in common for all controls using the Simple Motion module. When carrying out other controls ("major positioning control", "high-level positioning control", "OPR control"), set the respective setting items as well.
- Parameters are set for each axis.
- Refer to Chapter 5 "Data Used for Positioning Control" for the setting details.

12.1.3 Setting the required data for speed-torque control

■ Required control data setting for the control mode switching

The control data shown below must be set to execute the control mode switching.

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Cd.138	Control mode switching request	1	Set "1: Switching request" after setting "Cd.139 Control mode setting".	1574+100n	4374+100n
Cd.139	Control mode setting	→	Set the control mode to switch. 0: Position control mode 10: Speed control mode 20: Torque control mode 30: Continuous operation to torque control mode	1575+100n	4375+100n

n: Axis No.-1

∗: Refer to Section 5.7 "List of control data" for the setting details.

When "30: Continuous operation to torque control mode" is set, set the switching condition of the control mode to switch to the continuous operation to torque control mode.
The control data shown below must be set to set the switching condition of control mode.

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Cd.153	Control mode auto-shift selection	→	Set the switching condition when switching to continuous operation to torque control mode. 0: No switching condition 1: Current feed value pass 2: Real current value pass	1593+100n	4393+100n
Cd.154	Control mode auto-shift parameter	→	Set the condition value when setting the control mode switching condition.	1594+100n 1595+100n	4394+100n 4395+100n

n: Axis No.-1

∗: Refer to Section 5.7 "List of control data" for the setting details.

■ Required control data setting for the speed control mode

The control data shown below must be set to execute the speed control.

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Cd.140	Command speed at speed control mode	→	Set the command speed at speed control mode.	1576+100n 1577+100n	4376+100n 4377+100n
Cd.141	Acceleration time at speed control mode	→	Set the acceleration time at speed control mode.	1578+100n	4378+100n
Cd.142	Deceleration time at speed control mode	→	Set the deceleration time at speed control mode	1579+100n	4379+100n

n: Axis No.-1

∗: Refer to Section 5.7 "List of control data" for the setting details.

■ Required control data setting for the torque control mode

The control data shown below must be set to execute the torque control.

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Cd.143	Command torque at torque control mode	→	Set the command torque at torque control mode.	1580+100n	4380+100n
Cd.144	Torque time constant at torque control mode (Forward direction)	→	Set the time constant at driving during torque control mode.	1581+100n	4381+100n
Cd.145	Torque time constant at torque control mode (Negative direction)	→	Set the time constant at regeneration during torque control mode.	1582+100n	4382+100n
Cd.146	Speed limit value at torque control mode	→	Set the speed limit value at torque control mode.	1584+100n 1585+100n	4384+100n 4385+100n

n: Axis No.-1

∗: Refer to Section 5.7 "List of control data" for the setting details.

■ Required control data setting for the continuous operation to torque control mode

The control data shown below must be set to execute the continuous operation to torque control.

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Cd.147	Speed limit value at continuous operation to torque control mode	→	Set the speed limit value at continuous operation to torque control mode.	1586+100n 1587+100n	4386+100n 4387+100n
Cd.148	Acceleration time at continuous operation to torque control mode	→	Set the acceleration time at continuous operation to torque control mode.	1588+100n	4388+100n
Cd.149	Deceleration time at continuous operation to torque control mode	→	Set the deceleration time at continuous operation to torque control mode.	1589+100n	4389+100n
Cd.150	Target torque at continuous operation to torque control mode	→	Set the target torque at continuous operation to torque control mode.	1590+100n	4390+100n
Cd.151	Torque time constant at continuous operation to torque control mode (Forward direction)	→	Set the time constant at driving during continuous operation to torque control mode.	1591+100n	4391+100n
Cd.152	Torque time constant at continuous operation to torque control mode (Negative direction)	→	Set the time constant at regeneration during continuous operation to torque control mode.	1592+100n	4392+100n

n: Axis No.-1

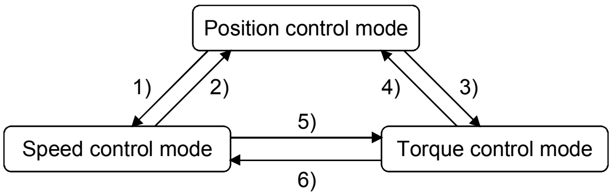
∗: Refer to Section 5.7 "List of control data" for the setting details.

12.1.4 Operation of speed-torque control

[1] Switching of control mode (Speed control/Torque control)

■ Switching method of control mode

To switch the control mode to the speed control or the torque control, set "1" in "Cd.138 Control mode switching request" after setting the control mode in "Cd.139 Control mode setting".
When the mode is switched to the speed control mode or the torque control mode, the control data used in each control mode must be set before setting "1" in "Cd.138 Control mode switching request".
When the switching condition is satisfied at control mode switching request, "30: Control mode switch" is set in "Md.26 Axis operation status", and the BUSY signal turns ON. "0" is automatically stored in "Cd.138 Control mode switching request" by Simple Motion module after completion of switching.
A warning "Control mode switching during BUSY" (warning code: 120) or "Control mode switching during zero speed OFF" (warning code: 121) occurs if the switching condition is not satisfied, and the control mode is not switched.
The following shows the switching condition of each control mode.



Switching operation		Switching condition
1)	Position control mode → Speed control mode	Not during positioning (Note-1) and during motor stop (Note-2), (Note-3)
2)	Seed control mode → Position control mode	During motor stop (Note-2), (Note-3)
3)	Position control mode → Torque control mode	Not during positioning (Note-1) and during motor stop (Note-2), (Note-3)
4)	Torque control mode → Position control mode	During motor stop (Note-2), (Note-3)
5)	Speed control mode → Torque control mode	None
6)	Torque control mode → Speed control mode	

(Note-1): BUSY signal is OFF.

(Note-2): ZERO speed (Low-order buffer memory address: b3 of "Md.108 Servo status") is ON.

	Buffer memory address (Low-order)	
	QD77MS2/QD77MS4	QD77MS16
Md.108 Servo status: b3	876+100n	2476+100n

n: Axis No.-1

(Note-3): The control mode can be changed without checking the switching condition of "during motor stop" in Simple Motion module by setting "1: Zero speed ON condition invalid (for switching control mode)" in "Condition selection at mode switching (b12 to b15)" of "Pr.90 Operation setting for speed-torque control mode". Set "1: Zero speed ON condition invalid (for switching control mode)" only when switching the control mode without waiting for the servomotor to stop.

The history of control mode switching is stored to the starting history at request of control mode switching. (Refer to Section 5.6.1 "System monitor data".)
Confirm the control mode with "control mode (high-order buffer memory address: b2, b3)" of "Md.108 Servo status". (Refer to Section 5.6.2 "Axis monitor data".)

	Buffer memory address (High-order)	
	QD77MS2/QD77MS4	QD77MS16
Md.108 Servo status: b2, b3	877+100n	2477+100n

n: Axis No.-1

■ Precautions at control mode switching

(1) The start complete signal and the positioning complete signal do not turn ON at control mode switching.
(2) When "30: Control mode switch", "31: Speed control", or "32: Torque control" is set in "Md.26 Axis operation status", the BUSY signal turns ON.
(3) The motor speed might change momentarily at switching from the speed control mode to the torque control mode. Therefore, it is recommended that the control mode is switched from the speed control to the torque control after the servomotors stop.
(4) Use the continuous operation to torque control mode for the usage such as pressing a workpiece. Do not execute the continuous operation to torque control in the speed control mode. Otherwise, an unexpected operation might occur at switching to the position control mode.
(5) In speed control flag (Md.31 Status: b0) does not turn ON during the speed control mode in the speed-torque control.

■ Operation for "Position control mode ↔ Speed control mode switching"

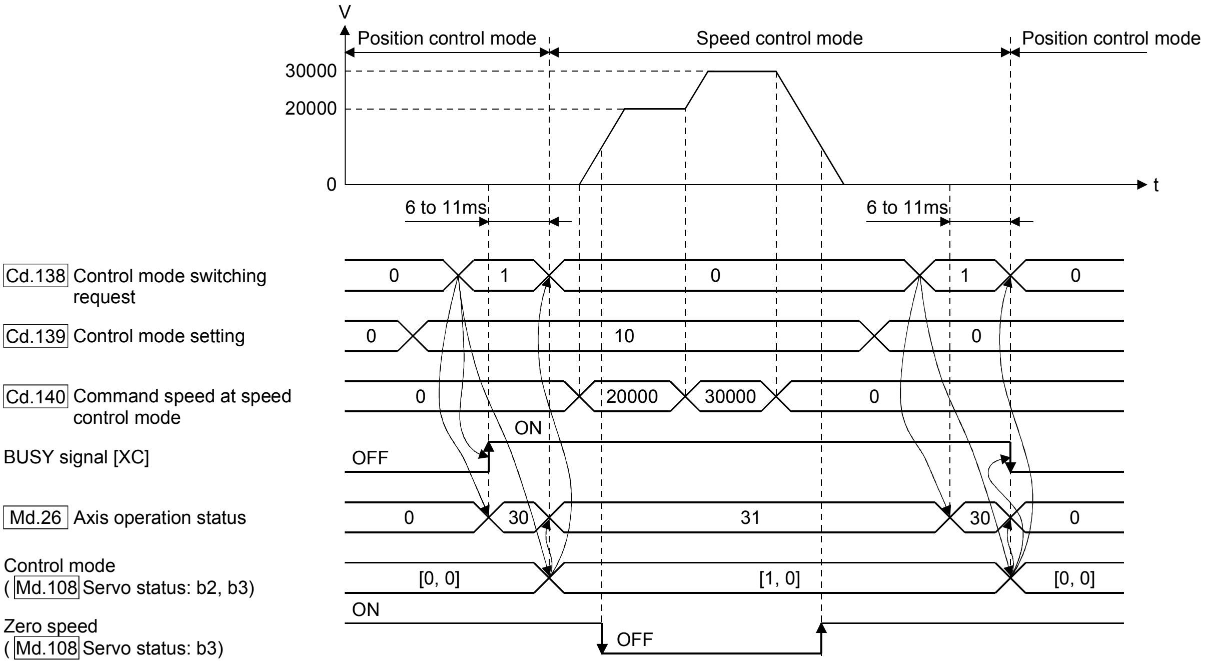
When the position control mode is switched to the speed control mode, the command speed immediately after the switching is the speed set in "speed initial value selection (b8 to b11)" of "Pr.90 Operation setting for speed-torque control mode".

Speed initial value selection (Pr.90 : b8 to b11)	Command speed to servo amplifier immediately after switching from position control mode to speed control mode
0: Command speed	The speed to servo amplifier immediately after switching is "0".
1: Feedback speed	Motor speed received from servo amplifier at switching.
2: Automatic selection	The command speed is invalid due to the setting of continuous operation to torque control mode. At control mode switching, operation is the same as "0: Command speed".

When the speed control mode is switched to the position control mode, the command position immediately after the switching is the current feed value at switching.

The following chart shows the operation timing for axis 1.

[QD77MS4 operation example]



(Note): Refer to Section 3.3 for input/output signal of QD77MS16 and Chapter 5 for buffer memory address.

■ Operation for "Position control mode ↔ Torque control mode switching"

When the position control mode is switched to the torque control mode, the command torque immediately after the switching is the torque set in "Torque initial value selection (b4 to b7)" of "Pr.90 Operation setting for speed-torque control mode".

Torque initial value selection (Pr.90 : b4 to b7)	Command torque to servo amplifier immediately after switching from position control mode to torque control mode
0: Command torque	The value of "Cd.143 Command torque at torque control mode" at switching.
1: Feedback torque	Motor torque value at switching.

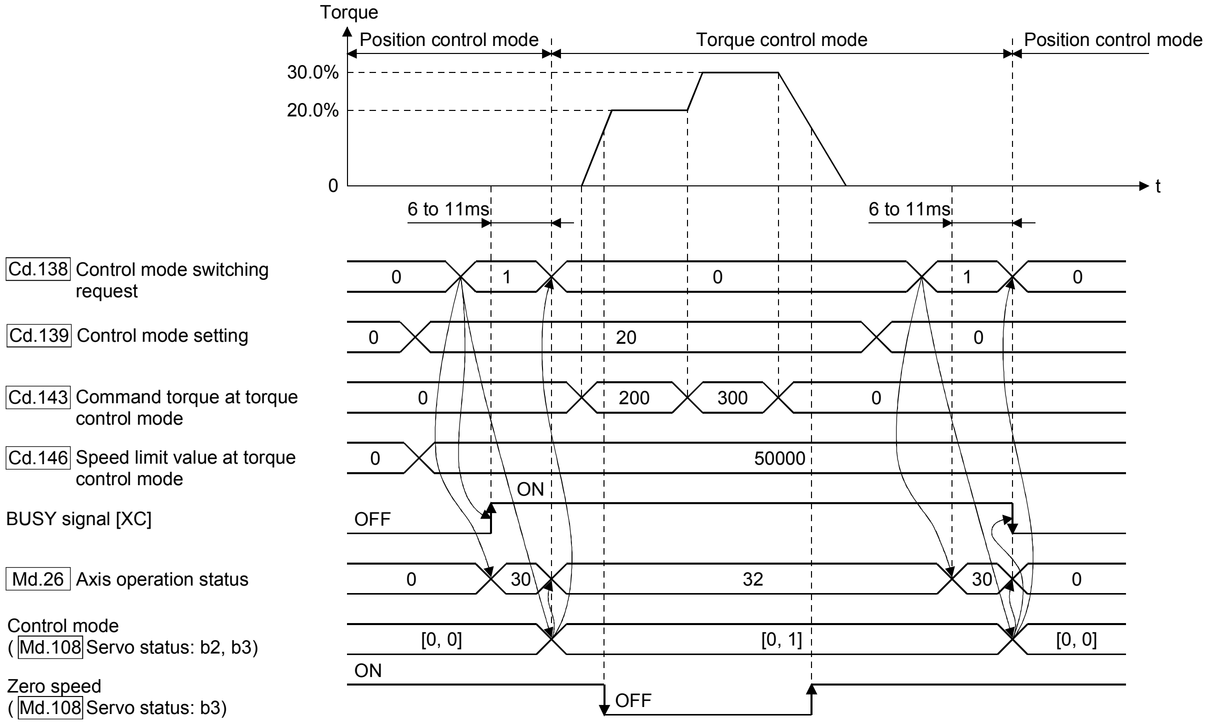
POINT

When the servo parameter "Function selection C-B POL reflection selection at torque control (PC29)" is set to "0: Enabled" and "Torque initial value selection" is set to "1: Feedback torque", a warning "Torque initial value selection invalid" (warning code: 521) will occur at control mode switching, and the command value immediately after switching is the same as the case of selecting "0: Command torque". If the feedback torque is selected, set "1: Disabled" in the servo parameter "Function selection C-B POL reflection selection at torque control (PC29)".

When the torque control mode is switched to the position control mode, the command position immediately after the switching is the current feed value at switching.

The following chart shows the operation timing for axis 1.

[QD77MS4 operation example]



(Note): Refer to Section 3.3 for input/output signal of QD77MS16 and Chapter 5 for buffer memory address.

■ Operation for "Speed control mode ↔ Torque control mode switching"

When the speed control mode is switched to the torque control mode, the command torque immediately after the switching is the torque set in "Torque initial value selection (b4 to b7)" of "Pr.90 Operation setting for speed-torque control mode".

Torque initial value selection (Pr.90 : b4 to b7)	Command torque to servo amplifier immediately after switching from speed control mode to torque control mode
0: Command torque	The value of "Cd.143 Command torque at torque control mode" at switching.
1: Feedback torque	Motor torque value at switching.

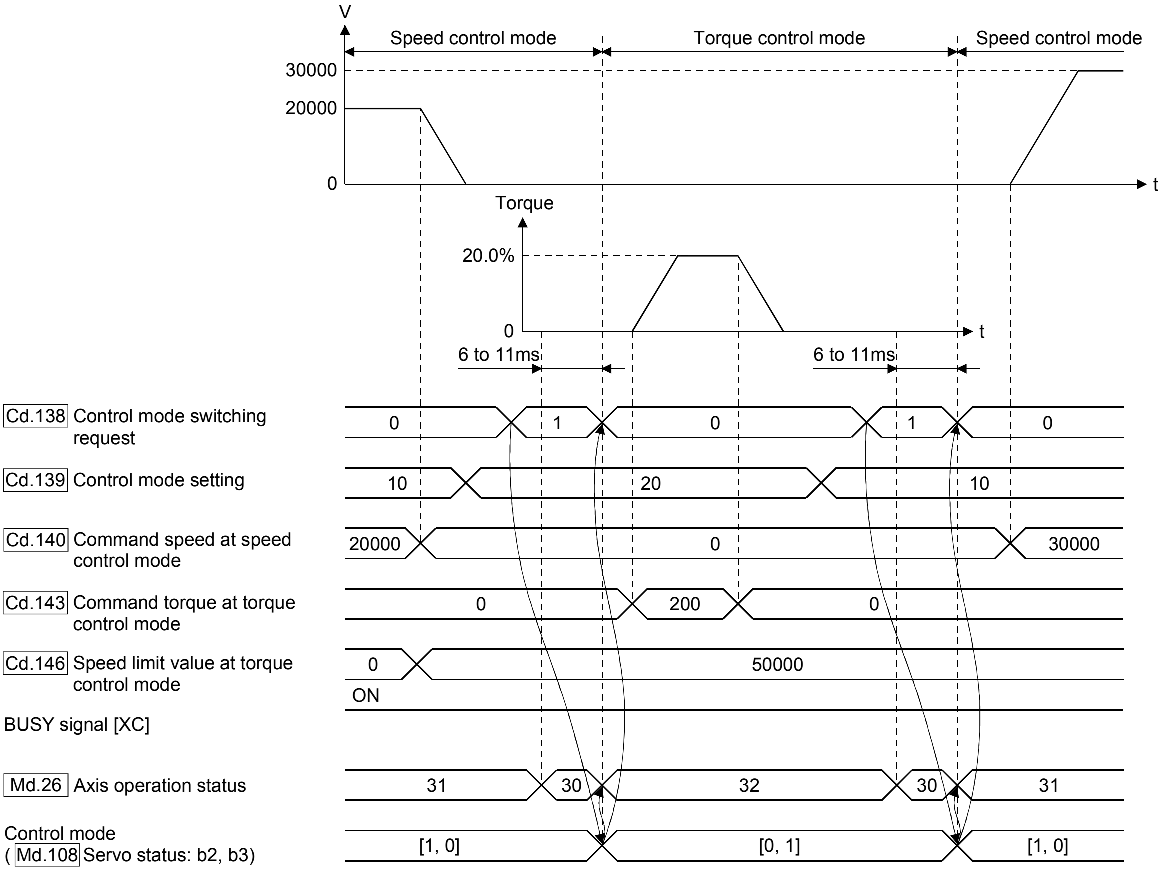
POINT

When the servo parameter "Function selection C-B POL reflection selection at torque control (PC29)" is set to "0: Enabled" and "Torque initial value selection" is set to "1: Feedback torque", a warning "Torque initial value selection invalid" (warning code: 521) will occur at control mode switching, and the command value immediately after switching is the same as the case of selecting "0: Command torque". If the feedback torque is selected, set "1: Disabled" in the servo parameter "Function selection C-B POL reflection selection at torque control (PC29)".

When the torque control mode is switched to the speed control mode, the command speed immediately after the switching is the motor speed at switching.

The following chart shows the operation timing for axis 1.

[QD77MS4 operation example]

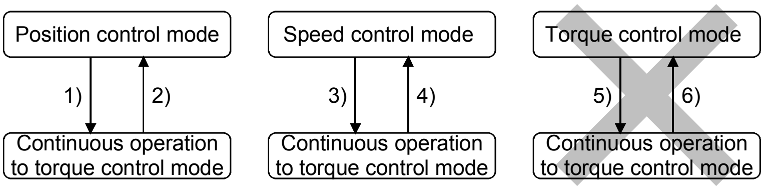


(Note): Refer to Section 3.3 for input/output signal of QD77MS16 and Chapter 5 for buffer memory address.

[2] Switching of control mode (Continuous operation to torque control)

■ Switching method of control mode

To switch the control mode to the continuous operation to torque control mode, set "1" in "Cd.138 Control mode switching request" after setting the control mode to switch to "Cd.139 Control mode setting" (30: Continuous operation to torque control mode) from position control mode or speed control mode.
The selected control mode can be checked in "Md.26 Axis operation status".
When the switching condition is satisfied at control mode switching request, "1: Position control mode - continuous operation to torque control mode, speed control mode - continuous operation to torque control mode switching" is set in "Md.124 Control mode switching status", and the BUSY signal turns ON.
The following shows the switching condition of the continuous operation to torque control mode.



Switching operation		Switching condition
1)	Position control mode → Continuous operation to torque control mode	Not during positioning (Note-1) or during following positioning/synchronous mode • ABS1 : 1-axis linear control (ABS) • INC1 : 1-axis linear control (INC) • FEED1 : 1-axis fixed-feed control • VF1 : 1-axis speed control (Forward) • VR1 : 1-axis speed control (Reverse) • VPF : Speed-position switching control (Forward) • VPR : Speed-position switching control (Reverse) • PVF : Position-speed switching control (Forward) • PVR : Position-speed switching control (Reverse) • Synchronous control
2)	Continuous operation to torque control mode → Position control mode	During motor stop (Note-2)
3)	Speed control mode → Continuous operation to torque control mode	None
4)	Continuous operation to torque control mode → Speed control mode	
5)	Torque control mode → Continuous operation to torque control mode	Switching is impossible.
6)	Continuous operation to torque control mode → Torque control mode	

(Note-1): BUSY signal is OFF.

(Note-2): ZERO speed (Low-order buffer memory address: b3 of "Md.108 Servo status") is ON. The control mode can be changed without checking the switching condition of "during motor stop" in Simple Motion module by setting "1: Zero speed ON condition invalid (for switching control mode)" in "Condition selection at mode switching (b12 to b15)" of "Pr.90 Operation setting for speed-torque control mode". Set "1: Zero speed ON condition invalid (for switching control mode)" only when switching the control mode without waiting for the servomotor to stop.

	Buffer memory address (Low-order)	
	QD77MS2/QD77MS4	QD77MS16
Md.108 Servo status: b3	876+100n	2476+100n

n: Axis No.-1

The history of control mode switching is stored to the starting history at request of control mode switching. (Refer to Section 5.6.1 "System monitor data".)
Confirm the status of the continuous operation to torque control mode with "b14: Continuous operation to torque control mode" of "Md.125 Servo status3". When the mode is switched to the continuous operation to torque control mode, the value in "control mode (high-order buffer memory address: b2, b3)" of "Md.108 Servo status" remains the same as before switching the control mode. (Refer to Section 5.6.2 "Axis monitor data".)

	Buffer memory address (High-order)	
	QD77MS2/QD77MS4	QD77MS16
Md.108 Servo status: b2, b3	877+100n	2477+100n

n: Axis No.-1

POINTS

(1) When the mode is switched from position control mode to continuous operation to torque control mode, only the switching from continuous operation to torque control mode to position control mode is possible. If the mode is switched to other control modes, a warning "Control mode switching not possible" (warning code: 125) will occur, and the control mode is not switched.

(2) When the mode is switched from speed control mode to continuous operation to torque control mode, only the switching from continuous operation to torque control mode to speed control mode is possible. If the mode is switched to other control modes, a warning "Control mode switching not possible" (warning code: 125) will occur, and the control mode is not switched.

■ Precautions at control mode switching

(1) The start complete signal and positioning complete signal do not turn ON at control mode switching.
(2) When "33: Continuous operation to torque control mode" is set in "Md.26 Axis operation status" and "1: Position control mode - continuous operation to torque control mode, speed control mode - continuous operation to torque control mode switching" is set in "Md.124 Control mode switching status", the BUSY signal turns ON.
(3) When using the continuous operation to torque control mode, use the servo amplifiers that are compatible with the continuous operation to torque control. If the servo amplifiers that are not compatible with the continuous operation to torque control are used, an error "Continuous operation to torque control not supported" (error code: 550) occurs at request of switching to continuous operation to torque control mode, and the operation stops. (In the positioning control, the operation stops according to the setting of "Pr.39 Stop group 3 sudden stop selection". In the speed control, the mode switches to the position control, and the operation immediately stops.)

■ Operation for "Position control mode ↔ Continuous operation to torque control mode switching"

To switch to the continuous operation to torque control mode, set the control data used in the control mode before setting "1" in "Cd.138 Control mode switching request".
When the switching condition is satisfied at control mode switching request, "1: Position control mode - continuous operation to torque control mode, speed control mode - continuous operation to torque control mode switching" is set in "Md.124 Control mode switching status" and the BUSY signal turns ON. (When the control mode switching request is executed while the BUSY signal is ON, the BUSY signal does not turn OFF but stays ON at control mode switching.)
"0" is automatically stored in "Cd.138 Control mode switching request" and "Md.124 Control mode switching status" after completion of switching.

When the position control mode is switched to the continuous operation to torque control mode, the command torque and command speed immediately after the switching are the values set according to the following setting in "Torque initial value selection (b4 to b7)" and "Speed initial value selection (b8 to b11)" of "Pr.90 Operation setting for speed-torque control mode".

Torque initial value selection (Pr.90 : b4 to b7)	Command torque to servo amplifier immediately after switching from position control mode to continuous operation to torque control mode
0: Command torque	The value of "Cd.150 Target torque at continuous operation to torque control mode" at switching.
1: Feedback torque	Motor torque value at switching.

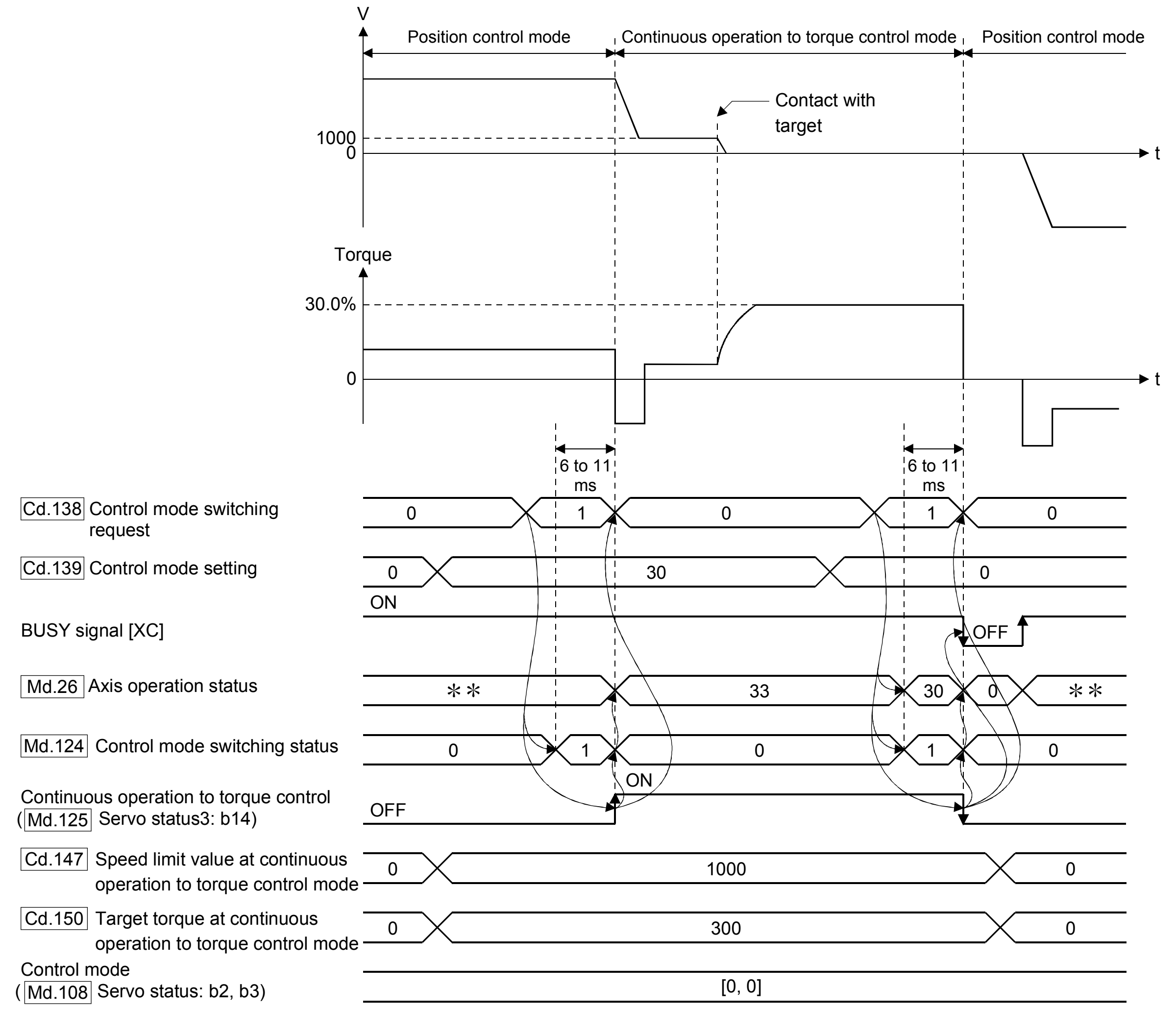
Speed initial value selection (Pr.90 : b8 to b11)	Command speed to servo amplifier immediately after switching from position control mode to continuous operation to torque control mode
0: Command speed	Speed that the position command at switching is converted into the motor speed. (When the positioning does not start at switching, the speed to servo amplifier immediately after switching is "0".)
1: Feedback speed	Motor speed received from servo amplifier at switching.
2: Automatic selection	The lower speed between speed that position command at switching is converted into the motor speed and motor speed received from servo amplifier at switching.

POINT

When the mode is switched to continuous operation to torque control mode in cases where command speed and actual speed are different such as during acceleration/deceleration or when the speed does not reach command speed due to torque limit, set "1: Feedback speed" in "Speed initial value selection (b8 to b11)".

The following chart shows the operation timing for axis 1.

[QD77MS4 operation example]



＊＊ : Depending on the positioning method.

(Note): Refer to Section 3.3 for input/output signal of QD77MS16 and Chapter 5 for buffer memory address.

■ Operation for "Speed control mode ↔ Continuous operation to torque control mode switching"

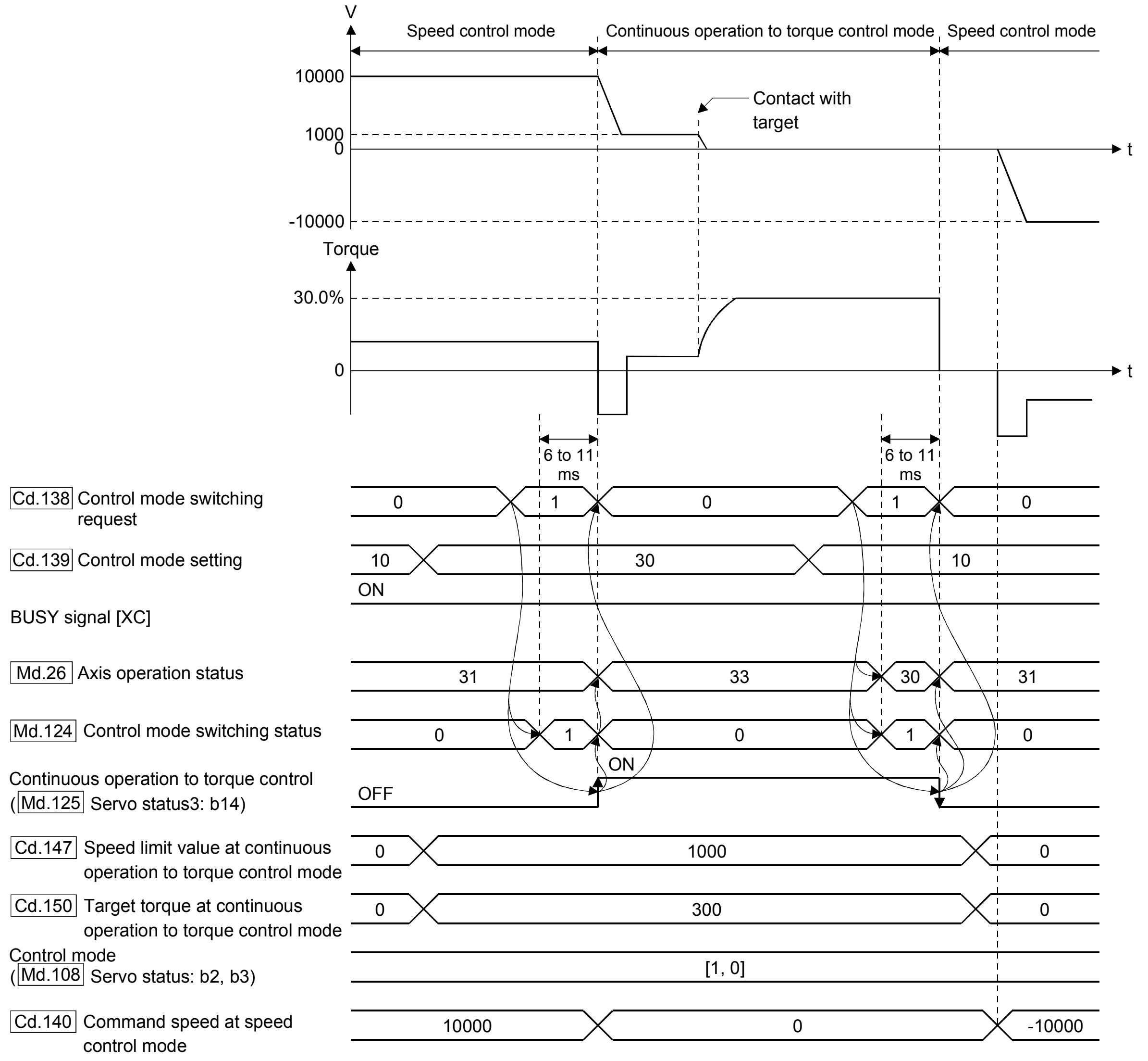
To switch to the continuous operation to torque control mode, set the control data used in the control mode before setting "1" in "Cd.138 Control mode switching request".
When the switching condition is satisfied at control mode switching request, "1: Position control mode - continuous operation to torque control mode, speed control mode - continuous operation to torque control mode switching" is set in "Md.124 Control mode switching status" and the BUSY signal turns ON. (When the control mode switching request is executed while the BUSY signal is ON, the BUSY signal does not turn OFF but stays ON at control mode switching.)
"0" is automatically stored in "Cd.138 Control mode switching request" and "Md.124 Control mode switching status" after completion of switching.

When the speed control mode is switched to the continuous operation to torque control mode, the command torque immediately after the switching is the torque set in "Torque initial value selection (b4 to b7)" of "Pr.90 Operation setting for speed-torque control mode".

Torque initial value selection (Pr.90 : b4 to b7)	Command torque to servo amplifier immediately after switching from speed control mode to continuous operation to torque control mode
0: Command torque	The value of "Cd.150 Target torque at continuous operation to torque control mode" at switching.
1: Feedback torque	Motor torque value at switching.

The following chart shows the operation timing for axis 1.

[QD77MS4 operation example]



(Note): Refer to Section 3.3 for input/output signal of QD77MS16 and Chapter 5 for buffer memory address.

■ Operation for switching from "Position control mode" to "Continuous operation to torque control mode" automatically

To switch to the continuous operation to torque control mode automatically when the conditions set in "Cd.153 Control mode auto-shift selection" and "Cd.154 Control mode auto-shift parameter" are satisfied, set the control data necessary in the continuous operation to torque control mode, "Cd.153 Control mode auto-shift selection" and "Cd.154 Control mode auto-shift parameter", and then set "30: Continuous operation to torque control mode" in "Cd.139 Control mode setting" and "1: Switching request" in "Cd.138 Control mode switching request".
In this case, the current control is continued until the setting condition is satisfied after control mode switching request, and "2: Waiting for the completion of control mode switching condition" is set in "Md.124 Control mode switching status".
When the set condition is satisfied, "1: Position control mode - continuous operation to torque control mode, speed control mode - continuous operation to torque control mode switching" is set in "Md.124 Control mode switching status".
"0" is stored in "Cd.138 Control mode switching request" and "Md.124 Control mode switching status" after completion of switching.

If "Cd.154 Control mode auto-shift parameter" is outside the setting range, an error "Outside control mode auto-shift switching parameter range" (error code: 551) occurs at control mode switching request, and the current processing stops. (In the positioning control, the operation stops according to the setting of "Pr.39 Stop group 3 sudden stop selection". In the speed control, the mode switches to the position control, and the operation immediately stops.)

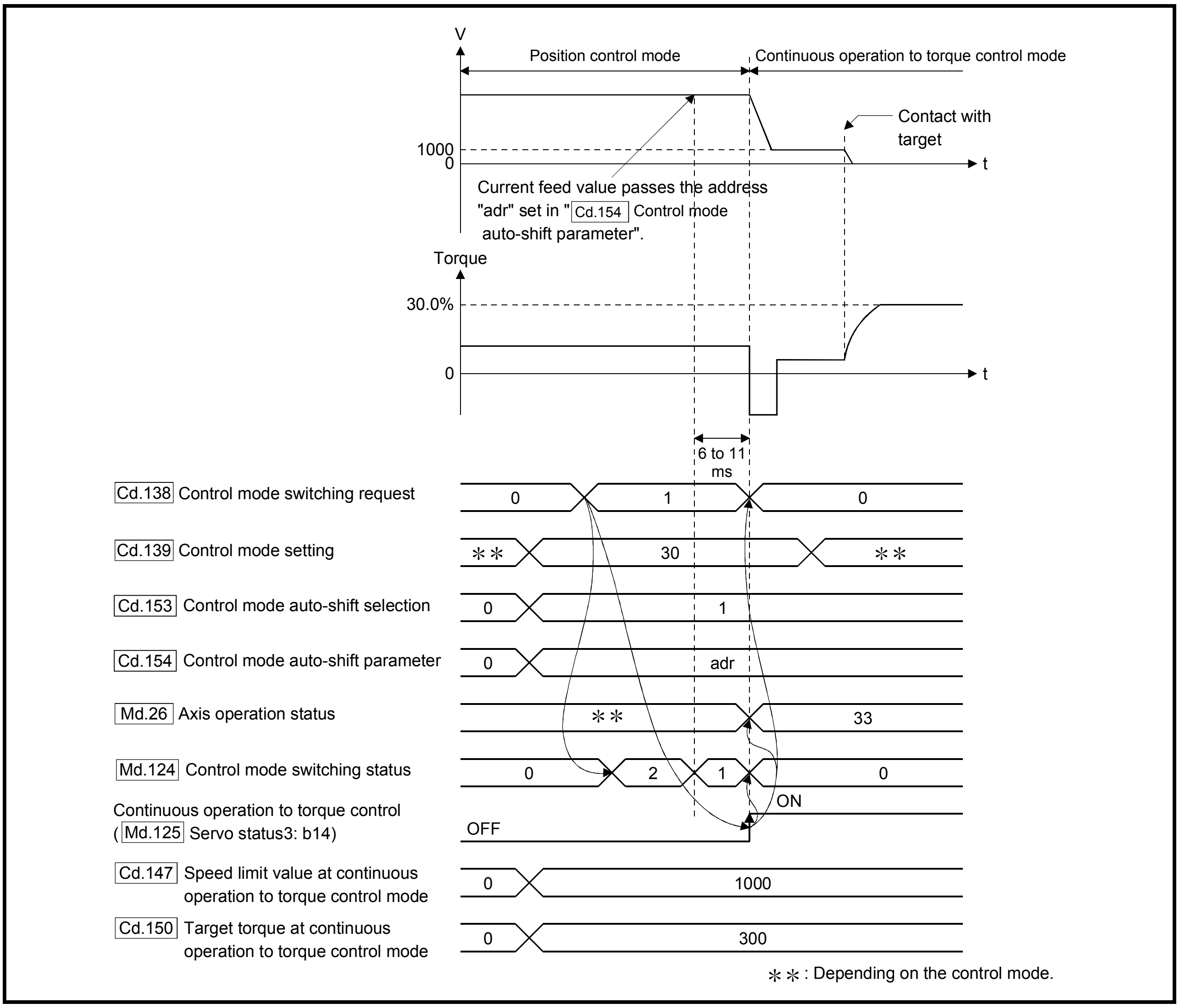
POINT

(1) Automatic switching is valid only when the control mode is switched from the position control mode to the continuous operation to torque control mode. When the mode is switched from speed control mode to continuous operation to torque control mode or from continuous operation to torque control mode to other control modes, even if the automatic switching is set, the state is not waiting for the completion of condition, and control mode switching is executed immediately.

(2) When the mode switching request is executed after setting the switching condition, the state of waiting for the completion of control mode switching condition continues until the setting condition is satisfied. Therefore, if the positioning by automatic switching is interrupted, unexpected control mode switching may be executed in other positioning operations. Waiting for the completion of control mode switching condition can be cancelled by setting "Other than 1: Not request" in "Cd.138 Control mode switching request" or by turning the axis stop signal ON. When an error occurs, waiting for the completion of control mode switching condition is also cancelled. (In both cases, "0" is stored in "Cd.138 Control mode switching request".

(3) In the state of waiting for the completion of control mode switching condition, if the current values are updated by the current value changing, the fixed-feed control or the speed control (when "2: Clear current feed value to zero" is set in "Pr.21 Current feed value during speed control"), an auto-shift judgment is executed based on the updated current value. Therefore, depending on the setting condition, the mode may be switched to the continuous operation to torque control mode immediately after the positioning starts. To avoid this switching, set "1: Switching request" in "Cd.138 Control mode switching request".

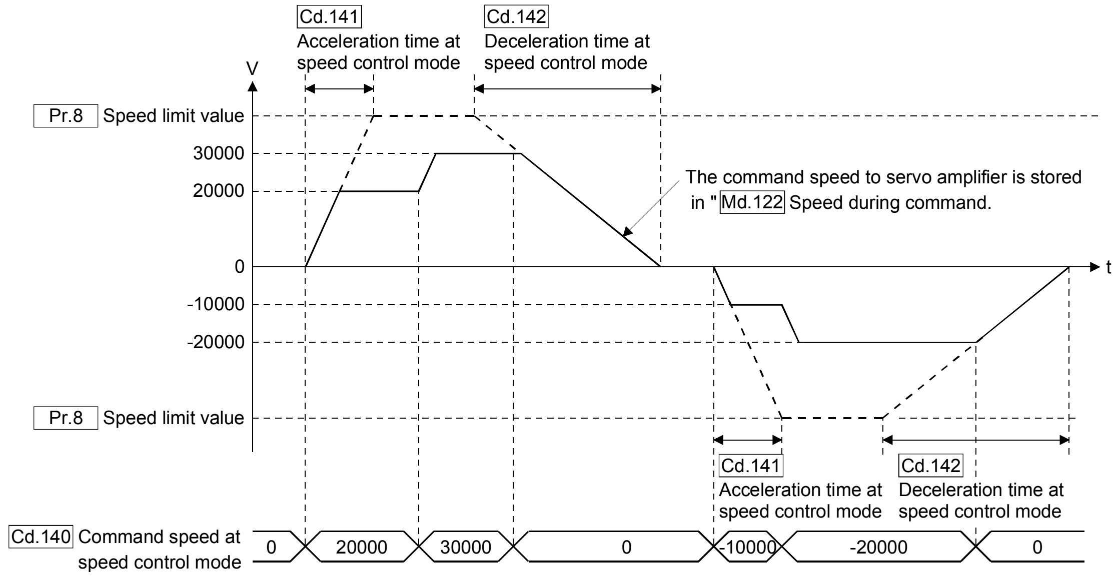
The following chart shows the operation when "1: Current feed value pass" is set in "Cd.153 Control mode auto-shift selection".



[3] Speed control mode

■ Operation for speed control mode

The speed control is executed at the speed set in "Cd.140 Command speed at speed control mode" in the speed control mode. Set a positive value for forward rotation and a negative value for reverse rotation. "Cd.140" can be changed any time during the speed control mode.
Acceleration/deceleration is performed based on a trapezoidal acceleration/deceleration processing. Set acceleration/deceleration time toward "Pr.8 Speed limit value" in "Cd.141 Acceleration time at speed control mode" and "Cd.142 Deceleration time at speed control mode". The value at speed control mode switching request is valid for "Cd.141" and "Cd.142".
The command speed during the speed control mode is limited with "Pr.8 Speed limit value". If the speed exceeding the speed limit value is set, a warning "Speed limit value over" (warning code: 501) occurs, and the operation is controlled with the speed limit value.
Confirm the command speed to servo amplifier with "Md.122 Speed during command".



■ Current feed value during speed control mode

"Md.20 Current feed value", "Md.21 Machine feed value" and "Md.101 Real current value" are updated even in the speed control mode.
If the current feed value exceeds the software stroke limit, an error "Software stroke limit +, -" (error code: 507, 508) occurs, and the operation switches to the position control mode. Invalidate the software stroke limit to execute one-way feed.

■ Stop cause during speed control mode

The operation for stop cause during speed control mode is shown below.

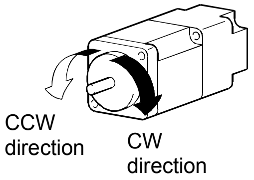
Item	Operation during speed control mode
Axis stop [Y4 to Y7] turned ON. QD77MS2 QD77MS4	The motor decelerates to speed "0" according to the setting value of "Cd.142 Deceleration time at speed control mode". The mode switches to the position control mode when "Zero speed" of "Md.108 Servo status" turns ON, and the operation stops.
"Cd.180 Axis stop" turned ON. QD77MS16	
Stop signal of "Cd.44 External input signal operation device" turned ON.	
All axis servo ON [Y1] turned OFF.	The servo OFF is not executed during the speed control mode. The command status when the mode is switched to the position control mode becomes valid.
"Cd.100 Servo OFF command" turned ON.	
The current value reached the software stroke limit.	An error (error code: 507, 508, 104, 105, or 101) occurs. The mode switches to the position control mode at the current position, and the operation immediately stops. (Deceleration processing is not executed.)
The position of the motor reached the hardware stroke limit	
PLC READY [Y0] turned OFF.	
The forced stop input to Simple Motion module.	The mode switches to the position control mode when the servo OFF (Servo ON of "Md.108 Servo status" turns OFF) is executed. (While the servo amplifier is servo OFF, even if the mode is switched to position control mode, the servomotor occurs to the free run. (The operation stops with dynamic brake.))
The emergency stop input to servo amplifier.	
The servo error occurred.	
The servo amplifier's power supply turned OFF.	The motor occurs to the free run. (The operation stops with dynamic brake.) (The mode is set to the position control mode at the servo amplifier's power supply ON again.)

[4] Torque control mode

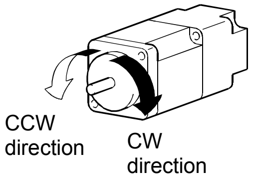
■ Operation for torque control mode

The torque control is executed at the command torque set in "Cd.143 Command torque at torque control mode" in the torque control mode. "Cd.143 Command torque at torque control mode" can be changed any time during torque control mode. The relation between the setting of command torque and the torque generation direction of servomotor varies depending on the setting of servo parameters "Rotation direction selection/travel direction selection (PA14)" and "Function selection C-B POL reflection selection at torque control (PC29)".

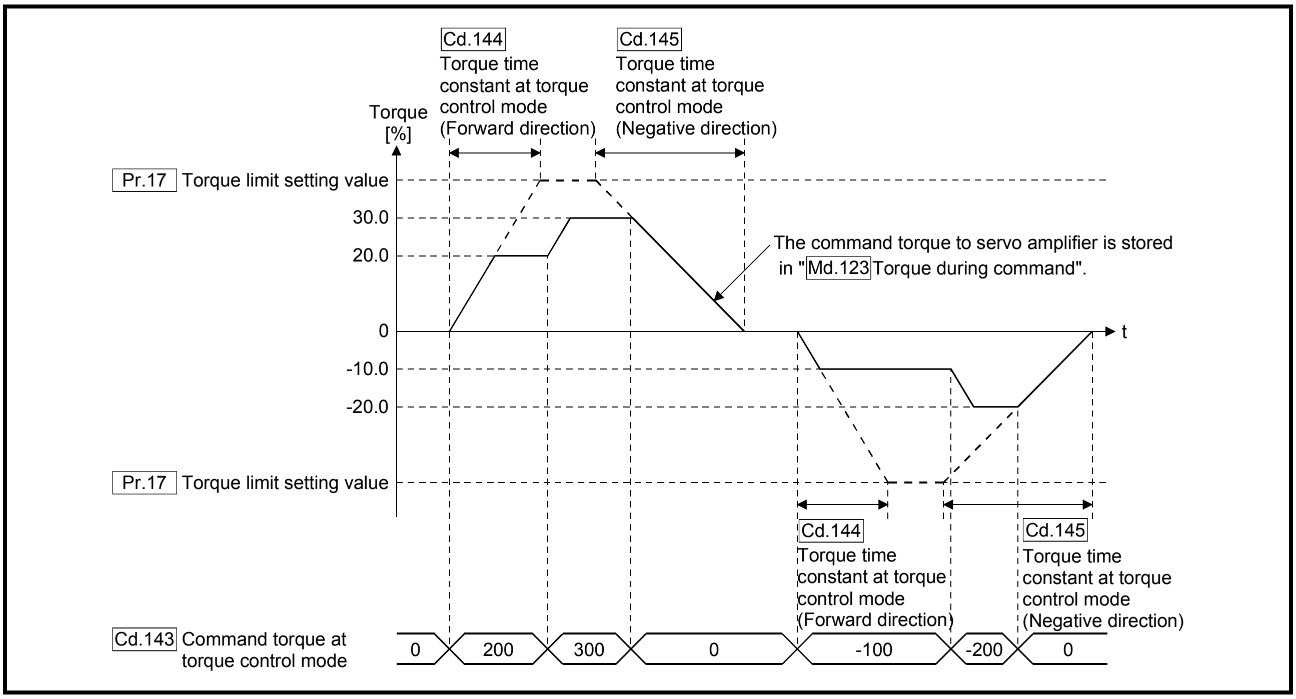
(1) When servo parameter "Function selection C-B POL reflection selection at torque control (PC29)" is set to "0: Enabled"

"Rotation direction selection/travel direction selection (PA14)"	"Cd.143 Command torque at torque control mode"	Torque generation direction of servo motor	
0: Forward rotation (CCW) with the increase of the positioning address	Positive value (Forward direction)	CCW direction	
	Negative value (Reverse direction)	CW direction	
1: Reverse rotation (CW) with the increase of the positioning address	Positive value (Forward direction)	CW direction	
	Negative value (Reverse direction)	CCW direction	

(2) When servo parameter "Function selection C-B POL reflection selection at torque control (PC29)" is set to "1: Disabled"

"Rotation direction selection/travel direction selection (PA14)"	"Cd.143 Command torque at torque control mode"	Torque generation direction of servo motor	
0: Forward rotation (CCW) with the increase of the positioning address	Positive value (Forward direction)	CCW direction	
	Negative value (Reverse direction)	CW direction	
1: Reverse rotation (CW) with the increase of the positioning address	Positive value (Forward direction)	CCW direction	
	Negative value (Reverse direction)	CW direction	

Set time for the command torque to increase from 0% to "Pr.17 Torque limit setting value" in "Cd.144 Torque time constant at torque control mode (Forward direction)" and for the command torque to decrease from "Pr.17 Torque limit setting value" to 0% in "Cd.145 Torque time constant at torque control mode (Negative direction)". The value at torque control mode switching request is valid for "Cd.144" and "Cd.145".
The command torque during the torque control mode is limited with "Pr.17 Torque limit setting value". If the torque exceeding the torque limit setting value is set, a warning "Torque limit value over" (warning code: 520) occurs, and the operation is controlled with the torque limit setting value.
Confirm the command torque to servo amplifier with "Md.123 Torque during command".



■ Speed during torque control mode

The speed during the torque control mode is controlled with "Cd.146 Speed limit value at torque control mode". At this time, "Speed limit" ("Md.108 Servo status" (low-order buffer memory address): b4) turns ON.

	Buffer memory address (Low-order)	
	QD77MS2/QD77MS4	QD77MS16
Md.108 Servo status: b4	876+100n	2476+100n

n: Axis No.-1

"Cd.146 Speed limit value at torque control mode" is set to a positive value regardless of the rotation direction. (Controlled by the same value for forward and reverse directions.)
In addition, "Cd.146 Speed limit value at torque control mode" is limited with "Pr.8 Speed limit value". If the speed exceeding the speed limit value is set, a warning "Speed limit value over" (warning code: 501) occurs, and the operation is controlled with the speed limit value.
The acceleration/deceleration processing is invalid for "Cd.146 Speed limit value at torque control mode".

POINT

The actual motor speed may not reach the speed limit value depending on the machine load situation during the torque control.

■ Current feed value during torque control mode

"Md.20 Current feed value", "Md.21 Machine feed value" and "Md.101 Real current value" are updated even in the torque control mode. If the current feed value exceeds the software stroke limit, an error "Software stroke limit +, -" (error code: 507, 508) occurs, and the operation switches to the position control mode. Invalidate the software stroke limit to execute one-way feed.

■ Stop cause during torque control mode

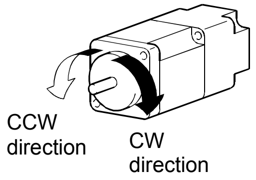
The operation for stop cause during torque control mode is shown below.

Item	Operation during torque control mode
Axis stop [Y4 to Y7] turned ON. QD77MS2 QD77MS4	The speed limit value commanded to servo amplifier is "0" regardless of the setting value of "Cd.146 Speed limit value at torque control mode". The mode switches to the position control mode when "Zero speed" of "Md.108 Servo status" turns ON, and the operation immediately stops. (Deceleration processing is not executed.) The value of command torque is not changed. It might take time to reach the speed "0" depending on the current torque command value.
Cd.180 Axis stop" turned ON. QD77MS16	
Stop signal of "Cd.44 External input signal operation device" turned ON.	
All axis servo ON [Y1] turned OFF.	The servo OFF is not executed during the torque control mode. The command status when the mode is switched to the position control mode becomes valid.
"Cd.100 Servo OFF command" turned ON.	
The current value reached the software stroke limit.	An error (error code: 507, 508, 104, 105, or 101) occurs. The mode switches to the position control mode at the current position, and the operation immediately stops. (Deceleration processing is not executed.)
The position of the motor reached the hardware stroke limit	
PLC READY [Y0] turned OFF.	
The forced stop input to Simple Motion module.	The mode switches to the position control mode when the servo OFF (Servo ON of "Md.108 Servo status" turns OFF) is executed. (While the servo amplifier is servo OFF, even if the mode is switched to position control mode, the servomotor occurs to the free run. (The operation stops with dynamic brake.))
The emergency stop input to servo amplifier.	
The servo error occurred.	
The servo amplifier's power supply turned OFF.	The motor occurs to the free run. (The operation stops with dynamic brake.) (The mode is set to the position control mode at the servo amplifier's power supply ON again.)

[5] Continuous operation to torque control mode

■ Operation for continuous operation to torque control mode

In continuous operation to torque control, the torque control can be executed without stopping the operation during the positioning in position control mode or speed command in speed control mode.
During the continuous operation to torque control mode, the torque control is executed at the command torque set in "Cd.150 Target torque at continuous operation to torque control mode" while executing acceleration/deceleration to reach the speed set in "Cd.147 Speed limit value at continuous operation to torque control mode".
"Cd.147 Speed limit value at continuous operation to torque control mode" and "Cd.150 Target torque at continuous operation to torque control mode" can be changed any time during the continuous operation to torque control mode. The relation between the setting value of command torque and the torque generation direction of servomotor is fixed regardless of the setting of servo parameters "Rotation direction selection/travel direction selection (PA14)" and "Function selection C-B POL reflection selection at torque control (PC29)".

"Rotation direction selection/travel direction selection (PA14)"	"Cd.150 Target torque at continuous operation to torque control mode"	Torque generation direction of servo motor	
0: Forward rotation (CCW) with the increase of the positioning address	Positive value (Forward direction)	CCW direction	
	Negative value (Reverse direction)	CW direction	
1: Reverse rotation (CW) with the increase of the positioning address	Positive value (Forward direction)	CCW direction	
	Negative value (Reverse direction)	CW direction	

Important

Regardless of the setting in "Rotation direction selection/travel direction selection (PA14)", set a positive value when torque command is in CCW direction of servomotor and a negative value when torque command is in CW direction of servomotor in "Cd.150 Target torque at continuous operation to torque control mode".
If the setting is incorrect, the motor may rotate in an opposite direction.

POINTS

(1) The motor rotates in a direction according to the setting in "Cd.150 Target torque at continuous operation to torque control mode". Set the value corresponding to the motor rotation direction in "Cd.147 Speed limit value at continuous operation to torque control mode".

(2) Speed is not limited for reverse torque generation direction.

■ Torque command setting method

During the continuous operation to torque control mode, set time for the command torque to increase from 0% to "Pr.17 Torque limit setting value" in "Cd.151 Torque time constant at continuous operation to torque control mode (Forward direction)" and for the command torque to decrease from "Pr.17 Torque limit setting value" to 0% in "Cd.152 Torque time constant at continuous operation to torque control mode (Negative direction)". The value at continuous operation to torque control mode switching request is valid for "Cd.151" and "Cd.152". The command torque during the continuous operation to torque control mode is limited with "Pr.17 Torque limit setting value".

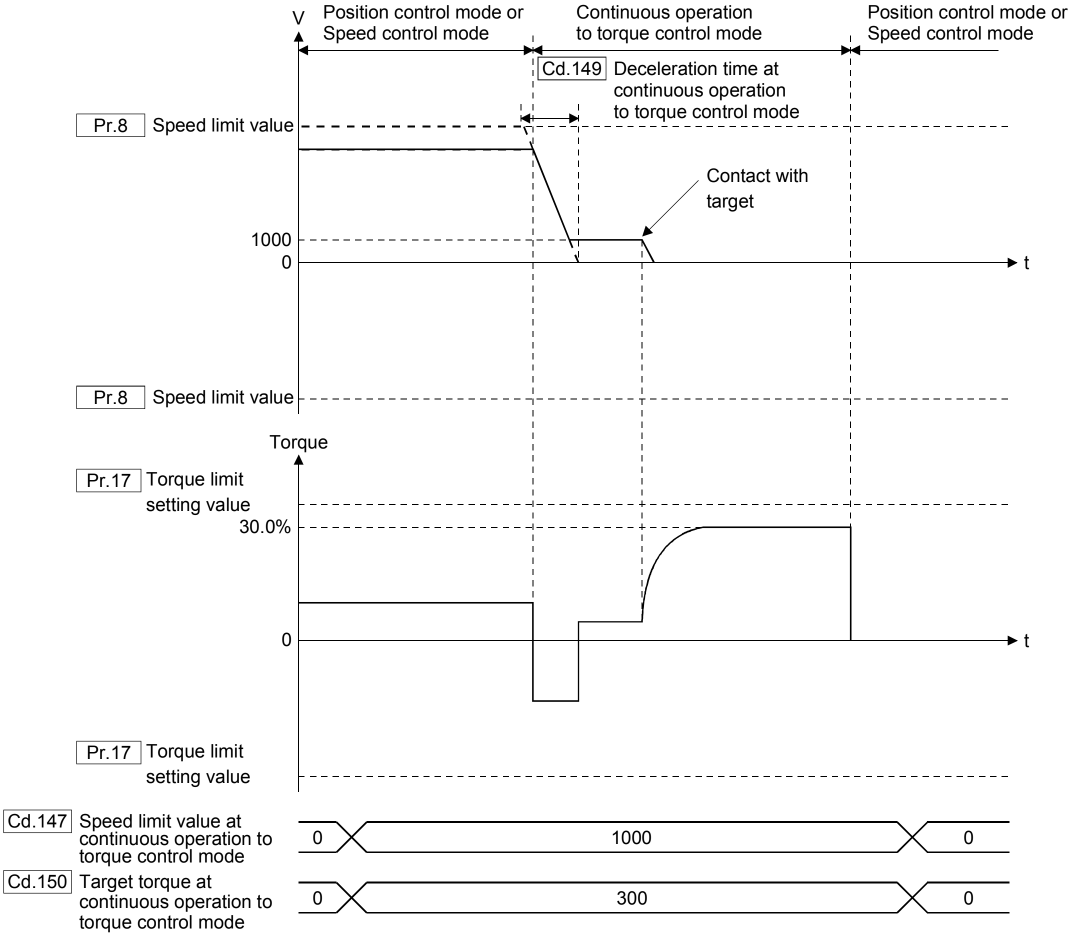
If torque exceeding the torque limit setting value is commanded, a warning "Torque limit value over" (warning code: 520) occurs, and the operation is controlled with the torque limit setting value.
Confirm the command torque to servo amplifier with "Md.123 Torque during command".
During the continuous operation to torque control mode, "Torque limit" ("Md.108 Servo status" (high-order buffer memory address): b13) does not turn ON. Confirm the current torque value in "Md.104 Motor current value".

	Buffer memory address (High-order)	
	QD77MS2/QD77MS4	QD77MS16
Md.108 Servo status: b13	877+100n	2477+100n

n: Axis No.-1

■ Speed limit value setting method

Acceleration/deceleration is performed based on a trapezoidal acceleration/deceleration processing. Set acceleration/deceleration time toward "Pr.8 Speed limit value" in "Cd.148 Acceleration time at continuous operation to torque control mode" and "Cd.149 Deceleration time at continuous operation to torque control mode". The value at continuous operation to torque control mode switching is valid for "Cd.148" and "Cd.149".
"Cd.147 Speed limit value at continuous operation to torque control mode" is limited with "Pr.8 Speed limit value". If the speed exceeding the speed limit value is commanded, a warning "Speed limit value over" (warning code: 501) occurs, and the operation is controlled with the speed limit value.
Confirm the command speed to servo amplifier with "Md.122 Speed during command".



■ Precautions at continuous operation to torque control mode

The following functions of the servo amplifier are not available during the continuous operation to torque control mode.

- Base circuit shut-off delay time function
- Forced stop deceleration function
- Vertical axis freefall prevention function
- Driver communication function

■ Speed during continuous operation to torque control mode

The speed during the continuous operation to torque control mode is controlled with an absolute value of the value set in "Cd.147 Speed limit value at continuous operation to torque control mode" as command speed. When the speed reaches the absolute value of "Cd.147 Speed limit value at continuous operation to torque control mode", "Speed limit" ("Md.108 Servo status" (low-order buffer memory address): b4) turns ON.

	Buffer memory address (Low-order)	
	QD77MS2/QD77MS4	QD77MS16
Md.108 Servo status: b4	876+100n	2476+100n

n: Axis No.-1

In addition, "Cd.147 Speed limit value at continuous operation to torque control mode" is limited with "Pr.8 Speed limit value". If the command speed exceeding the speed limit value is set, a warning "Speed limit value over" (warning code: 501) occurs, and the operation is controlled with the speed limit value.

POINT

The actual motor speed may not reach the command speed depending on the machine load situation during the continuous operation to torque control mode.

■ Current feed value during continuous operation to torque control mode

"Md.20 Current feed value", "Md.21 Machine feed value" and "Md.101 Real current value" are updated even in the continuous operation to torque control mode. If the current feed value exceeds the software stroke limit, an error "Software stroke limit +, -" (error code: 507, 508) occurs, and the operation switches to the position control mode. Invalidate the software stroke limit to execute one-way feed.

■ Stop cause during continuous operation to torque control mode

The operation for stop cause during continuous operation to torque control mode is shown below.

Item	Operation during continuous operation to torque control mode
Axis stop [Y4 to Y7] turned ON. QD77MS2 QD77MS4	The speed limit value commanded to servo amplifier is "0" regardless of the setting value of "Cd.147 Speed limit value at continuous operation to torque control mode". The mode switches to the position control mode when "Zero speed" of "Md.108 Servo status" turns ON, and the operation immediately stops. (Deceleration processing is not executed.) The value of command torque is not changed. It might take time to reach the speed "0" depending on the current torque command value.
"Cd.180 Axis stop" turned ON. QD77MS16	
Stop signal of "Cd.44 External input signal operation device" turned ON.	
All axis servo ON [Y1] turned OFF.	The servo OFF is not executed during the continuous operation to torque control mode. The command status when the mode is switched to the position control mode becomes valid.
"Cd.100 Servo OFF command" turned ON.	
The current value reached the software stroke limit.	An error (error code: 507, 508, 104, 105, or 101) occurs. The mode switches to the position control mode at the current position, and the operation immediately stops. (Deceleration processing is not executed.) When the operation immediately stops, the motor may start hunting depending on the motor speed. Therefore, be sure not to reach the limit in high speed and not to turn OFF the PLC READY.
The position of the motor reached the hardware stroke limit	
PLC READY [Y0] turned OFF.	
The forced stop input to Simple Motion module.	The mode switches to the position control mode when the servo OFF (Servo ON of "Md.108 Servo status" turns OFF) is executed. (While the servo amplifier is servo OFF, even if the mode is switched to position control mode, the servomotor occurs to the free run (The operation stops with dynamic brake).)
The emergency stop input to servo amplifier.	
The servo error occurred.	
The servo amplifier's power supply turned OFF.	The motor occurs to the free run (The operation stops with dynamic brake.). (The mode is set to the position control mode at the servo amplifier's power supply ON again.)

12.2 Synchronous control

"Synchronous control" can be achieved using software instead of controlling mechanically with gear, shaft, speed change gear or cam, etc.
"Synchronous control" synchronizes movement with the input axis (servo input axis or synchronous encoder axis), by setting "the parameters for synchronous control" and starting synchronous control on each output axis.
Refer to "MELSEC-Q/L QD77MS/QD77GF/LD77MS/LD77MH Simple Motion Module User's Manual (Synchronous Control)" for details of synchronous control.

Chapter 13 Control Sub Functions

The details and usage of the "sub functions" added and used in combination with the main functions are explained in this chapter.

A variety of sub functions are available, including functions specifically for machine OPR and generally related functions such as control compensation, etc.
More appropriate, finer control can be carried out by using these sub functions.
Each sub function is used together with a main function by creating matching parameter settings and sequence programs. Read the execution procedures and settings for each sub function, and set as required.

13.1 Outline of sub functions

"Sub functions" are functions that compensate, limit, add functions, etc., to the control when the main functions are executed. These sub functions are executed by parameter settings, operation from GX Works2, sub function sequence programs, etc.

13.1.1 Outline of sub functions

The following table shows the types of sub functions available.

Sub function		Details
Functions characteristic to machine OPR	OPR retry function	This function retries the OPR with the upper/lower limit switches during machine OPR. This allows machine OPR to be carried out even if the axis is not returned to before the near-point dog with JOG operation, etc.
	OP shift function	After returning to the machine OP, this function offsets the position by the designated distance from the machine OP position and sets that position as the OP address.
Functions that compensate control	Backlash compensation function	This function compensates the mechanical backlash. Feed command equivalent to the set backlash amount are output each time the movement direction changes.
	Electronic gear function	By setting the movement amount per pulse, this function can freely change the machine movement amount per commanded pulse. When the movement amount per pulse is set, a flexible positioning system that matches the machine system can be structured.
	Near pass function ＊1	This function suppresses the machine vibration when the positioning data is switched during continuous path control in the interpolation control.
Functions that limit control	Speed limit function	If the command speed exceeds "Pr.8 Speed limit value" during control, this function limits the commanded speed to within the "Pr.8 Speed limit value" setting range.
	Torque limit function	If the torque generated by the servomotor exceeds "Pr.17 Torque limit setting value" during control, this function limits the generated torque to within the "Pr.17 Torque limit setting value" setting range.
	Software stroke limit function	If a command outside of the upper/lower limit stroke limit setting range, set in the parameters, is issued, this function will not execute positioning for that command.
	Hardware stroke limit function	This function carries out deceleration stop with the hardware stroke limit switch.
	Forced stop function	This function is stopped the all axes of the servo amplifier when the forced stop input signal of the Simple Motion module external input signal connector is turned ON.
Functions that change control details	Speed change function	This function changes the speed during positioning. Set the changed speed in the speed change buffer memory (Cd.14 New speed value), and change the speed with the speed change request (Cd.15 Speed change request).
	Override function	This function changes the speed within a percentage of 1 to 300% during positioning. This is executed using "Cd.13 Positioning operation speed override".
	Acceleration/deceleration time change function	This function changes the acceleration/deceleration time during speed change. (Functions added to the speed change function and override function.)
	Torque change function	This function changes the "torque limit value" during control.
	Target position change function	This function changes the target position during the execution of positioning. At the same time, this also can change the speed.

＊1: The near pass function is validated only when the machine of the standard specification carries out the position control with the continuous path control mode. It cannot be invalidated with parameters.

Sub function		Details
Absolute position system function		This function restores the absolute position of designated axis. By this function, the OPR after power ON from OFF is not required once the OPR is executed when the system operation is started.
Other functions	Step function	This function temporarily stops the operation to confirm the positioning operation during debugging, etc. The operation can be stopped at each "automatic deceleration" or "positioning data".
	Skip function	This function stops the positioning being executed (decelerates to a stop) when the skip signal is input, and carries out the next positioning.
	M code output function	This function issues a sub work (clamp or drill stop, tool change, etc.) according to the code No. (0 to 65535) set for each positioning data.
	Teaching function	This function stores the address positioned with manual control into the positioning address (Da.6 Positioning address/movement amount) having the designated positioning data No.
	Command in-position function	At each automatic deceleration, this function calculates the remaining distance for the Simple Motion module to reach the positioning stop position, and when the value is less than the set value, sets the "command in-position flag". When using another sub work before ending the control, use this function as a trigger for the sub work.
	Acceleration/deceleration processing function	This function adjusts the control acceleration/deceleration.
	Pre-reading start function	This function shortens the virtual start time.
	Deceleration start flag function	Function that turns ON the flag when the constant speed status or acceleration status switches to the deceleration status during position control, whose operation pattern is "Positioning complete", to make the stop timing known.
	Stop command processing for deceleration stop function	Function that selects a deceleration curve when a stop cause occurs during deceleration stop processing to speed 0.
	Follow up function	This function monitors the motor rotation amount with the servo turned OFF, and reflects it on the current feed value.
	Speed control 10 x multiplier setting for degree axis function	This function is executed the positioning control by the 10 x speed of the command speed and the speed limit value when the setting unit is "degree".
	Operation setting for incompletion of OPR function	This function is provided to select whether positioning control is operated or not, when OPR request flag is ON.

13.2 Sub functions specifically for machine OPR

The sub functions specifically for machine OPR include the "OPR retry function" and "OP shift function". Each function is executed by parameter setting.

13.2.1 OPR retry function

When the workpiece goes past the OP without stopping during positioning control, it may not move back in the direction of the OP although a machine OPR is commanded, depending on the workpiece position. This normally means the workpiece has to be moved to a position before the near-point dog by a JOG operation, etc., to start the machine OPR again. However, by using the OPR retry function, a machine OPR can be carried out regardless of the workpiece position.

The details shown below explain about the "OPR retry function".

[1] Control details
[2] Precautions during control
[3] Setting the OPR retry function

[1] Control details

The following drawing shows the operation of the OPR retry function.

(1) OPR retry point return retry operation when the workpiece is within the range between the upper and lower limits.

1) The movement starts in the "Pr.44 OPR direction" by a machine OPR start.
2) The operation decelerates when the limit signal OFF is detected.
3) After stopping due to the limit signal OFF detection, the operation moves at the "Pr.46 OPR speed" in the opposite direction of the "Pr.44 OPR direction".
4) The operation decelerates when the near-point dog turns OFF.
5) After stopping due to the near-point dog OFF, a machine OPR is carried out in the "Pr.44 OPR direction".
6) Machine OPR completion

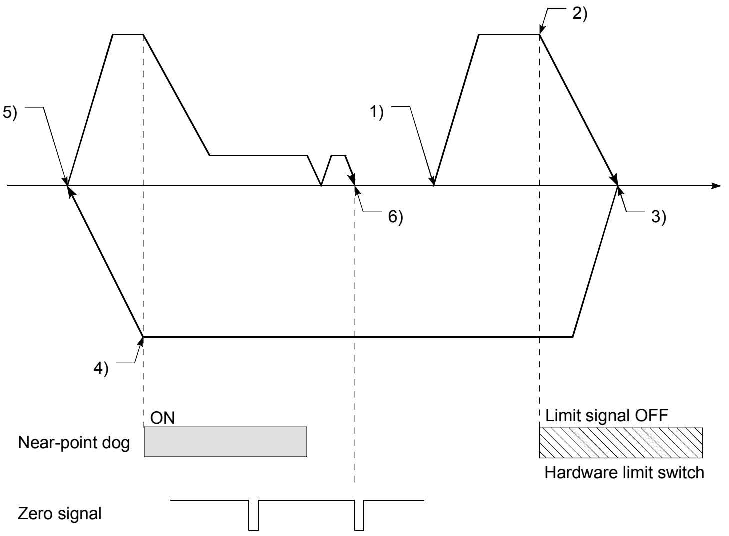
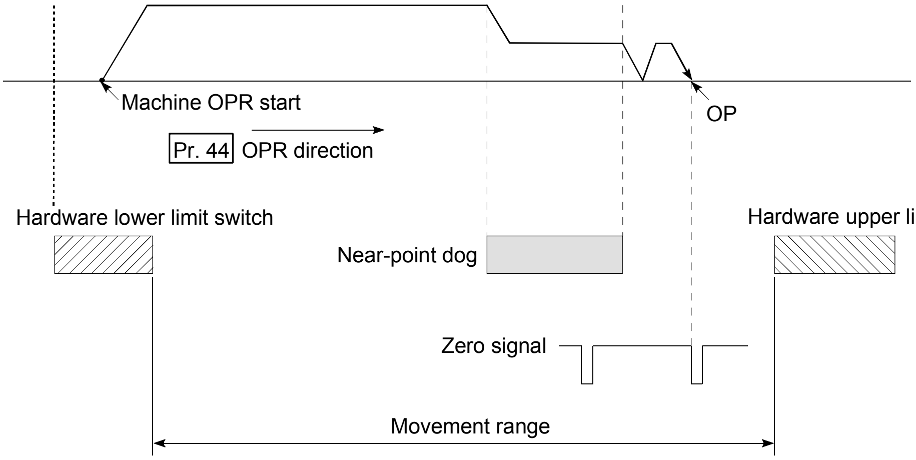


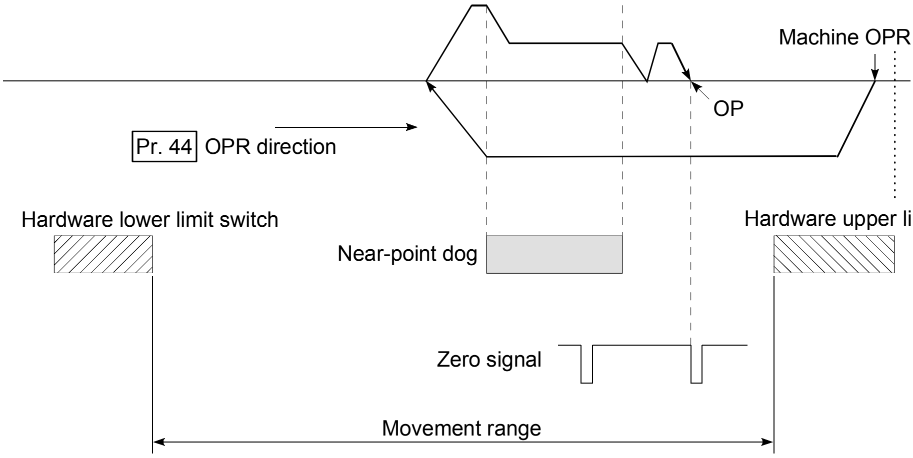
Fig. 13.1 OPR retry operation by limit signal detection

(2) OPR retry operation when the workpiece is outside the range between the upper and lower limits.

1) When the direction from the workpiece to the OP is the same as the "Pr.44 OPR direction", a normal machine OPR is carried out.



2) When the direction from the workpiece to the OP is the opposite direction from the "Pr.44 OPR direction", the operation carries out a deceleration stop when the near-point dog turns OFF, and then carries out a machine OPR in the direction set in "Pr.44 OPR direction".



＊ In the above example 1) and 2), "0: Positive direction" is set in "Pr.44 OPR direction"

REMARK

- When the "0: Positive direction" is selected in "Pr.44 OPR direction", the upper limit switch is set to the limit switch in the OPR direction.
- When the "1: Negative direction" is selected in "Pr.44 OPR direction", the lower limit switch is set to the limit switch in the OPR direction.
- If inverting the install positions of upper/lower limit switches, hardware stroke limit function cannot be operated properly.
  If any problem is found for OPR operation, review "Rotation direction selection/travel direction selection (PA14)" and the wiring for the upper/lower limit switch.

Fig. 13.2 OPR retry operation from on limit (limit signal OFF)

(3) Setting the dwell time during an OPR retry
The OPR retry function can perform such function as the dwell time using "Pr.57 Dwell time during OPR retry" when the reverse run operation is carried out due to detection by the limit signal for upper and lower limits and when the machine OPR is executed after the near point dog is turned OFF to stop the operation.

"Pr.57 Dwell time during OPR retry" is validated when the operation stops at the "A" and "B" positions in the following drawing. (The dwell time is the same value at both positions "A" and "B".)

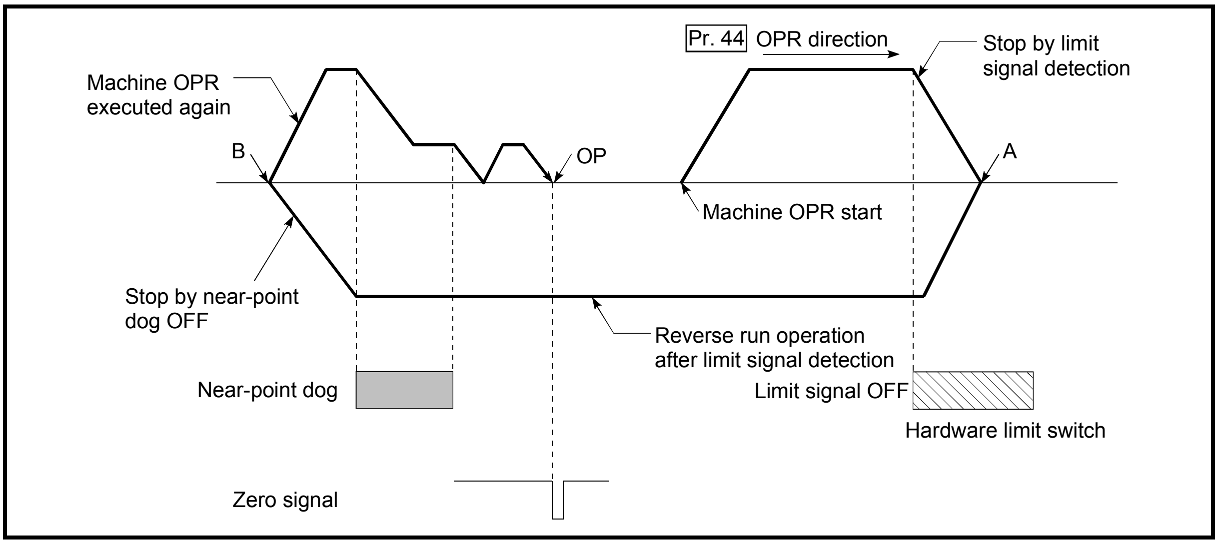


Fig. 13.3 Setting the dwell time during an OPR retry

[2] Precaution during control

(1) The following table shows whether the OPR retry function may be executed by the "Pr.43 OPR method".

Pr.43 OPR method	Execution status of OPR retry function
Near-point dog method	○: Execution possible
Count method 1)	○: Execution possible
Count method 2)	○: Execution possible
Data set method	–
Scale origin signal detection method	×: Execution not possible

(2) Always establish upper/lower limit switches at the upper/lower limit positions of the machine, and connect a Simple Motion module. If the OPR retry function is used without hardware stroke limit switches, the motor will continue rotation until a hardware stroke limit signal is detected.

(3) Do not configure a system so that the servo amplifier power turns OFF by the upper/lower limit switches connected to the Simple Motion module. If the servo amplifier power is turned OFF, the OPR retry cannot be carried out.

(4) The operation decelerates upon detection of the hardware limit signal, and the movement starts in the opposite direction. In this case, however, an error (104, 105) is not produced.

[3] Setting the OPR retry function

To use the "OPR retry function", set the required details in the parameters shown in the following table, and write them to the Simple Motion module.

When the parameters are set, the OPR retry function will be added to the machine OPR control. The set details are validated at the rising edge (OFF → ON) of the PLC READY signal [Y0]. Set "Pr.57 Dwell time during OPR retry" according to the user's requirements.

Setting item		Setting value	Setting details	Factory-set initial value
Pr.48	OPR retry	1	Set "1: Carry out OPR retry by limit switch".	0
Pr.57	Dwell time during OPR retry	→	Set the deceleration stop time during OPR retry. (Random value between 0 and 65535 (ms))	0

*: Refer to Section 5.2 "List of parameters" for setting details.

REMARK

- Parameters are set for each axis.
- It is recommended that the parameters be set whenever possible with GX Works2. Execution by sequence program uses many sequence programs and devices. The execution becomes complicated, and the scan times will increase.

13.2.2 OP shift function

When a machine OPR is carried out, the OP is normally established using the near-point dog and zero signal. However, by using the OP shift function, the machine can be moved a designated movement amount from the position where the zero signal was detected. A mechanically established OP can then be interpreted at that point.

The details shown below explain about the "OP shift function".

[1] Control details
[2] Setting range for the OP shift amount
[3] Movement speed during OP shift
[4] Precautions during control
[5] Setting the OP shift function

[1] Control details

The following drawing shows the operation of the OP shift function.

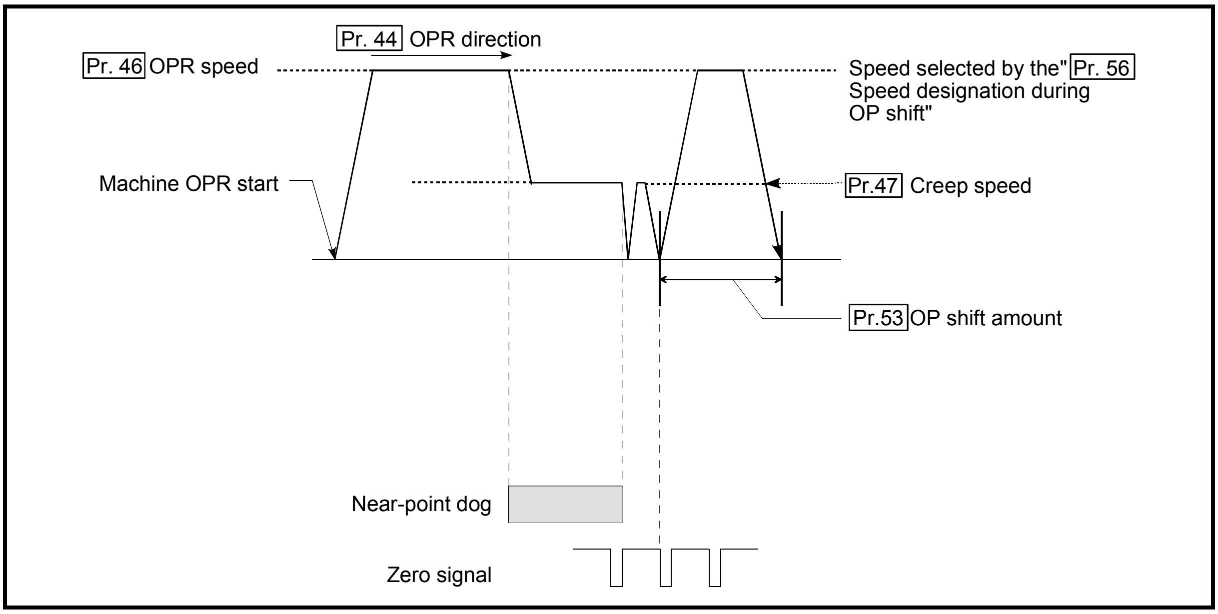


Fig. 13.4 OP shift operation

[2] Setting range for the OP shift amount

Set the OP shift amount within the range from the detected zero signal to the upper/lower limit switches.

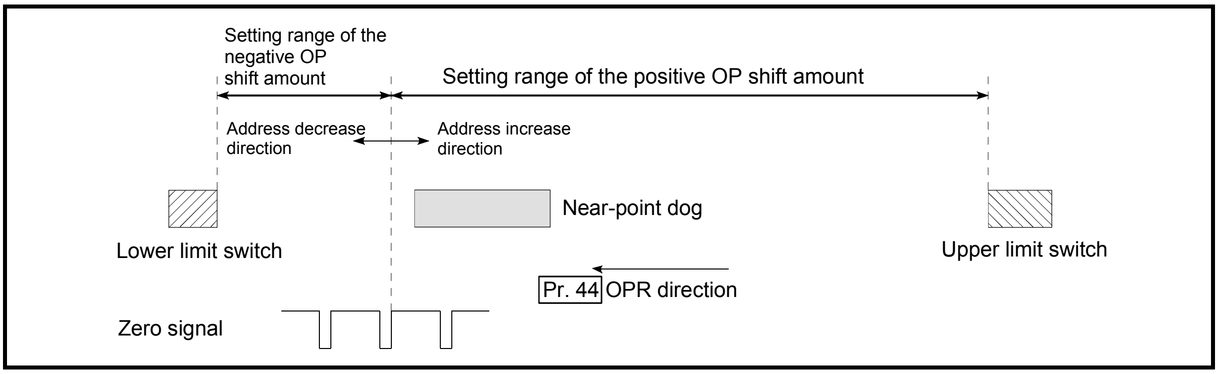


Fig. 13.5 Setting range for the OP shift amount

[3] Movement speed during OP shift

When using the OP shift function, the movement speed during the OP shift is set in "Pr.56 Speed designation during OP shift". The movement speed during the OP shift is selected from either the "Pr.46 OPR speed" or the "Pr.47 Creep speed". The following drawings show the movement speed during the OP shift when a mechanical OPR is carried out by the near-point dog method.

(1) OP shift operation at the "Pr.46 OPR speed"
(When "Pr.56 Speed designation during OP shift" is 0)

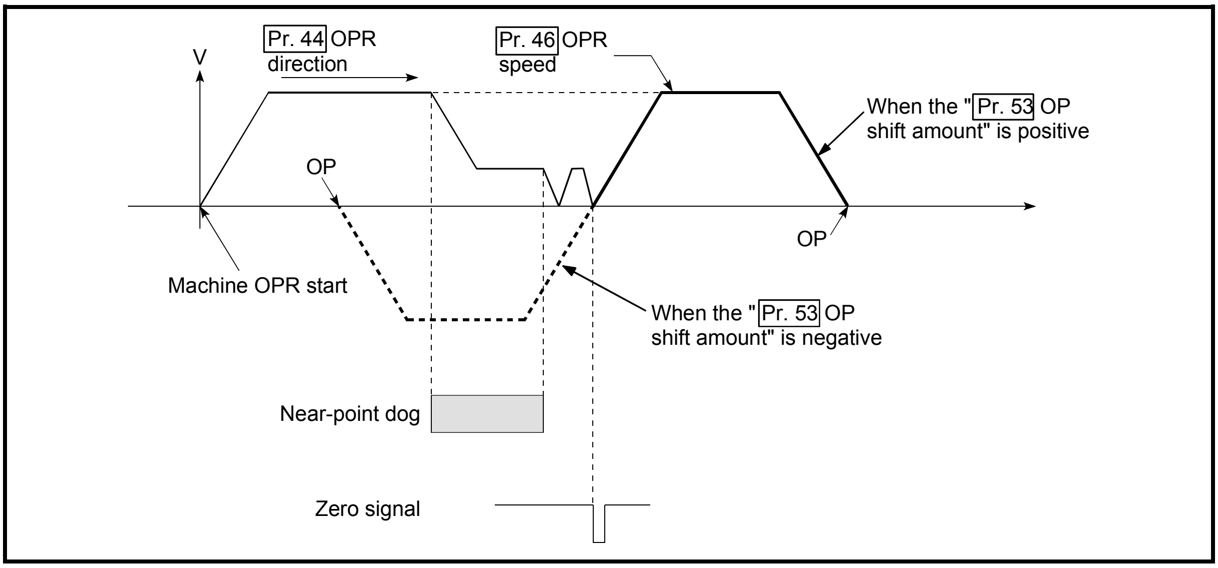


Fig. 13.6 OP shift operation at the OPR speed

(2) OP shift operation at the "Pr.47 Creep speed"
(When "Pr.56 Speed designation during OP shift" is 1)

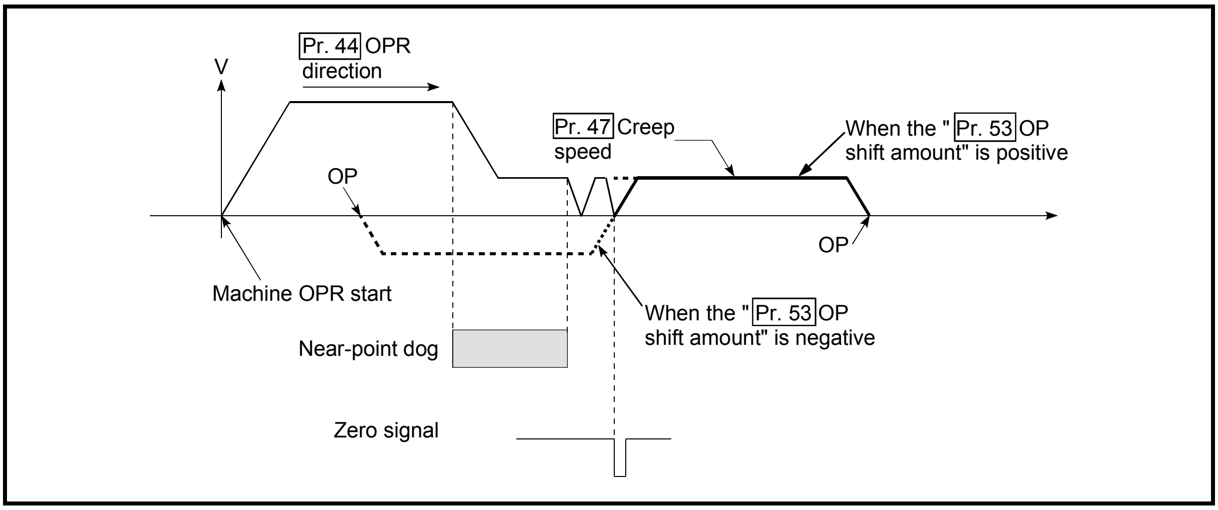


Fig. 13.7 OP shift operation at the creep speed

[4] Precautions during control

(1) The following data are set after the OP shift amount is complete.

- OPR complete flag (Md.31 Status: b4)
- Md.20 Current feed value
- Md.21 Machine feed value
- Md.26 Axis operation status

OPR request flag (Md.31 Status: b3) is reset after completion of the OP shift.

(2) "Pr.53 OP shift amount" is not added to "Md.34 Movement amount after near-point dog ON". The movement amount immediately before the OP shift operation, considering near-point dog ON as "0", is stored.

[5] Setting the OP shift function

To use the "OP shift function", set the required details in the parameters shown in the following table, and write them to the Simple Motion module.
When the parameters are set, the OP shift function will be added to the machine OPR control. The set details are validated at the rising edge (OFF → ON) of the PLC READY signal [Y0].

Setting item		Setting value	Setting details	Factory-set initial value
Pr.53	OP shift amount	→	Set the shift amount during the OP shift.	0
Pr.56	Speed designation during OP shift	→	Select the speed during the OP shift 0: Pr.46 OPR speed 1: Pr.47 Creep speed	0

*: Refer to Section 5.2 "List of parameters" for setting details.

REMARK

- Parameters are set for each axis.
- It is recommended that the parameters be set whenever possible with GX Works2. Execution by sequence program uses many sequence programs and devices. The execution becomes complicated, and the scan times will increase.

13.3 Functions for compensating the control

The sub functions for compensating the control include the "backlash compensation function", "electronic gear function", and "near pass function". Each function is executed by parameter setting or sequence program creation and writing.

13.3.1 Backlash compensation function

The "backlash compensation function" compensates the backlash amount in the mechanical system. When the backlash compensation amount is set, an extra amount of command equivalent to the set backlash amount is output every time the movement direction changes.

The details shown below explain about the "backlash compensation function".
[1] Control details
[2] Precautions during control
[3] Setting the backlash compensation function

[1] Control details

The following drawing shows the operation of the backlash compensation function.

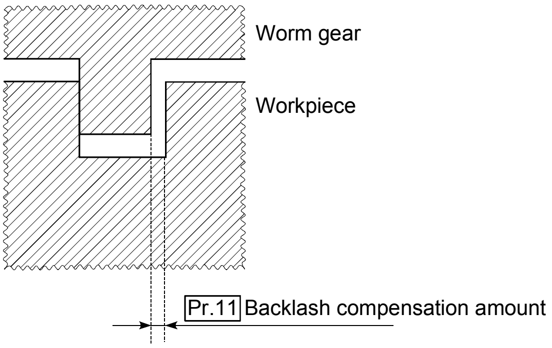


Fig. 13.8 Backlash compensation amount

[2] Precautions during control

(1) The feed command of the backlash compensation amount are not added to the "Md.20 Current feed value" or "Md.21 Machine feed value".

(2) Always carry out a machine OPR before starting the control when using the backlash compensation function (when "Pr.11 Backlash compensation amount" is set). The backlash in the mechanical system cannot be correctly compensated if a machine OPR is not carried out.

(3) Backlash compensation, which includes the movement amount and "Pr.11 Backlash compensation amount", is output the moment at the moving direction changes.

(4) Backlash compensation cannot be made when the speed control mode, torque control mode or continuous operation to torque control mode.

[3] Setting the backlash compensation function

To use the "backlash compensation function", set the "backlash compensation amount" in the parameter shown in the following table, and write it to the Simple Motion module.

The set details are validated at the rising edge (OFF → ON) of the PLC READY signal [Y0].

Setting item		Setting value	Setting details	Factory-set initial value
Pr.11	Backlash compensation amount	→	Set the backlash compensation amount.	0

＊: Refer to Section 5.2 "List of parameters" for setting details.

REMARK

- Parameters are set for each axis.
- It is recommended that the parameters be set whenever possible with GX Works2. Execution by sequence program uses many sequence programs and devices. The execution becomes complicated, and the scan times will increase.

13.3.2 Electronic gear function

The "electronic gear function" adjusts the actual machine movement amount and number of pulse output to servo amplifier according to the parameters set in the Simple Motion module.

The "electronic gear function" has the following three functions ([A] to [C]).

[A] During machine movement, the function increments in the Simple Motion module values less than one pulse that could not be output, and outputs the incremented amount when the total incremented value reached one pulse or more.

[B] When machine OPR is completed, current value changing is completed, speed control is started (except when current feed value change is present), or fixed-feed control is started, the function clears to "0" the cumulative values of less than one pulse which could not be output. (If the cumulative value is cleared, an error will occur by a cleared amount in the feed machine value. Control can be constantly carried out at the same machine movement amount, even when the fixed-feed control is continued.)

[C] The function compensates the mechanical system error of the command movement amount and actual movement amount by adjusting the "electronic gear".
(The "movement amount per pulse" value is defined by "Pr.2 Number of pulses per rotation (AP)", "Pr.3 Movement amount per rotation (AL)" and "Pr.4 Unit magnification (AM)".)

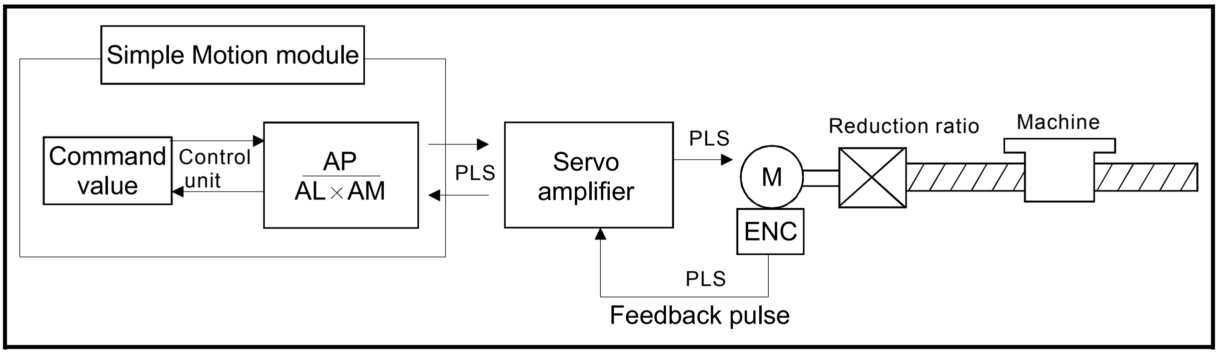
The Simple Motion module automatically carries out the processing for [A] and [B].

The details shown below explain about the "electronic gear function", including the method for compensating the error in [C] above, etc.

[1] Basic concept of the electronic gear
[2] The method for compensating the error

[1] Basic concept of the electronic gear

The electronic gear is an item which determines how many rotations (rotations by how many pulses) the motor must make in order to move the machine according to the programmed movement amount.



The basic concept of the electronic gear is represented by the following expression.

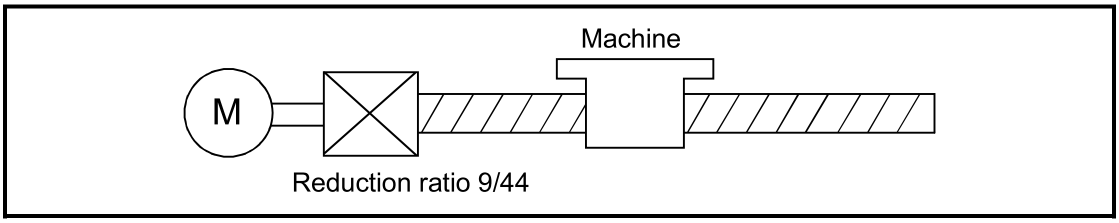
- Pr.2 (Number of pulses per rotation) = AP
- Pr.3 (Movement amount per rotation) = AL
- Pr.4 (Unit magnification) = AM
- Movement amount per rotation that considered unit magnification = ⊿S

$$\text{Electronic gear} = \frac{AP}{\Delta S} = \frac{AP}{AL \times AM} \quad \ldots(1)$$

Set values for AP, AL and AM so that this related equation is established. However, because values to be set for AP, AL and AM have the settable range, values calculated (reduced) from the above related equation must be contained in the setting range for AP, AL and AM.

(1) For "Ball screw" + "Reduction gear"

When the ball screw pitch is 10mm, the motor is the HG-KR (4194304 PLS/rev) and the reduction ratio of the reduction gear is 9/44.



First, find how many millimeters the load (machine) will travel (⊿S) when the motor turns one revolution (AP).

- AP (Number of pulses per rotation) = 4194304 [PLS]
- ⊿S (Movement amount per rotation)

$$\begin{aligned} &= \text{Ball screw pitch} \times \text{Reduction ratio} \\ &= 10\ [\text{mm}] \times 9/44 \\ &= 10000.0\ [\mu\text{m}] \times 9/44 \end{aligned}$$

Substitute this for the above expression (1).

At this time, make calculation with the reduction ratio 9/44 remaining as a fraction.

$$\begin{aligned} \frac{AP}{\varDelta S} &= \frac{4194304\ [\text{PLS}]}{10000.0\ [\mu\text{m}] \times 9/44} \\ &= \frac{4194304 \times 44}{10000.0 \times 9} \\ &= \frac{184549376}{90000.0} \\ &= \frac{23068672}{11250.0} = \frac{23068672\ (\text{AP})}{11250.0\ (\text{AL}) \times 1\ (\text{AM})} \\ &= \frac{23068672\ (\text{AP})}{1125.0\ (\text{AL}) \times 10\ (\text{AM})} \end{aligned}$$

Thus, AP, AL and AM to be set are as follows.

AP = 23068672... $\boxed{\text{Pr.2}}$
AL = 11250.0 … $\boxed{\text{Pr.3}}$
AM = 1 ………… $\boxed{\text{Pr.4}}$

or

AP = 23068672 ... $\boxed{\text{Pr.2}}$
AL = 1125.0 …... $\boxed{\text{Pr.3}}$
AM = 10 ……….. $\boxed{\text{Pr.4}}$

Note): These two examples of settings are only examples. There are settings other than these examples.

(2) When "PLS (pulse)" is set as the control unit

When using PLS (pulse) as the control unit, set the electronic gear as follows.

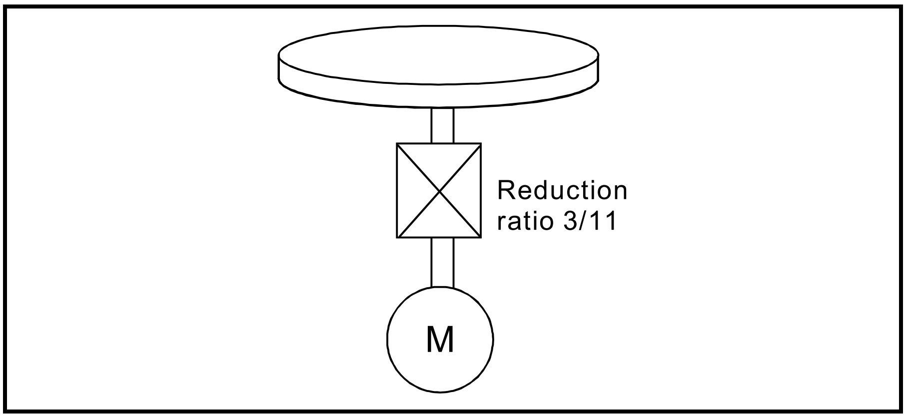
AP = "Number of pulses per rotation"
AL = "Movement amount per rotation"
AM = 1

Example) When the motor is the HG-KR (4194304PLS/rev)

AP = 4194304 .. Pr.2
AL = 4194304 .. Pr.3
AM = 1 ……….. Pr.4

(3) When "degree" is set as the control unit for a rotary axis

When the rotary axis is used, the motor is HG-KR (4194304PLS/rev) and the reduction ratio of the reduction gear is 3/11.



First, find how many degrees the load (machine) will travel (⊿S) when the motor turns one revolution (AP).

- AP (Number of pulses per rotation) = 4194304 [PLS]
- ⊿S (Movement amount per rotation)
  = 360.00000 [degree] × Reduction ratio
  = 360.00000 × 3/11

Substitute this for the above expression (1).

$$\frac{AP}{\Delta S} = \frac{4194304\ [PLS]}{360.00000\ [degree] \times 3/11}$$

$$= \frac{4194304\ [PLS] \times 11}{360.00000 \times 3}$$

$$= \frac{46137344}{1080.00000}$$

$$= \frac{2883584}{67.50000} \qquad = \frac{2883584\ (AP)}{67.50000(AL) \times 1\ (AM)}$$

$$= \frac{2883584\ (AP)}{0.06750\ (AL) \times 1000\ (AM)}$$

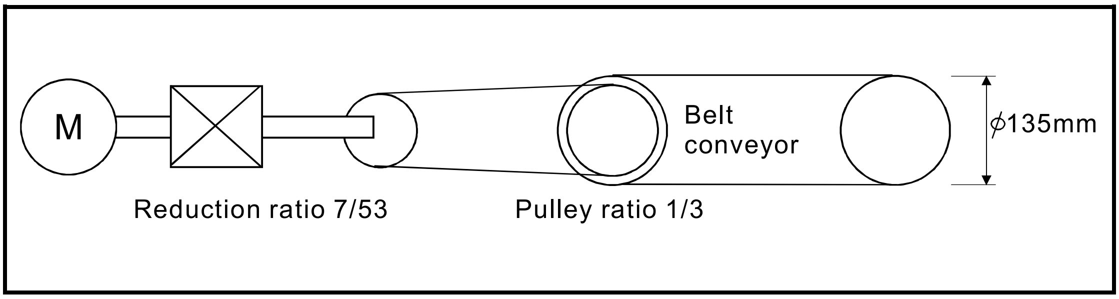
Thus, AP, AL and AM to be set are as follows.

AP = 2883584 ……$\boxed{\text{Pr.2}}$		AP = 2883584 …$\boxed{\text{Pr.2}}$
AL = 67.50000 ….$\boxed{\text{Pr.3}}$	or	AL = 0.06750 …$\boxed{\text{Pr.3}}$
AM = 1 ……………$\boxed{\text{Pr.4}}$		AM = 1000 …….$\boxed{\text{Pr.4}}$

Note): These two examples of settings are only examples. There are settings other than these examples.

(4) When "mm" is set as the control unit for conveyor drive (calculation including π)

When the belt conveyor drive is used, the conveyor diameter is 135mm, the pulley ratio is 1/3, the motor is HG-KR (4194304PLS/rev) and the reduction ratio of the reduction gear is 7/53.



As the travel value of the conveyor is used to exercise control, set "mm" as the control unit.

First, find how many millimeters the load (machine) will travel (ΔS) when the motor turns one revolution (AP).

- AP (Number of pulses per rotation) = 4194304 [PLS]
- ΔS (Movement amount per rotation)

$$= 135000.0\ [\mu m] \times \pi \times \text{Reduction ratio}$$
$$= 135000.0\ [\mu m] \times \pi \times 7/53 \times 1/3$$

Substitute this for the above expression (1).

At this time, make calculation with the reduction ratio 7/53 × 1/3 remaining as a fraction.

$$\frac{AP}{\Delta S} = \frac{AP}{AL \times AM} = \frac{4194304\ [PLS]}{135000.0\ [\mu m] \times \pi \times 7/53 \times 1/3}$$
$$= \frac{4194304 \times 53 \times 3}{135000.0 \times \pi \times 7}$$
$$= \frac{166723584}{236250 \times \pi}$$

Here, make calculation on the assumption that π is equal to 3.141592654.

$$\frac{AP}{\Delta S} = \frac{AP}{AL \times AM} = \frac{166723584}{742201.2645075}$$

AL has a significant number to first decimal place, round down numbers to two decimal places.

$$\frac{AP}{\Delta S} = \frac{AP}{AL \times AM} = \frac{166723584}{742201.2} = \frac{166723584\ (AP)}{742201.2\ (AL) \times 1 (AM)}$$

Thus, AP, AL and AM to be set are as follows.

AP = 166723584 .... $\boxed{\text{Pr.2}}$
AL = 742201.2 .... $\boxed{\text{Pr.3}}$
AM = 1 .... $\boxed{\text{Pr.4}}$

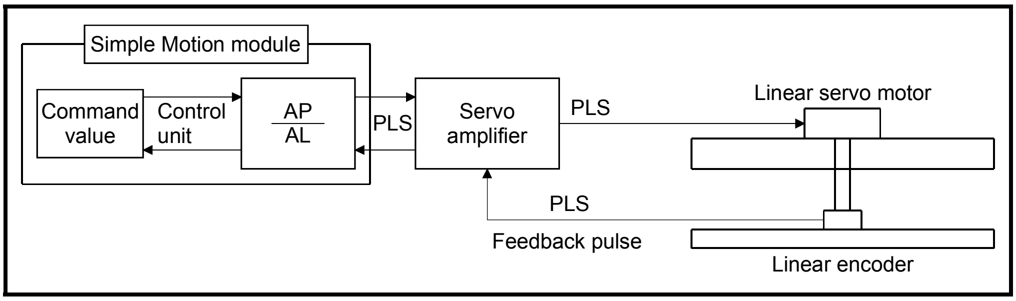
This setting will produce an error for the true machine value, but it cannot be helped. This error is as follows.

$$\left(\frac{7422012/166723584}{2362500\ \pi/166723584} - 1 \right) \times 100 = -8.69 \times 10^{-6}\ [\%]$$

- AP (Number of pulses per rotation) = 4194304 [PLS]
- ΔS (Movement amount per rotation)
  $= 135000.0\ [\mu m] \times \pi \times$ Reduction ratio
  $= 135000.0\ [\mu m] \times \pi \times 7/53 \times 1/3$

It is equivalent to an about 86.9 [μm] error in continuous 1km feed.

(5) Number of pulses/ movement amount at linear servo use



Calculate the number of pulses (AP) and movement amount (AL) for the linear encoder in the following conditions.

$$\text{Linear encoder resolution} = \frac{\text{Number of pulses (AP)}}{\text{Movement amount (AL)}}$$

Linear encoder resolution: 0.05[μm]

$$\frac{\text{Number of pulses (AP) [PLS]}}{\text{Movement amount (AL) [}\mu\text{m]}} = \frac{1}{0.05} = \frac{20}{1.0}$$

Set the number of pulses in "$\boxed{\text{Pr.2}}$ Number of pulses per rotation (AP)", and the movement amount in "$\boxed{\text{Pr.3}}$ Movement amount per rotation (AL)" in the actual setting.

(Note): Set the same value as the value set in the fixed parameter to the servo parameter "Linear encoder resolution setting Numerator (PS02)" and "Linear encoder resolution setting Denominator (PS03)".
Refer to each servo amplifier instruction manual for details.

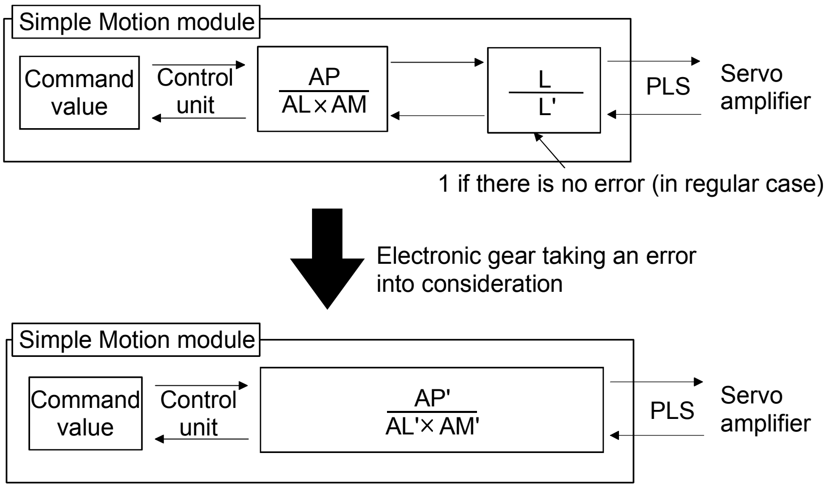
[2] The method for compensating the error

When the position control is carried out using the "Electronic gear" set in a parameter, this may produce an error between the command movement amount (L) and the actual movement amount (L'). With Simple Motion module, this error is compensated by adjusting the electronic gear. The "Error compensation amount", which is used for error compensation, is defined as follows:

$$\text{Error compensation amount} = \frac{\text{Command movement amount (L)}}{\text{Actual movement amount (L')}} \quad \ldots(2)$$

The electronic gear including an error compensation amount is shown below.

$$\frac{AP}{AL \times AM} \times \frac{L}{L'} = \frac{AP'}{AL' \times AM'}$$



Calculation example

(Conditions)

Number of pulses per rotation (AP) : 4194304 [PLS]
Movement amount per rotation (AL) : 5000.0 [µm]
Unit magnification (AM) : 1

(Positioning results)

Command movement amount (L) : 100 [mm]
Actual movement amount (L') : 101 [mm]

(Compensation value)

$$\frac{AP}{AL \times AM} \times \frac{L}{L'} = \frac{4194304}{5000.0 \times 1} \times \frac{100}{101} = \frac{4194304\,(AP')}{5050(AL') \times 1(AM')}$$

Number of pulses per rotation (AP') : 4194304 … Pr.2
Movement amount per rotation (AL') : 5050.0 …. Pr.3
Unit magnification (AM') : 1 ……….. Pr.4

Set the post-compensation "Pr.2 Number of pulses per rotation (AP')", "Pr.3 Movement amount per rotation (AL')", and "Pr.4 Unit magnification (AM')" in the parameters, and write them to the Simple Motion module.
The set details are validated at the rising edge (OFF → ON) of the PLC READY signal [Y0].

13.3.3 Near pass function

When continuous pass control is carried out using interpolation control, the near pass function is carried out.

The "near pass function" is a function to suppress the mechanical vibration occurring at the time of switching the positioning data when continuous pass control is carried out using interpolation control.

[Near pass function]
The extra movement amount occurring at the end of each positioning data unit being continuously executed is carried over to the next positioning data unit. Alignment is not carried out, and thus the output speed drops are eliminated, and the mechanical vibration occurring during speed changes can be suppressed. Because alignment is not carried out, the operation is controlled on a path that passes near the position set in "Da.6 Positioning address/movement amount".

The details shown below explain about the "near pass function".
[1] Control details
[2] Precautions during control

[1] Control details

The following drawing shows the path of the continuous path control by the 2-axis linear interpolation control.

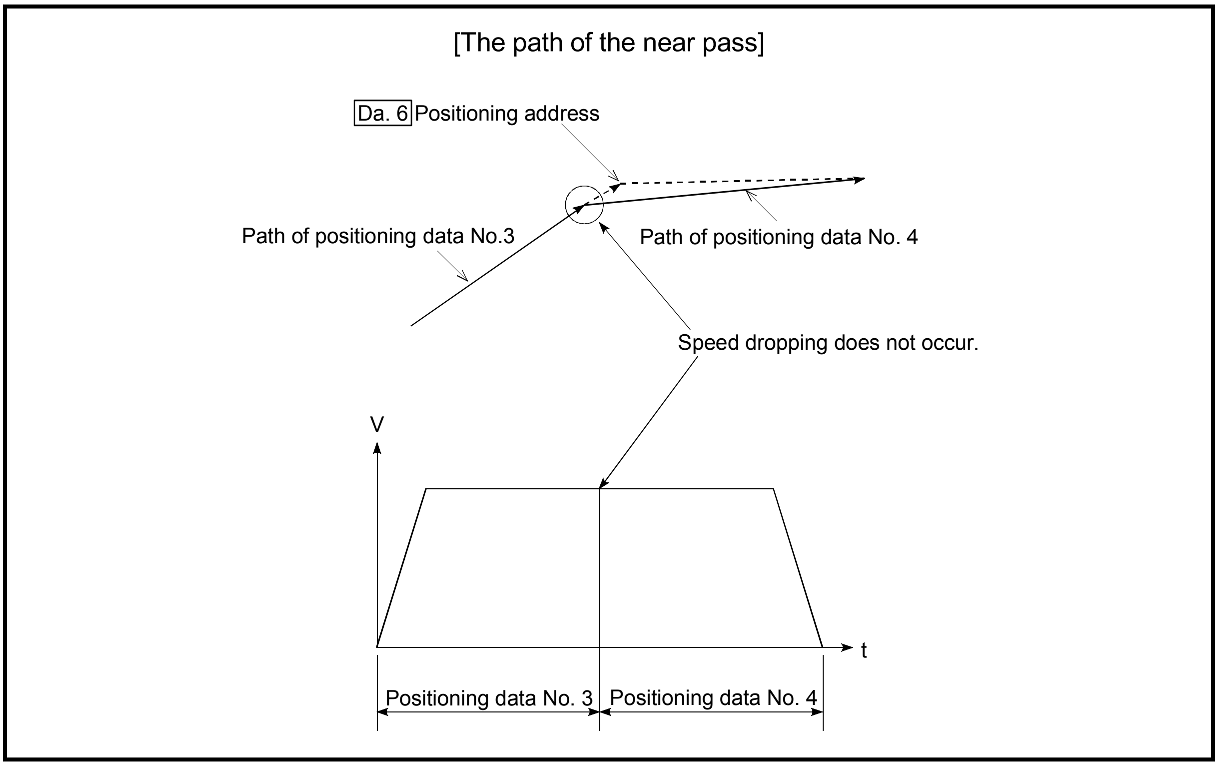


Fig. 13.9 The path of the continuous path control

[2] Precautions during control

(1) If the movement amount designated by the positioning data is small when the continuous path control is executed, the output speed may not reach the designated speed.

(2) The movement direction is not checked during interpolation operation. Therefore, a deceleration stops are not carried out even if the movement direction changes. (See below) For this reason, the output will suddenly reverse when the reference axis movement direction changes. To prevent the sudden output reversal, assign not the continuous path control "11", but the continuous positioning control "01" to the positioning data of the passing point.

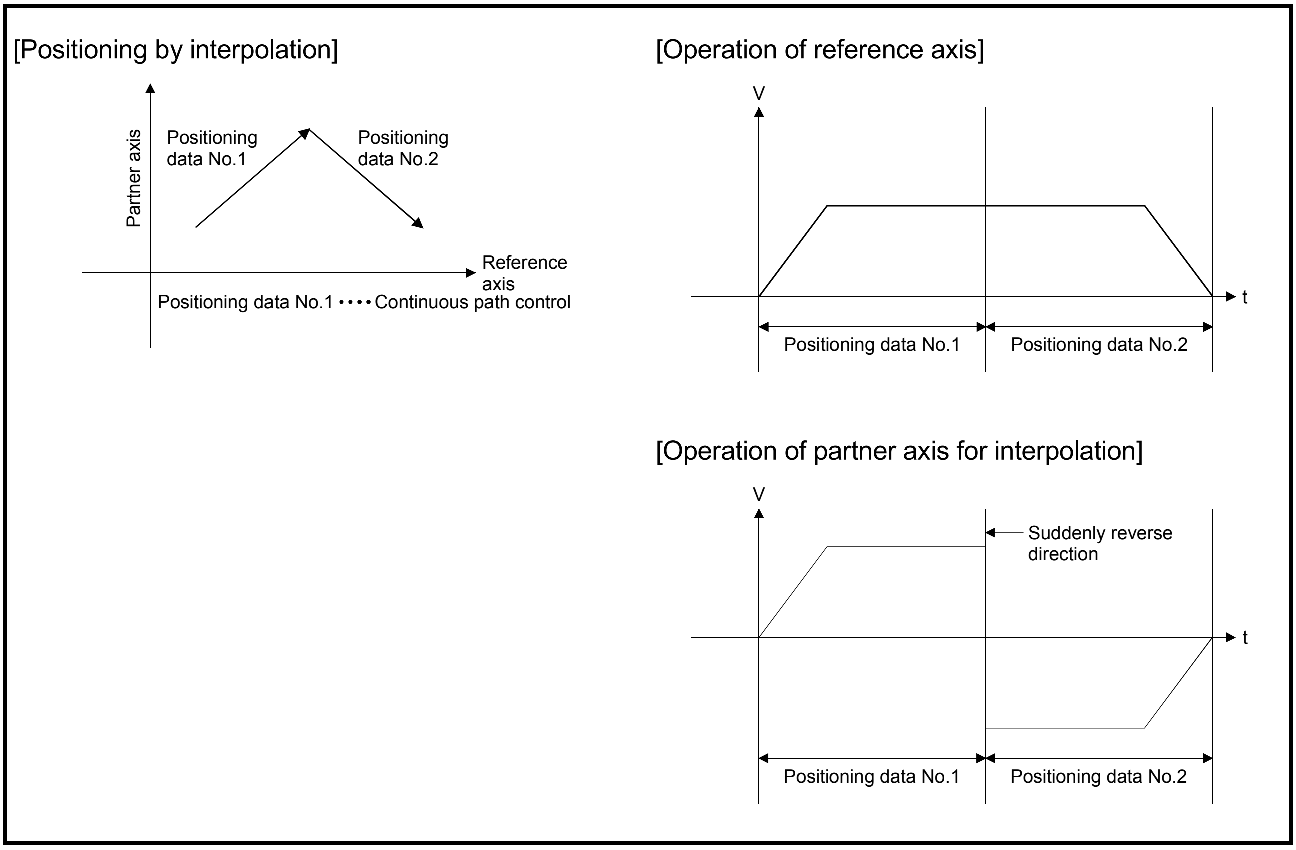


Fig. 13.10 Path and output speed of various axes when movement direction varies during continuous path control

13.4 Functions to limit the control

Functions to limit the control include the "speed limit function", "torque limit function", "software stroke limit function", "hardware stroke limit function", and "forced stop function". Each function is executed by parameter setting or sequence program creation and writing.

13.4.1 Speed limit function

The speed limit function limits the command speed to a value within the "speed limit value" setting range when the command speed during control exceeds the "speed limit value".

The details shown below explain about the "speed limit function".

[1] Relation between the speed limit function and various controls
[2] Precautions during control
[3] Setting the speed limit function

[1] Relation between the speed limit function and various controls

The following table shows the relation of the "speed limit function" and various controls.

Control type			Speed limit function	Speed limit value
OPR control	Machine OPR control		◎	Pr.8 Speed limit value
	Fast OPR control		◎	
Major positioning control	Position control	1-axis linear control	◎	
		2 to 4-axes linear interpolation control	◎	
		1-axis fixed-feed control	◎	
		2 to 4-axes fixed-feed control (interpolation)	◎	
		2-axis circular interpolation control	◎	
	1 to 4-axes Speed control		◎	
	Speed-position switching control, Position-speed switching control		◎	
	Other control	Current value changing	–	Setting value invalid
		JUMP instruction, NOP instruction, LOOP to LEND	–	
Manual control	JOG operation, Inching operation		◎	Pr.31 JOG speed limit value
	Manual pulse generator operation		–	Setting is invalid
Expansion control	Speed-torque control		◎	Pr.8 Speed limit value

◎ : Always set
– : Setting not required (Setting value is invalid. Use the initial value or a value within the setting range.)

[2] Precautions during control

If any axis exceeds "Pr.8 Speed limit value" during 2- to 4-axis speed control, the axis in excess of the speed limit value is controlled at the speed limit value. The speeds of the other axes interpolated are suppressed depending on their command speed ratios.

If the reference axis exceeds "Pr.8 Speed limit value" during 2- to 4-axis linear interpolation control, 2- to 4-axis fixed-feed control or 2-axis circular interpolation control, the reference axis is controlled at the speed limit value (The speed limit does not function on the interpolation axis side.)

[3] Setting the speed limit function

To use the "speed limit function", set the "speed limit value" in the parameters shown in the following table, and write them to the Simple Motion module.

The set details are validated after they are written to the Simple Motion module.

Setting item		Setting value	Setting details	Factory-set initial value
Pr.8	Speed limit value	→	Set the speed limit value (max. speed during control).	200000
Pr.31	JOG speed limit value	→	Set the speed limit value during JOG operation (max. speed during control). (Note that "Pr.31 JOG speed limit value" shall be less than or equal to "Pr.8 Speed limit value".)	20000

＊: Refer to Section 5.2 "List of parameters" for setting details.

REMARK

- Parameters are set for each axis.
- It is recommended that the parameters be set whenever possible with GX Works2. Execution by sequence program uses many sequence programs and devices. The execution becomes complicated, and the scan times will increase.

13.4.2 Torque limit function

The "torque limit function" limits the generated torque to a value within the "torque limit value" setting range when the torque generated in the servomotor exceeds the "torque limit value".
The "torque limit function" protects the deceleration function, limits the power of the operation pressing against the stopper, etc. It controls the operation so that unnecessary force is not applied to the load and machine.

The details shown below explain about the "torque limit function".

[1] Relation between the torque limit function and various controls
[2] Control details
[3] Precautions during control
[4] Setting the torque limit function

[1] Relation between the torque limit function and various controls

The following table shows the relation of the "torque limit function" and various controls.

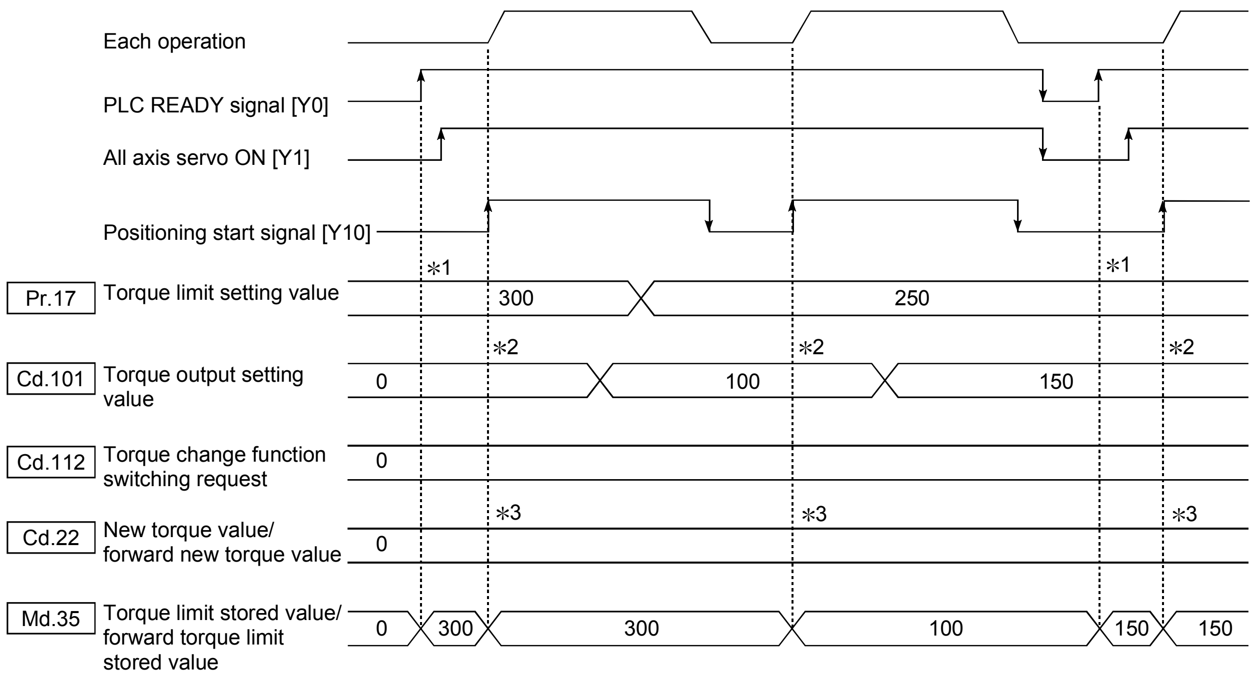
Control type			Torque limit function	Torque limit value ＊
OPR control	Machine OPR control		○	"Pr.17 Torque limit setting value" or "Cd.101 Torque output setting value". ＊: After the "Pr.47 Creep speed" is reached, this value becomes the "Pr.54 OPR torque limit value".
	Fast OPR control		○	"Pr.17 Torque limit setting value" or "Cd.101 Torque output setting value".
Major positioning control	Position control	1-axis linear control	○	
		2 to 4-axes linear interpolation control	○	
		1-axis fixed-feed control	○	
		2 to 4-axes fixed-feed control (interpolation)	○	
		2-axis circular interpolation control	○	
	1 to 4-axes speed control		○	
	Speed-position switching control Position-speed switching control		○	
	Other control	Current value changing	–	Setting value is invalid.
		JUMP instruction, NOP instruction, LOOP to LEND	–	
Manual control	JOG operation, Inching operation		○	"Pr.17 Torque limit setting value" or "Cd.101 Torque output setting value".
	Manual pulse generator operation		○	
Expansion control	Speed-torque control		○	Torque limit value is continued after control mode switching.

○ : Set when required (Set to " – " when not used.)
– : Setting not required (Setting value is invalid. Use the initial value or a value within the setting range.)
＊ : Shows the torque limit value when "Cd.22 New torque value/forward new torque value" or "Cd.113 Reverse new torque value" is set to "0".

[2] Control details

The following drawing shows the operation of the torque limit function.

[QD77MS4 operation example]



*1: The torque limit setting value or torque output setting value becomes effective at the PLC READY signal [Y0] rising edge (however, after the servo turned ON.)
If the torque output setting value is "0" or larger than the torque limit setting value, the torque limit setting value will be its value.

*2: The torque limit setting value or torque output setting value becomes effective at the positioning start signal [Y10] rising edge.
If the torque output setting value is "0" or larger than the torque limit setting value, the torque limit setting value will be its value.

*3: The torque change value is cleared to "0" at the positioning start signal [Y10] rising edge.

(Note): Refer to Section 3.3 for input/output signal or Chapter 5 for buffer memory address of QD77MS16.

Fig. 13.11 Torque limit function operation

[3] Precautions during control

(1) When limiting the torque at the "Pr.17 Torque limit setting value", confirm that "Cd.22 New torque value/forward new torque value" or "Cd.113 Reverse new torque value" is set to "0". If this parameter is set to a value besides "0", the setting value will be validated, and the torque will be limited at that value. (Refer to Section 13.5.4 "Torque change function" for details about the "new torque value".)

(2) When the "Pr.54 OPR torque limit value" exceeds the "Pr.17 Torque limit setting value", an error occurs. (Error code: 995)

(3) When the operation is stopped by torque limiting, the droop pulse will remain in the deviation counter. If the load torque is eliminated, operation for the amount of droop pulses will be carried out.

[4] Setting the torque limit function

(1) To use the "torque limit function", set the "torque limit value" in the parameters shown in the following table, and write them to the Simple Motion module.

a) The set details are validated at the rising edge (OFF → ON) of the PLC READY signal [Y0].

Setting item		Setting value	Setting details	Factory-set initial value
Pr.17	Torque limit setting value	→	Set the torque limit value as a percentage.	300
Pr.54	OPR torque limit value	→	Set the torque limit value after the "Pr.47 Creep speed" is reached. Set as a percentage.	300

b) The set details are validated at the rising edge (OFF → ON) of the positioning start signal [Y10].

Setting item		Setting value	Setting details	Factory-set initial value
Cd.101	Torque output setting value	→	Set the torque output setting value as a percentage.	0

＊: Refer to Section 5.2 "List of parameters" or Section 5.7 "List of control data" for setting details.

＊: Torque limit value: Will be an upper limit value of the torque change value. Even if a larger value has been mistakenly input for the torque change value, it is restricted within the torque limit setting values to prevent an erroneous entry. (Even if a value larger than the torque limit setting value has been input to the torque change value, the torque value is not changed.)

＊: Torque output setting value: to be taken at the start of positioning, and used as a torque limit value. If the value is "0" or larger than the torque limit setting value, the parameter "torque limit setting value" is taken at the start.

(2) The "torque limit value" set in the Simple Motion module is set in the "Md.35 Torque limit stored value/forward torque limit stored value" or "Md.120 Reverse torque limit stored value".

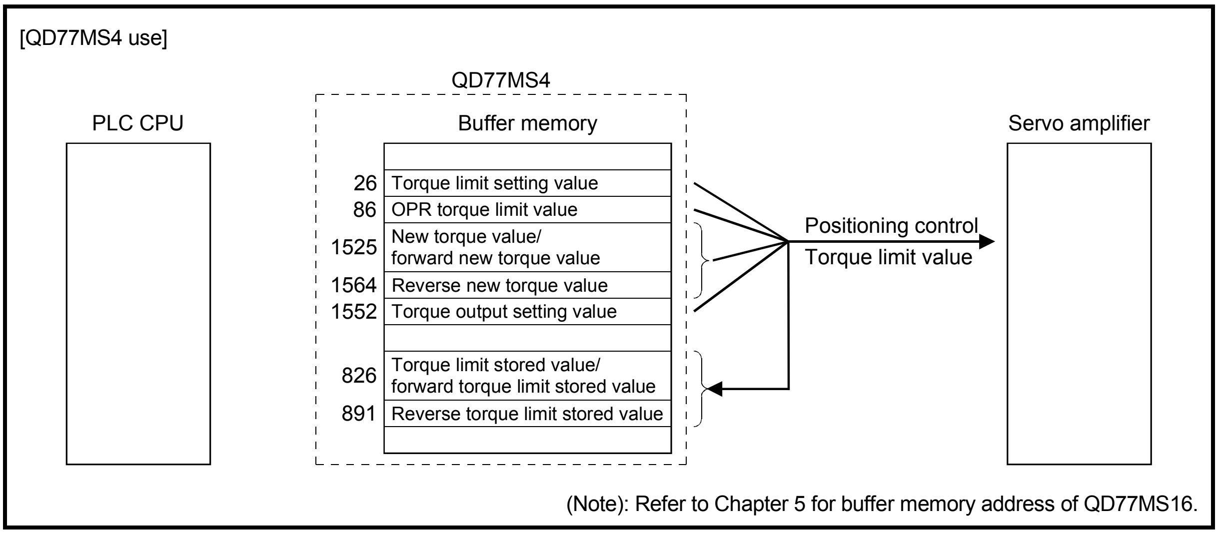


Fig. 13.12 Limiting the torque to the servo amplifier (Axis 1)

(3) The following table shows the "Md.35 Torque limit stored value/forward torque limit stored value" and "Md.120 Reverse torque limit stored value" of the buffer memory address.

Monitor item		Monitor value	Storage details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Md.35	Torque limit stored value/forward torque limit stored value	→	The "torque limit value/forward torque limit stored value" valid at that time is stored. (Pr.17 , Pr.54 , Cd.22 or Cd.101)	826+100n	2426+100n
Md.120	Reverse torque limit stored value	→	The "reverse torque limit stored value" is stored depending on the control status. (Pr.17 , Pr.54 , Cd.22 , Cd.101 or Cd.113)	891+100n	2491+100n

n: Axis No.-1

∗: Refer to Section 5.6 "List of monitor data" for information on the storage details.

REMARK

- Parameters are set for each axis.
- It is recommended that the parameters be set whenever possible with GX Works2. Execution by sequence program uses many sequence programs and devices. The execution becomes complicated, and the scan times will increase.
- Use "Md.120 Reverse torque limit stored value" and "Cd.113 Reverse new torque value" only when "1: Forward/reverse torque limit value individual setting" is set in "Cd.112 Torque change function switching request".
  (Refer to Section 13.5.4 "Torque change function".)

13.4.3 Software stroke limit function

In the "software stroke limit function" the address established by a machine OPR is used to set the upper and lower limits of the moveable range of the workpiece. Movement commands issued to addresses outside that setting range will not be executed.
In the Simple Motion module, the "current feed value" and "machine feed value" are used as the addresses indicating the current position. However, in the "software stroke limit function", the address used to carry out the limit check is designated in the "Pr.14 Software stroke limit selection". (Refer to Section 9.1.4 "Confirming the current value" or details on the "current feed value" and "machine feed value".)
The upper and lower limits of the moveable range of the workpiece are set in "Pr.12 Software stroke limit upper limit value"/"Pr.13 Software stroke limit lower limit value".

The details shown below explain about the "software stroke limit function".

[1] Differences in the moveable range when "current feed value" and "machine feed value" are selected.
[2] Software stroke limit check details
[3] Relation between the software stroke limit function and various controls
[4] Precautions during software stroke limit check
[5] Setting the software stroke limit function
[6] Invalidating the software stroke limit
[7] Setting when the control unit is "degree"

[1] Differences in the moveable range when "current feed value" and "machine feed value" are selected.

The following drawing shows the moveable range of the workpiece when the software stroke limit function is used.

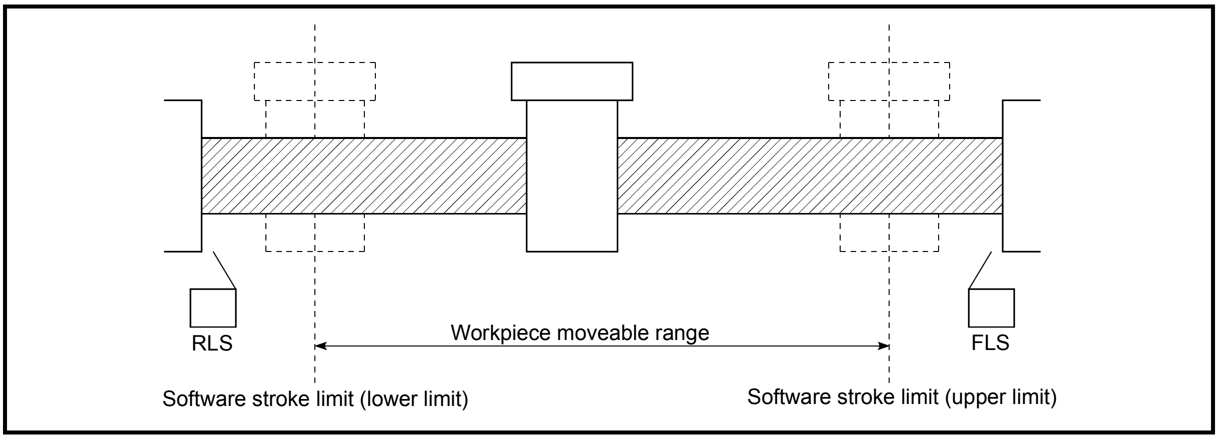
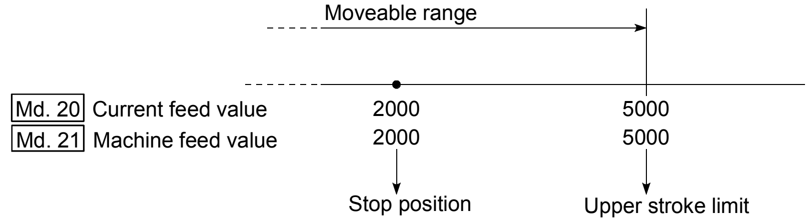


Fig. 13.13 Workpiece moveable range

The following drawing shows the differences in the operation when "Md.20 Current feed value" and "Md.21 Machine feed value" are used in the moveable range limit check.

[Conditions]

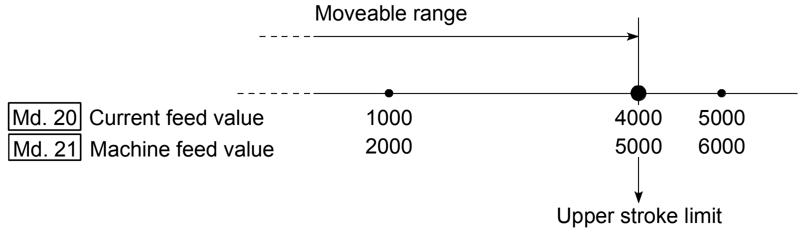
Assume the current stop position is 2000, and the upper stroke limit is set to 5000.



[Current value changing]

When the current value is changed by a new current value command from 2000 to 1000, the current value will change to 1000, but the machine feed value will stay the same at 2000.

1) When the machine feed value is set at the limit
   The machine feed value of 5000 (current feed value: 4000) becomes the upper stroke limit.



2) When the current feed value is set at the limit
   The current feed value of 5000 (machine feed value: 6000) becomes the upper stroke limit.

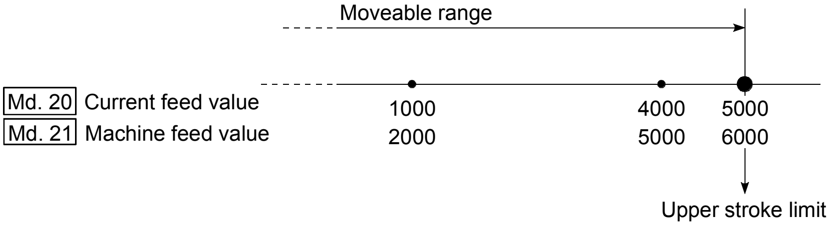


Fig. 13.14 Software stroke limits of the current feed value and machine feed value

POINT

When "machine feed value" is set in "Pr.14 Software stroke limit selection", the moveable range becomes an absolute range referenced on the OP. When "current feed value" is set, the moveable range is the relative range from the "current feed value".

[2] Software stroke limit check details

Check details		Processing when an error occurs
1)	An error shall occur if the current value *1 is outside the software stroke limit range *2. (Check "Md.20 Current feed value" or "Md.21 Machine feed value".)	An "axis error" will occur (error code: 507, 508)
2)	An error shall occur if the command address is outside the software stroke limit range. (Check "Da.6 Positioning address/movement amount".)	

*1: Check whether the "Md.20 Current feed value" or "Md.21 Machine feed value" is set in "Pr.14 Software stroke limit selection".

*2: Moveable range from the "Pr.12 Software stroke limit upper limit value" to the "Pr.13 Software stroke limit lower limit value".

[3] Relation between the software stroke limit function and various controls

Control type			Limit check	Processing at check
OPR control	Machine OPR control	Data set method	◎	Check not carried out.
		Other than "Data set method"	–	
	Fast OPR control		–	
Major positioning control	Position control	1-axis linear control	◎	Checks 1) and 2) in the previous section [2] are carried out. For speed control : The axis decelerates to a stop when it exceeds the software stroke limit range. For position control: The axis comes to an immediate stop when it exceeds the software stroke limit range.
		2 to 4-axes axis linear interpolation control	◎	
		1-axis fixed-feed control	◎	
		2 to 4-axes fixed-feed control (interpolation)	◎	
		2-axis circular interpolation control	◎	
	1 to 4-axes speed control		○ *3, *4	
	Speed-position switching control Position-speed switching control		○ *3, *4	
	Other control	Current value changing	◎	The current value will not be changed if the new current value is outside the software stroke limit range.
		JUMP instruction, NOP instruction, LOOP to LEND	–	Check not carried out.
Manual control	JOG operation, Inching operation		△ *5	Check 1) in the previous section [2] is carried out. The machine will carry out a deceleration stop when the software stroke limit range is exceeded. If the address is outside the software stroke limit range, the operation can only be started toward the moveable range.
	Manual pulse generator operation		△ *5	
Expansion control	Speed-torque control		◎	Check 1) in the previous section [2] is carried out. The mode switches to the position control mode when the software stroke limit range is exceeded, and the operation immediately stops.

◎ : Check valid

○ : Check is not made when the current feed value is not updated (Refer to Pr.21) at the setting of " current feed value" in "Pr.14 Software stroke limit selection" during speed control.

– : Check not carried out (check invalid).

△ : Valid only when "0: valid" is set in the "Pr.15 Software stroke limit valid/invalid setting".

*3: The value in "Md.20 Current feed value" will differ according to the "Pr.21 Current feed value during speed control" setting.

*4: When the unit is "degree", check is not made during speed control.

*5: When the unit is "degree", check is not carried out.

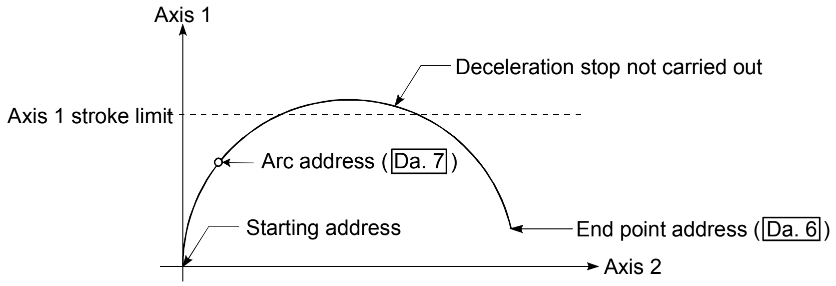
[4] Precautions during software stroke limit check

(1) A machine OPR must be executed beforehand for the "software stroke limit function" to function properly.

(2) During interpolation control, a stroke limit check is carried out for the every current value of both the reference axis and the interpolation axis. Every axis will not start if an error occurs, even if it only occurs in one axis.

(3) During circular interpolation control, the "Pr.12 Software stroke limit upper limit value"/"Pr.13 Software stroke limit lower limit value" may be exceeded.
In this case, a deceleration stop will not be carried out even if the stroke limit is exceeded. Always install an external limit switch if there is a possibility the stroke limit will be exceeded.

Example



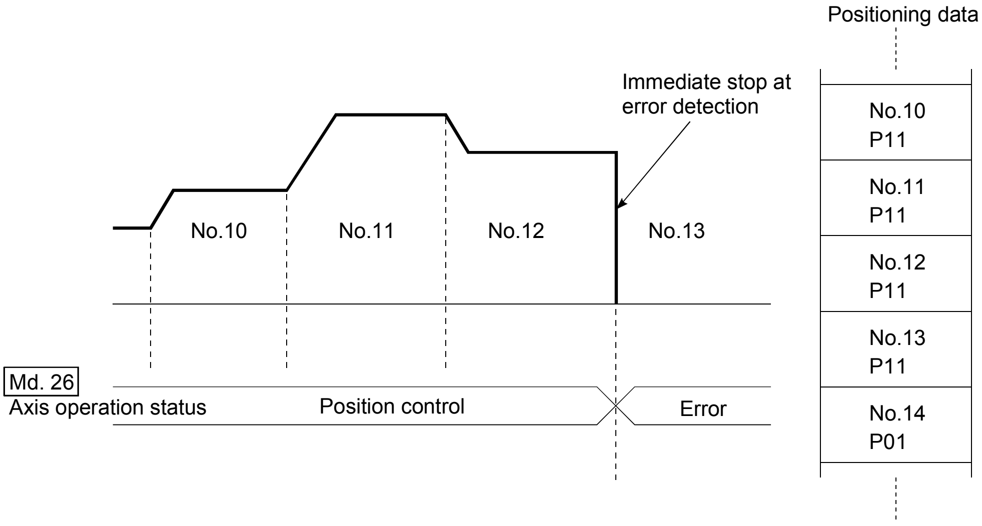
∗ : The software stroke limit check is carried out for the following addresses during circular interpolation control. (Note that "Da. 7 Arc address" is carried out only for circular interpolation control with sub point designation.

Current value/end point address (Da. 6)/arc address (Da. 7)

(4) If an error is detected during continuous path control, the axis stops immediately on completion of execution of the positioning data located right before the positioning data in error.

Example

- If the positioning address of positioning data No. 13 is outside the software stroke limit range, the operation immediately stops after positioning data No. 12 has been executed.



(5) During simultaneous start, a stroke limit check is carried out for the current values of every axis to be started. Every axis will not start if an error occurs, even if it only occurs in one axis.

[5] Setting the software stroke limit function

To use the "software stroke limit function", set the required values in the parameters shown in the following table, and write them to the Simple Motion module.

The set details are validated at the rising edge (OFF → ON) of the PLC READY signal [Y0].

Setting item		Setting value	Setting details	Factory-set initial value
Pr.12	Software stroke limit upper limit value	→	Set the upper limit value of the moveable range.	2147483647
Pr.13	Software stroke limit lower limit value	→	Set the lower limit value of the moveable range.	–2147483648
Pr.14	Software stroke limit selection	→	Set whether to use the "Md.20 Current feed value" or "Md.21 Machine feed value" as the "current value".	0: Current feed value
Pr.15	Software stroke limit valid/invalid setting	0:Valid	Set whether the software stroke limit is validated or invalidated during manual control (JOG operation, Inching operation, manual pulse generator operation).	0: valid

＊: Refer to Section 5.2 "List of parameters" for setting details.

[6] Invalidating the software stroke limit

To invalidate the software stroke limit, set the following parameters as shown, and write them to the Simple Motion module. (Set the value within the setting range.)

Pr.12	Software stroke limit upper limit value	=	Pr.13	Software stroke limit lower limit value

(To invalidate only the manual operation, set "1: software stroke limit invalid" in the "Pr.15 Software stroke limit valid/invalid setting".)

The set details are validated at the rising edge (OFF → ON) of the PLC READY signal [Y0].

When the unit is "degree", the software stroke limit check is not performed during speed control (including speed control in speed-position switching control or position-speed switching control) or during manual control, independently of the values set in Pr.12, Pr.13 and Pr.15.

REMARK

- Parameters are set for each axis.
- It is recommended that the parameters be set whenever possible with GX Works2. Execution by sequence program uses many sequence programs and devices. The execution becomes complicated, and the scan times will increase.

[7] Setting when the control unit is "degree"

■ Current value address

The "Md.20 Current feed value" address is a ring address between 0 and 359.99999° .

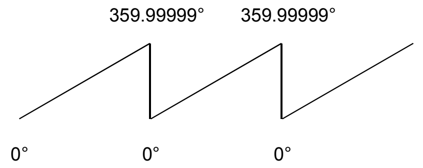
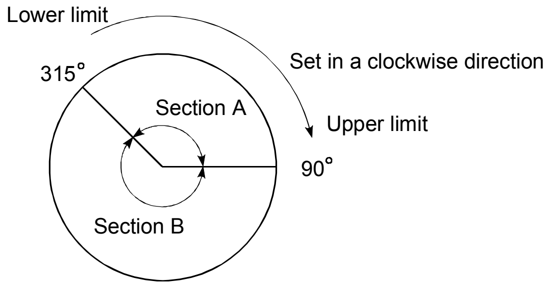


Fig. 13.15 Current value address when the control unit is "degree".

■ Setting the software stroke limit

The upper limit value/lower limit value of the software stroke limit is a value between 0 and 359.99999° .

(1) Setting when the software stroke limit is to be validated.
When the software stroke limit is to be validated, set the upper limit value in a clockwise direction from the lower limit value.



(a) Set the movement range of section A as follows.
- Software stroke limit lower limit value .... 315.00000°
- Software stroke limit upper limit value................ 90.00000°

(b) Set the movement range of section B as follows.
- Software stroke limit lower limit value .... 90.00000°
- Software stroke limit upper limit value................ 315.00000°

Fig. 13.16 Software stroke limit when the control unit is "degree"

13.4.4 Hardware stroke limit function

⚠DANGER

- When the hardware stroke limit is required to be wired, ensure to wire it in the negative logic using b-contact. If it is set in positive logic using a-contact, a serious accident may occur.

In the "hardware stroke limit function", limit switches are set at the upper/lower limit of the physical moveable range, and the control is stopped (by deceleration stop) by the input of a signal from the limit switch. Damage to the machine can be prevented by stopping the control before the upper/lower limit of the physical moveable range is reached.

The hardware stroke limit is able to use the following signals. (Refer to the "Pr.80 External input signal selection".)

- External input signal of QD77MS
- External input signal of servo amplifier
- External input signal via CPU (buffer memory of QD77MS)

The details shown below explain about the "hardware stroke limit function".

[1] Control details
[2] Wiring the hardware stroke limit
[3] Precautions during control
[4] When the hardware stroke limit function is not used

[1] Control details

The following drawing shows the operation of the hardware stroke limit function.

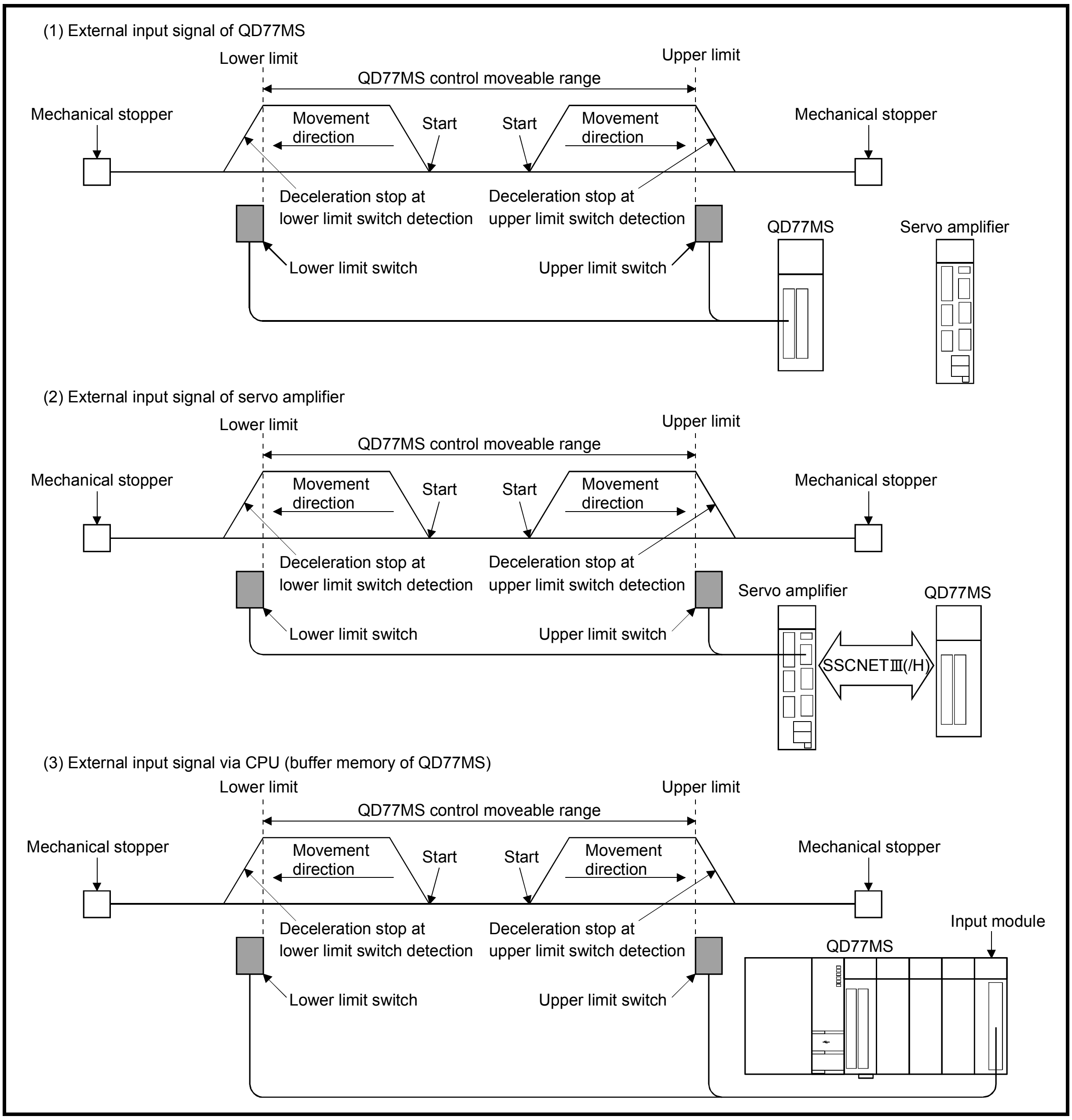
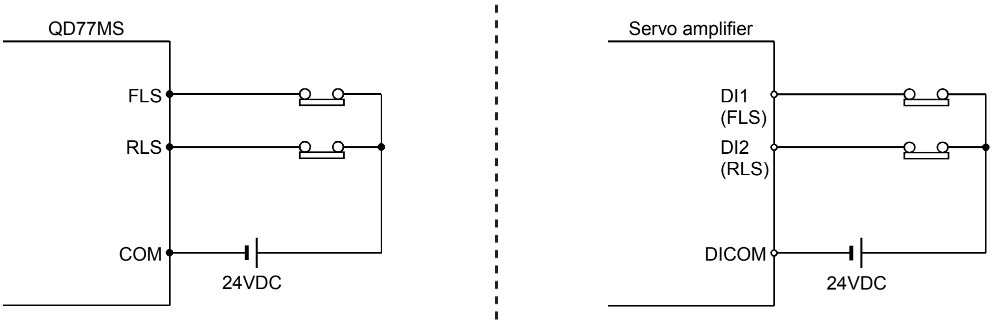


Fig. 13.17 Hardware stroke limit function operation

[2] Wiring the hardware stroke limit

When using the hardware stroke limit function, wire the terminals of the QD77MS/servo amplifier upper/lower limit stroke limit as shown in the following drawing. As for the 24VDC power supply, the direction of current can be switched. (When "Pr.22 Input signal logic selection" is set to the initial value)

When using the hardware stroke limit function with the external input signal via CPU (buffer memory of QD77MS), wiring differs depending on the input module.



(Note): Wire the limit switch installed in the direction to which "Current feed value" increases as upper limit switch and the limit switch installed in the limit switch installed in the direction to which "Current feed value" decreases as lower limit switch. If inverting the install positions of upper/lower limit switches, hardware stroke limit function cannot be operated properly. In addition, the servomotor does not stop. Refer to each servo amplifier instruction manual for details about the "Rotation direction selection/travel direction selection (PA14)".

Fig. 13.18 Wiring when using the hardware stroke limit

[3] Precautions during control

(1) If the machine is stopped outside the Simple Motion module control range (outside the upper/lower limit switches), or if stopped by hardware stroke limit detection, the starting for the "OPR control", "major positioning control", and "high-level positioning control" and the control mode switching cannot be executed. To carry out these types of control again, return the workpiece to the Simple Motion module control range by a "JOG operation", "inching operation" or "manual pulse generator operation".

(2) When "Pr.22 Input signal logic selection" is set to the initial value, the Simple Motion module cannot carry out the positioning control if FLS (limit switch for upper limit) is separated from DICOM or RLS (limit switch for lower limit) is separated from DICOM (including when wiring is not carried out).

[4] When the hardware stroke limit function is not used

When not using the hardware stroke limit function, wire the terminals of the QD77MS/servo amplifier upper/lower limit stroke limit as shown in the following drawing. As for the 24VDC power supply, the direction of current can be switched. When the logic of FLS and RLS is set to "positive logic" using "Pr.22 Input signal logic selection", positioning control can be carried out even if FLS and RLS of the following signals are not wired.

- External input signal of QD77MS
- External input signal of servo amplifier
- External input signal via CPU (buffer memory of QD77MS)

(For details, refer to Section 14.5 "External I/O signal logic switching function".)

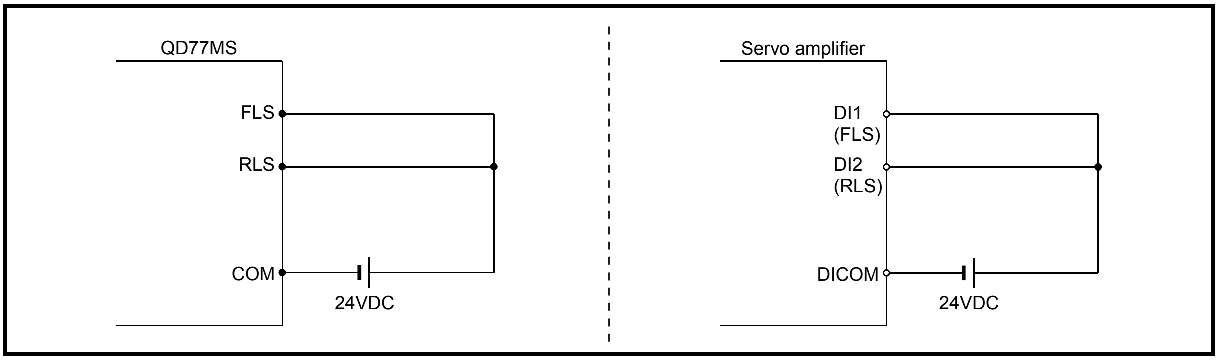


Fig. 13.19 Wiring when not using the hardware stroke limit function
(When "Pr.22 Input signal logic selection" is the initial value)

13.4.5 Forced stop function

⚠DANGER

- When the forced stop is required to be wired, ensure to wire it in the negative logic using b-contact.
- Provided safety circuit outside the Simple Motion module so that the entire system will operate safety even when the "Pr.82 Forced stop valid/invalid selection" is set "1: Invalid". Be sure to use the forced stop signal (EMI) of the servo amplifier.

By the Simple Motion module external input signal connector is connected forced stop input, this function is available for all axes of servo amplifier. (The initial value is "0: Valid".)
The forced stop input valid/invalid is selected by "Pr.82 Forced stop valid/invalid selection".

The details shown below explain about the "forced stop function".

[1] Control details
[2] Wiring the forced stop
[3] Setting the forced stop
[4] How to check the forced stop
[5] Precautions during control

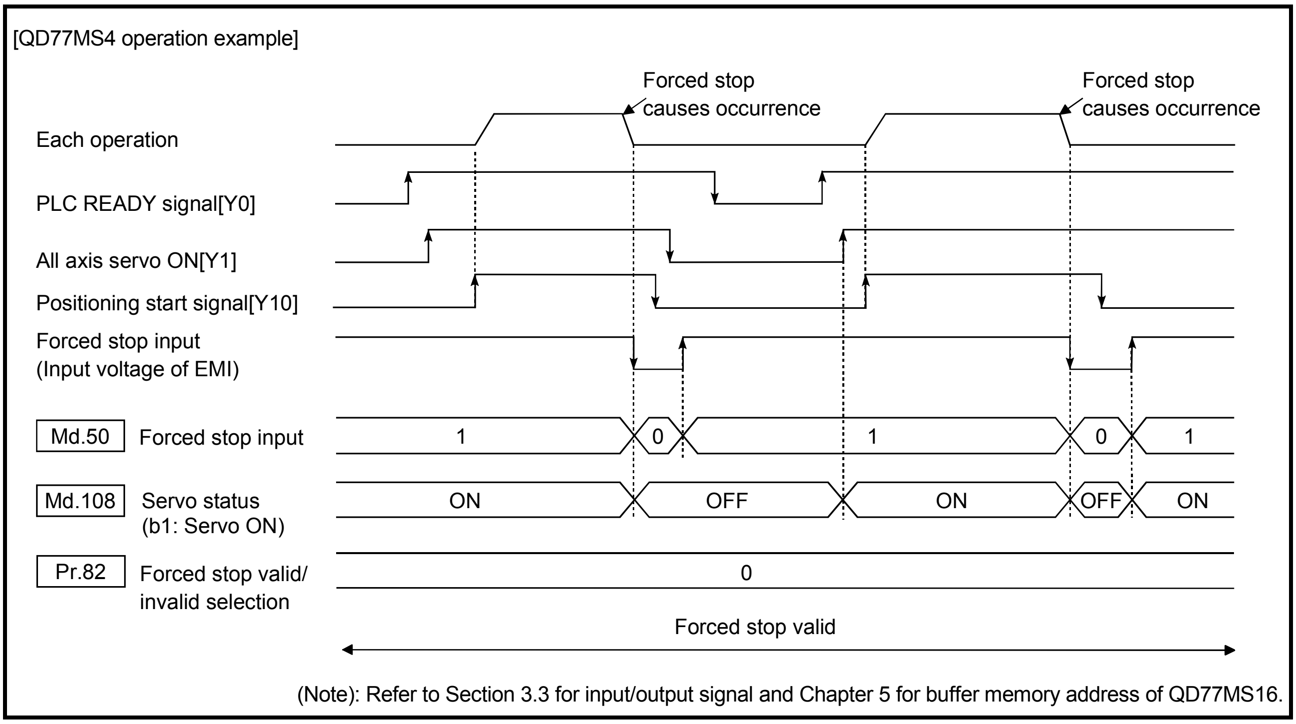
[1] Control details

A warning "controller forced stop warning (warning code: 2147)" will occur if turned on the forced stop input signal when the "Pr.82 Forced stop valid/invalid selection" is set "0: Valid". And then it is available for all axes of servo amplifier.

The outline of the forced stop process is shown below.

Stop cause		Stop axis	M code ON signal after stop	Axis operation status (Md.26) after stopping	Stop process					
					OPR control		Major positioning control	High-level positioning control	Manual control	
					Machine OPR control	Fast OPR control			JOG/ Inching operation	Manual pulse generator operation
Forced stop	"Forced stop input signal" OFF	All axes	No change	Servo OFF	Servo OFF or free run (The operation stops with dynamic brake)					—

The following drawing shows the operation of the forced stop function.



(Note): Refer to Section 3.3 for input/output signal and Chapter 5 for buffer memory address of QD77MS16.

Fig. 13.20 Operation for the forced stop function

[2] Wiring the forced stop

When using the forced stop function, wire the terminals of the Simple Motion module forced stop input as shown in the following drawing. As for the 24VDC power supply, the direction of current can be switched.

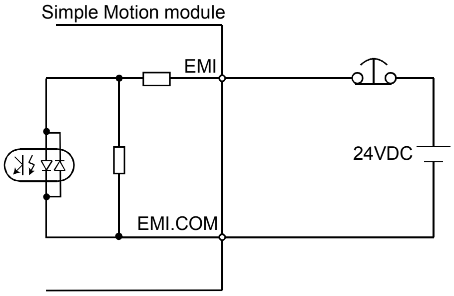


Fig. 13.21 Wiring when using the forced stop

[3] Setting the forced stop

To use the "Forced stop function", set the following data using a sequence program.

The set details are validated at the rising edge (OFF → ON) of the PLC READY signal [Y0].

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Pr.82	Forced stop valid/ invalid selection	→	Set the forced stop function. 0: Valid (Forced stop is used) 1: Invalid (Forced stop is not used)	35	

∗: Refer to Section 5.2.3 "Detailed parameters 1" for details on the setting details.

[4] How to check the forced stop

To use the states (ON/OFF) of forced stop input, set the parameters shown in the following table.

Monitor item		Monitor value	Storage details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Md.50	Forced stop input	→	Stores the states (ON/OFF) of forced stop input. 0: Forced stop input ON (Forced stop) 1: Forced stop input OFF (Forced stop release)	1431	4231

∗: Refer to Section 5.6.1 "System monitor data" for details on the storage details.

[5] Precautions during control

(1) After the "Forced stop input" is released, the servo ON/OFF is valid for the status of all axis servo ON [Y1].

(2) If the setting is other than 0 and 1, "Forced stop valid/invalid setting error" (error code: 937) occurs.

(3) The " Md.50 Forced stop input" is stored "1" by setting " Pr.82 Forced stop valid/invalid selection" to "1: invalid".

(4) When the "Forced stop input" is turned ON during operation, the "Servo READY signal OFF during operation error (error code: 102)" will not occur.

13.5 Functions to change the control details

Functions to change the control details include the "speed change function", "override function", "acceleration/deceleration time change function", "torque change function" and "target position change function". Each function is executed by parameter setting or sequence program creation and writing.
Refer to Section 3.2.5 "Combination of QD77MS main functions and sub functions" for combination with main function.

Both the "speed change function" or "override function" change the speed, but the differences between the functions are shown below. Use the function that corresponds to the application.

"Speed change function"
- The speed is changed at any time, only in the control being executed.
- The new speed is directly set.

"Override function"
- The speed is changed for all control to be executed.
- The new speed is set as a percent (%) of the command speed.

POINT

"Speed change function" and "Override function" cannot be used in the manual pulse generator operation and speed-torque control.

13.5.1 Speed change function

The speed control function is used to change the speed during control to a newly designated speed at any time.
The new speed is directly set in the buffer memory, and the speed is changed by a speed change command (Cd.15 Speed change request) or external command signal.
During the machine OPR, a speed change to the creep speed cannot be carried out after deceleration start because the near point dog ON is detected.

The details shown below explain about the "speed change function".
[1] Control details
[2] Precautions during control
[3] Setting the speed change function from the PLC CPU
[4] Setting the speed change function using an external command signal

[1] Control details

The following drawing shows the operation during a speed change.

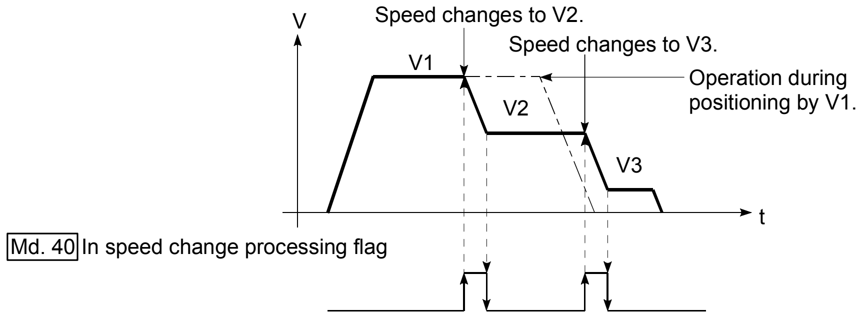


Fig. 13.22 Speed change operation

[2] Precautions during control

(1) Control is carried out as follows at the speed change during continuous path control.

a) When no speed designation (current speed) is provided in the next positioning data:
→ The next positioning data is controlled at the "Cd.14 New speed value".

b) When a speed designation is provided in the next positioning data:
→ The next positioning data is controlled at its "Da.8 Command speed".

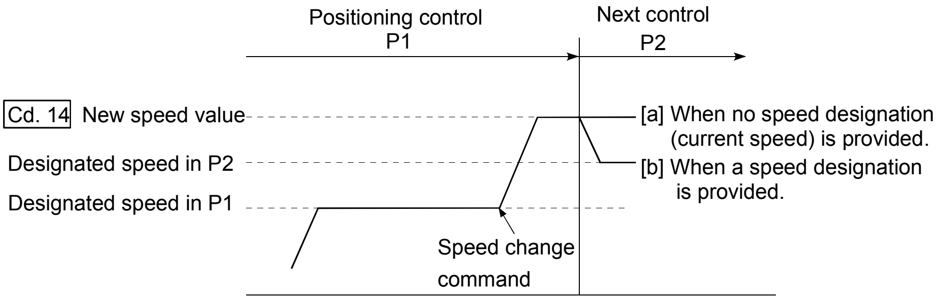


Fig. 13.23 Speed change during continuous path control

(2) When changing the speed during continuous path control, the speed change will be ignored if there is not enough distance remaining to carry out the change.

(3) When the stop command was given to make a stop after a speed change that had been made during position control, the restarting speed depends on the "Cd.14 New speed value".

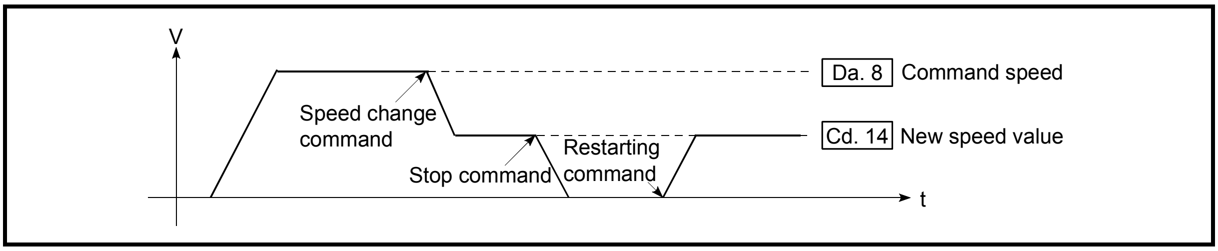
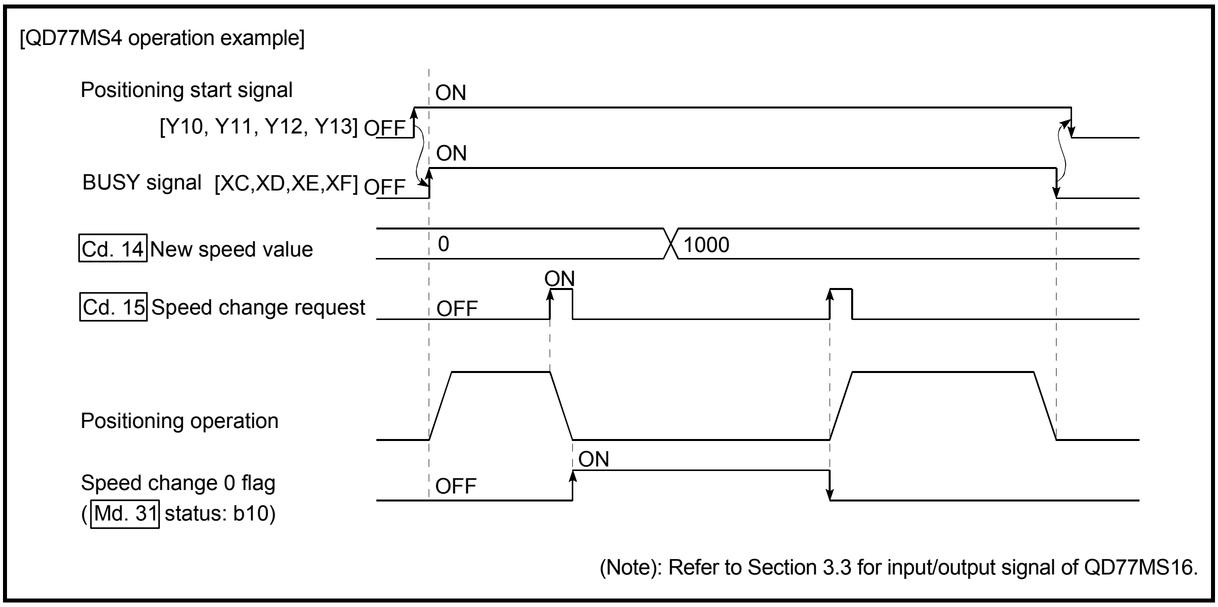


Fig. 13.24 Restarting speed after speed change made during position control

(4) When the speed is changed by setting "Cd.14 New speed value" to "0", the operation is carried out as follows.

- When "Cd.15 Speed change request" is turned ON, the speed change 0 flag (Md.31 Status: b10) turns ON.
  (During interpolation control, the speed change 0 flag on the reference axis side turns ON.)
- The axis stops, but "Md.26 Axis operation status" does not change, and the BUSY signal remains ON. (If a stop signal is input, the BUSY signal will turn OFF, and "Md.26 Axis operation status" will change to "stopped".)

In this case, setting the "Cd.14 New speed value" to a value besides "0" will turn OFF the speed change 0 flag (Md.31 Status: b10), and enable continued operation.



(Note): Refer to Section 3.3 for input/output signal of QD77MS16.

Fig. 13.25 Speed change at new speed value "0"

(5) A warning "Deceleration/stop speed change (warning code: 500)" occurs and the speed cannot be changed in the following cases.
- During deceleration by a stop command
- During automatic deceleration during positioning control

(6) A warning "Speed limit value over (warning code: 501)" occurs and the speed is controlled at the "Pr.8 Speed limit value" when the value set in "Cd.14 New speed value" is larger than the "Pr.8 Speed limit value".

(7) When the speed is changed during interpolation control, the required speed is set in the reference axis.

(8) When carrying out consecutive speed changes, be sure there is an interval between the speed changes of 100ms or more.
(If the interval between speed changes is short, the Simple Motion module will not be able to track, and it may become impossible to carry out commands correctly.)

(9) When a speed change is requested simultaneously for multiple axes, change the speed one by one.
Therefore, the start timing of speed change is different for each axis.

(10) Speed change cannot be carried out during the machine OPR. A request for speed change is ignored.

(11) When deceleration is started by the speed change function, the deceleration start flag does not turn ON.

(12) The speed change function cannot be used during speed control mode, torque control mode or continuous operation to torque control mode.
Refer to Section 12.1 "Speed-torque control" for the speed change during speed control mode or continuous operation to torque control mode.

[3] Setting the speed change function from the PLC CPU

The following shows the data settings and sequence program example for changing the control speed of axis 1 from the PLC CPU. (In this example, the control speed is changed to "20.00mm/min".)

(1) Set the following data.
(Use the speed change time chart shown in section (2) below as a reference, and set using the sequence program shown in section (3).)

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Cd.14	New speed value	2000	Set the new speed.	1514+100n 1515+100n	4314+100n 4315+100n
Cd.15	Speed change request	1	Set "1: Change the speed".	1516+100n	4316+100n

n: Axis No.-1

∗: Refer to Section 5.7 "List of control data" for details on the setting details.

(2) The following shows the speed change time chart.

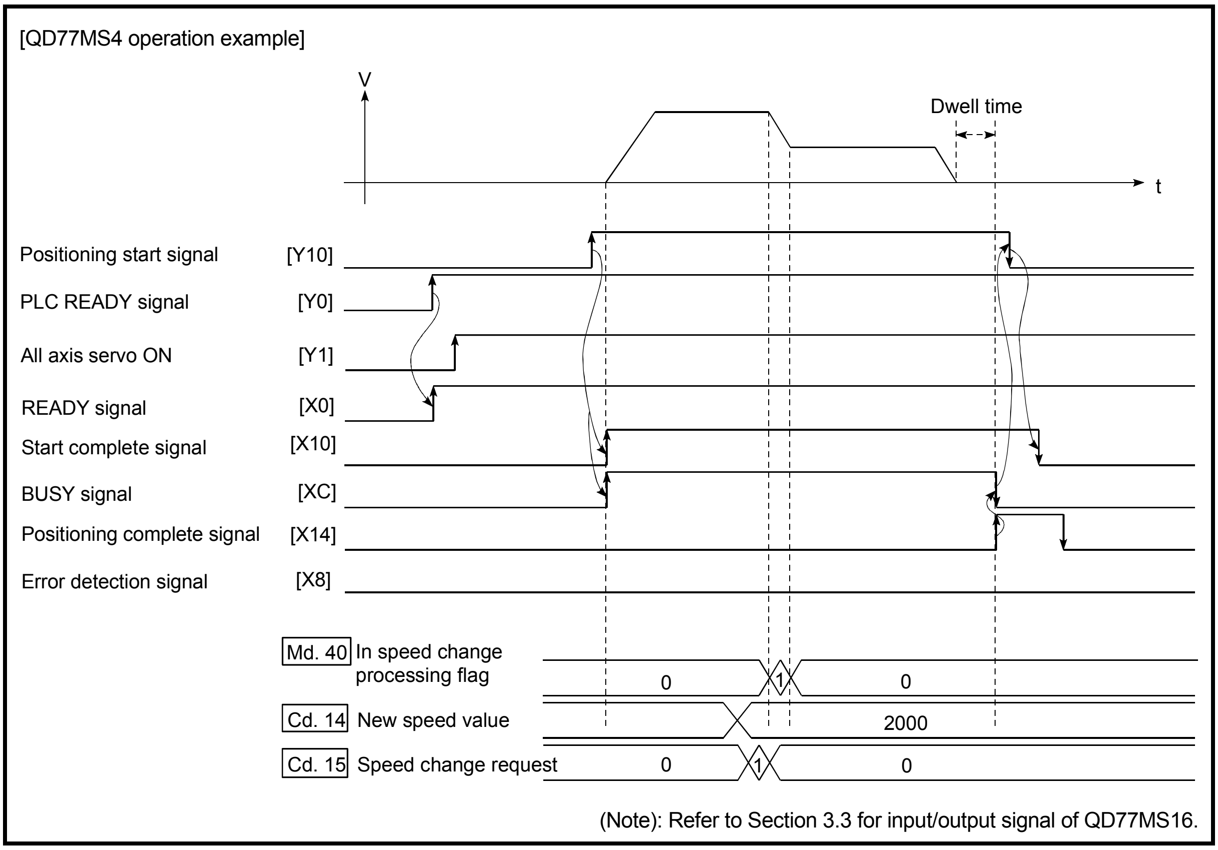
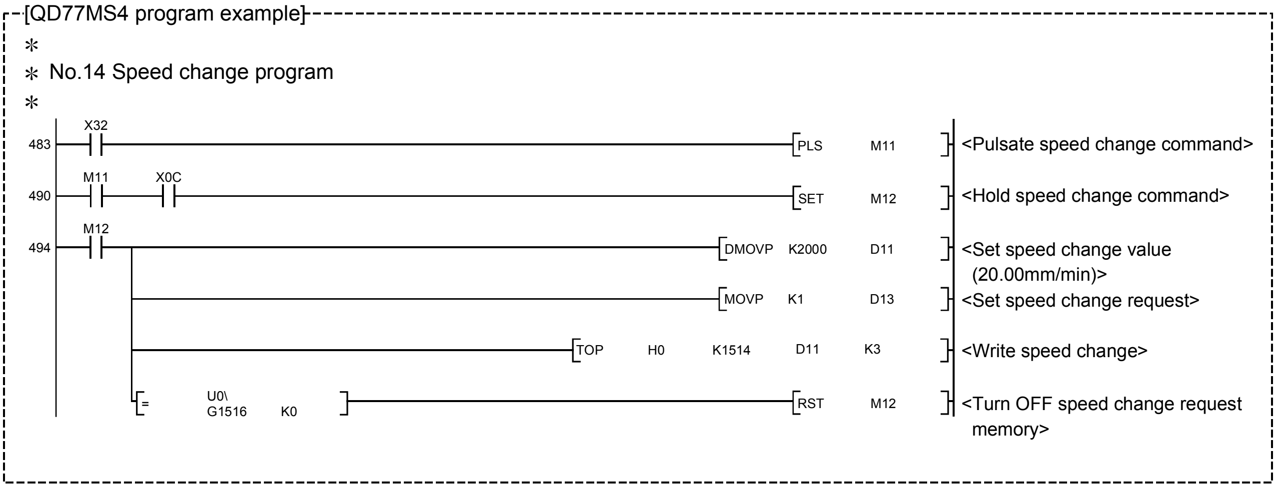


Fig. 13.26 Time chart for changing the speed from the PLC CPU

(3) Add the following sequence program to the control program, and write it to the PLC CPU.



[4] Setting the speed change function using an external command signal

The speed can also be changed using an "external command signal".
The following shows the data settings and sequence program example for changing the control speed of axis 1 using an "external command signal". (In this example, the control speed is changed to "10000.00mm/min".)

(1) Set the following data to change the speed using an external command signal.
(Use the speed change time chart shown in section (2) below as a reference, and set using the sequence program shown in section (3).)

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Pr.42	External command function selection	1	Set "1: External speed change request".	62+150n	
Cd.8	External command valid	1	Set "1: Validate the external command".	1505+100n	4305+100n
Cd.14	New speed value	1000000	Set the new speed.	1514+100n 1515+100n	4314+100n 4315+100n

n: Axis No.-1

＊: Set the external command signal (D1) in "Pr.95 External command signal selection" at QD77MS16 use.
Refer to Section 5.2 "List of parameters" and Section 5.7 "List of control data" for details on the setting details.

(2) The following shows the speed change time chart.

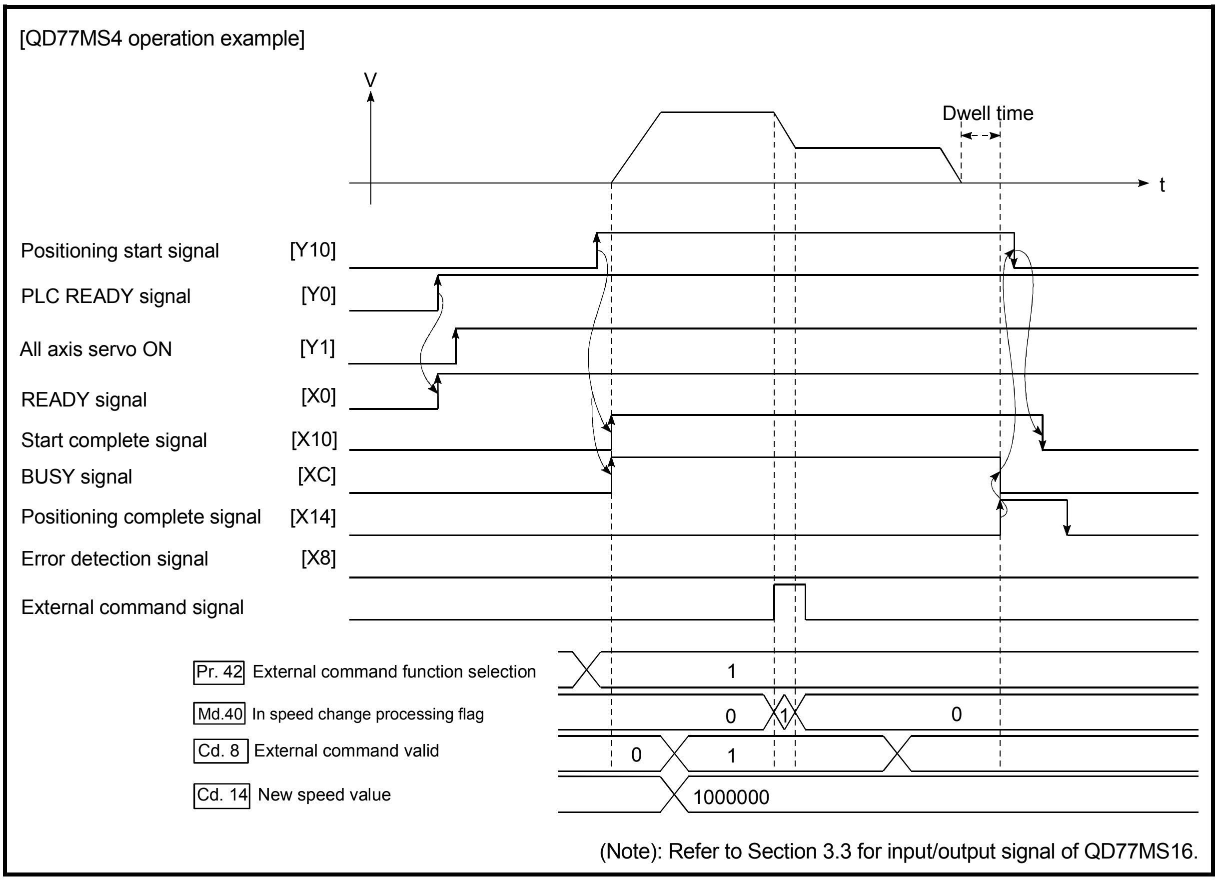
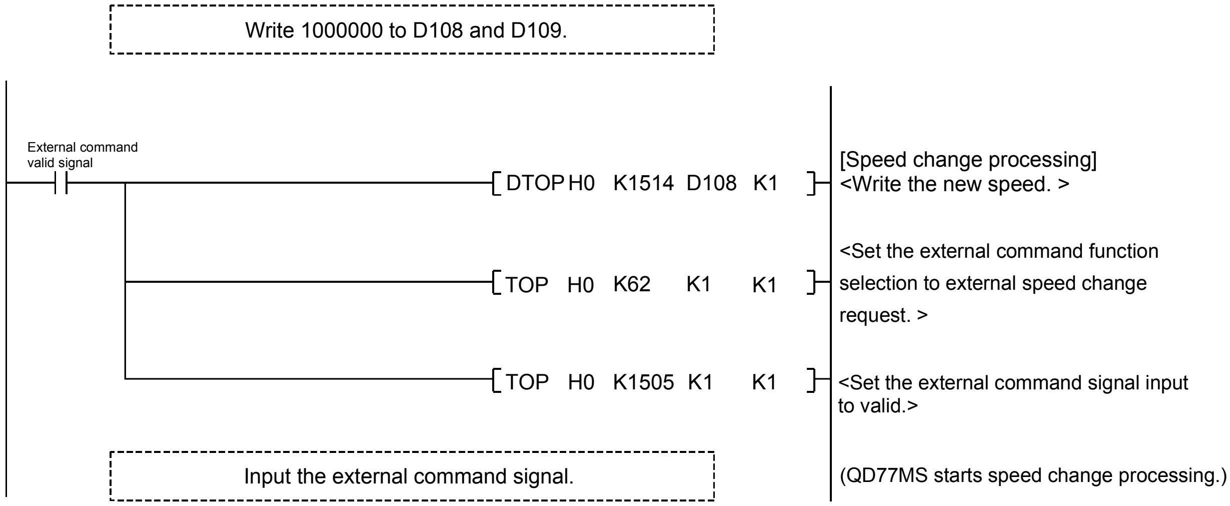


Fig. 13.27 Time chart for changing the speed using an external command signal

(3) Add the following sequence program to the control program, and write it to the PLC CPU.

[QD77MS4 program example]



```
[DTOP H0  K1514 D108 K1 ]
[TOP  H0  K62   K1   K1 ]
[TOP  H0  K1505 K1   K1 ]
```

[Speed change processing]
<Write the new speed. >

<Set the external command function selection to external speed change request. >

<Set the external command signal input to valid.>

(QD77MS starts speed change processing.)

13.5.2 Override function

The override function changes the command speed by a designated percentage (1 to 300%) for all control to be executed.
The speed can be changed by setting the percentage (%) by which the speed is changed in "Cd.13 Positioning operation speed override".

[1] Control details
[2] Precautions during control
[3] Setting the override function

[1] Control details

The following shows that operation of the override function.

1) A value changed by the override function is monitored by "Md.22 Feedrate".
2) If "Cd.13 Positioning operation speed override" is set to 100%, the speed will not change.
3) If "Cd.13 Positioning operation speed override" is set a value less than 100%, the warning "Less than minimum speed (warning code: 110)" is generated, and control will be carried out at speed unit "1" at the time "Md.22 Feedrate" becomes a value of "1" or less.
4) If there is not enough remaining distance to change the speed due to the "override function", when the speed is changed during the position control of speed-position switching control or position-speed switching control, the operation will be carried out at the speed that could be changed.
5) If the speed changed by the override function is greater than the "Pr.8 Speed limit value", a warning "Speed limit value over (warning code: 501)" will occur and the speed will be controlled at the "Pr.8 Speed limit value". The "Md.39 In speed limit flag" will turn ON.

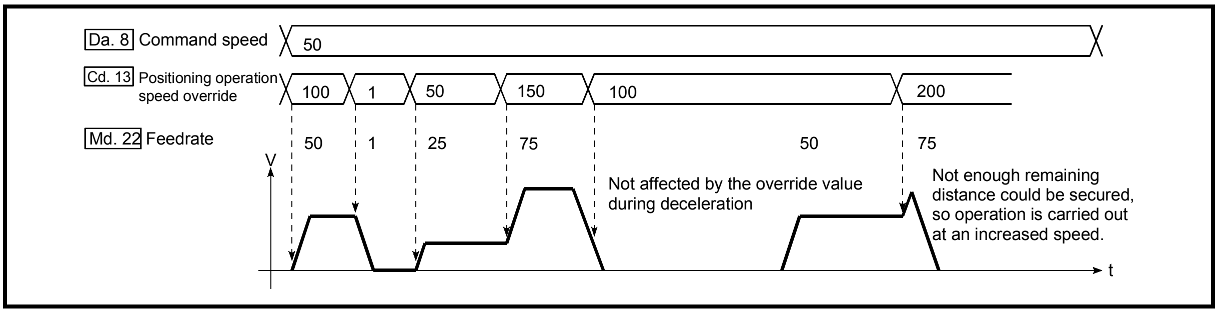


Fig. 13.28 Override function operation

[2] Precaution during control

(1) When changing the speed by the override function during continuous path control, the speed change will be ignored if there is not enough distance remaining to carry out the change.

(2) A warning "Deceleration/stop speed change (warning code: 500)" occurs and the speed cannot be changed by the override function in the following cases.
(The value set in "Cd.13 Positioning operation speed override" is validated after a deceleration stop.)

- During deceleration by a stop command
- During automatic deceleration during positioning control

(3) When the speed is changed by the override function during interpolation control, the required speed is set in the reference axis.

(4) When carrying out consecutive speed changes by the override function, be sure there is an interval between the speed changes of 100ms or more.
(If the interval between speed changes is short, the Simple Motion module will not be able to track, and it may become impossible to carry out commands correctly.)

(5) When a machine OPR is performed, the speed change by the override function cannot be carried out after a deceleration start to the creep speed following the detection of near-point dog ON. In this case, a request for speed change is ignored.

(6) When deceleration is started by the override function, the deceleration start flag does not turn ON.

(7) The override function cannot be used during speed control mode, torque control mode or continuous operation to torque control mode.

[3] Setting the override function

The following shows the data settings and sequence program example for setting the override value of axis 1 to "200%".

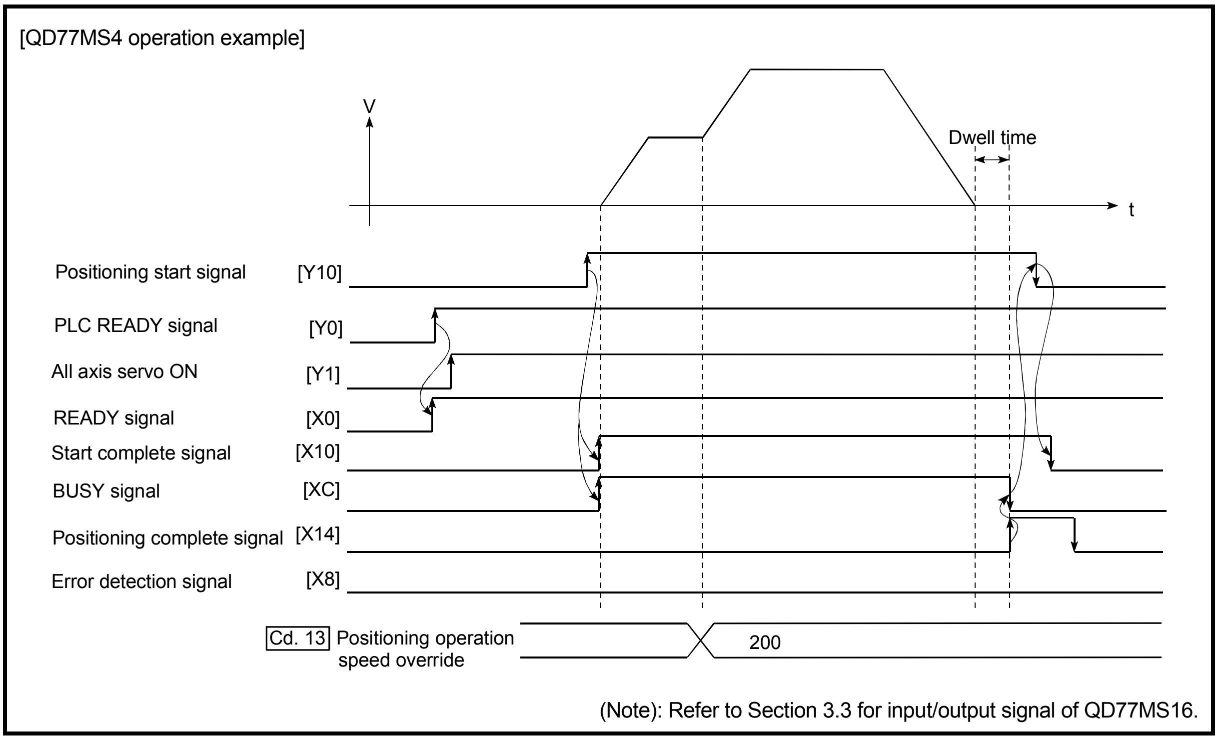
(1) Set the following data. (Use the speed change time chart shown in section (2) below as a reference, and set using the sequence program shown in section (3).)

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Cd.13	Positioning operation speed override	200	Set the new speed as a percentage (%).	1513+100n	4313+100n

n: Axis No.-1

*: Refer to Section 5.7 "List of control data" for details on the setting details.

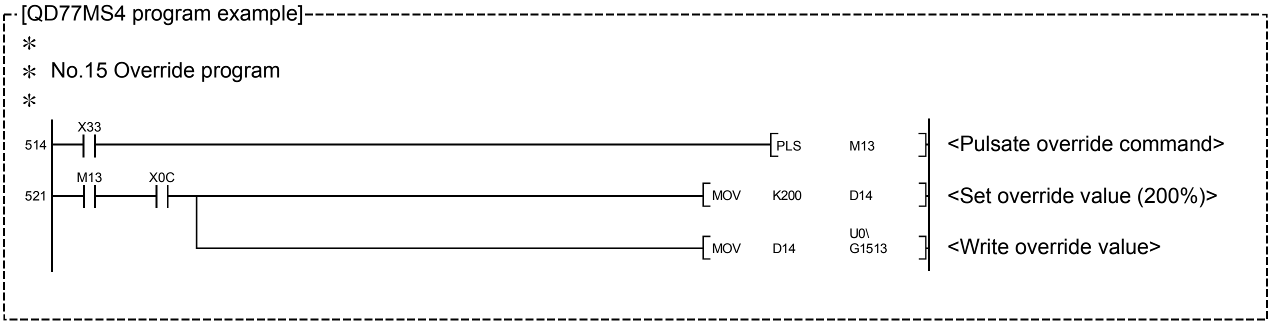
(2) The following shows a time chart for changing the speed using the override function.


[QD77MS4 operation example]

(Note): Refer to Section 3.3 for input/output signal of QD77MS16.

Fig.13.29 Time chart for changing the speed using the override function

(3) Add the following sequence program to the control program, and write it to the PLC CPU.



13.5.3 Acceleration/deceleration time change function

The "acceleration/deceleration time change function" is used to change the acceleration/deceleration time during a speed change to a random value when carrying out the speed change by the "speed change function" and "override function". In a normal speed change (when the acceleration/deceleration time is not changed), the acceleration/deceleration time previously set in the parameters (Pr.9, Pr.10, and Pr.25 to Pr.30 values) is set in the positioning parameter data items Da.3 and Da.4, and control is carried out with that acceleration/deceleration time. However, by setting the new acceleration/deceleration time (Cd.10, Cd.11) in the control data, and issuing an acceleration/deceleration time change enable command (Cd.12 Acceleration/deceleration time change during speed change, enable/disable selection) to change the speed when the acceleration/deceleration time change is enabled, the speed will be changed with the new acceleration/deceleration time (Cd.10, Cd.11).

The details shown below explain about the "acceleration/deceleration time change function".

[1] Control details
[2] Precautions during control
[3] Setting the acceleration/deceleration time change function

[1] Control details

After setting the following two items, carry out the speed change to change the acceleration/deceleration time during the speed change.

- Set change value of the acceleration/deceleration time ("Cd.10 New acceleration time value", "Cd.11 New deceleration time value")
- Setting acceleration/deceleration time change to enable ("Cd.12 Acceleration/deceleration time change during speed change, enable/disable selection")

The following drawing shows the operation during an acceleration/deceleration time change.

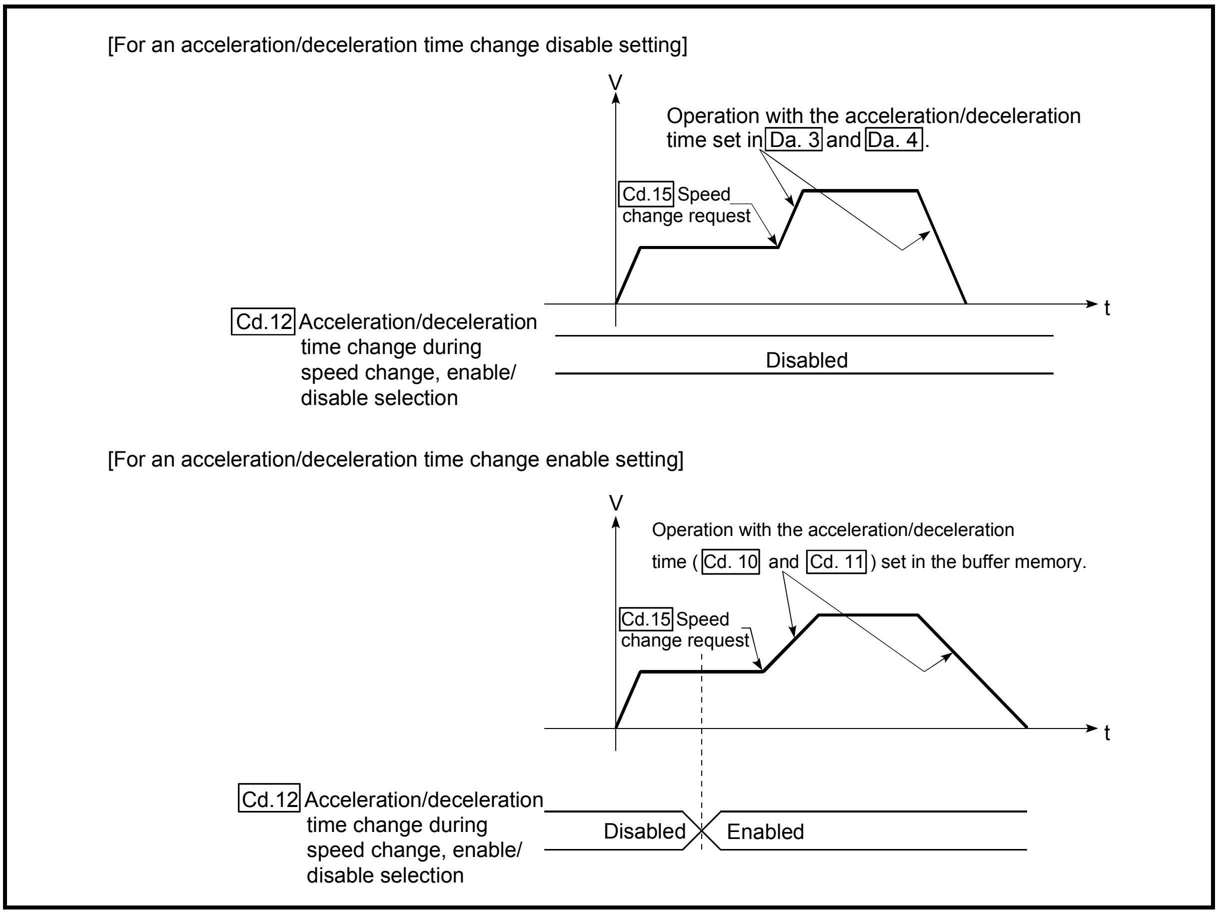


Fig. 13.30 Operation during an acceleration/deceleration time change

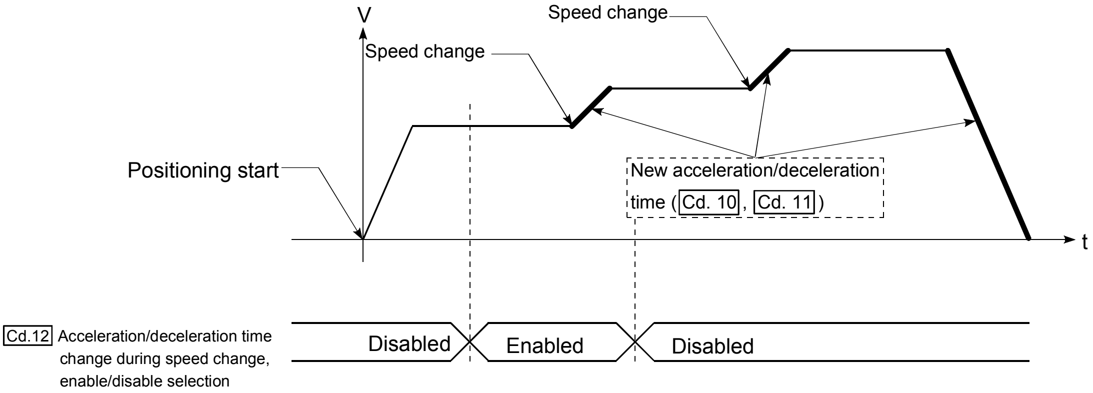
[2] Precautions during control

(1) When "0" is set in "Cd.10 New acceleration time value" and "Cd.11 New deceleration time value", the acceleration/deceleration time will not be changed even if the speed is changed. In this case, the operation will be controlled at the acceleration/deceleration time previously set in the parameters.

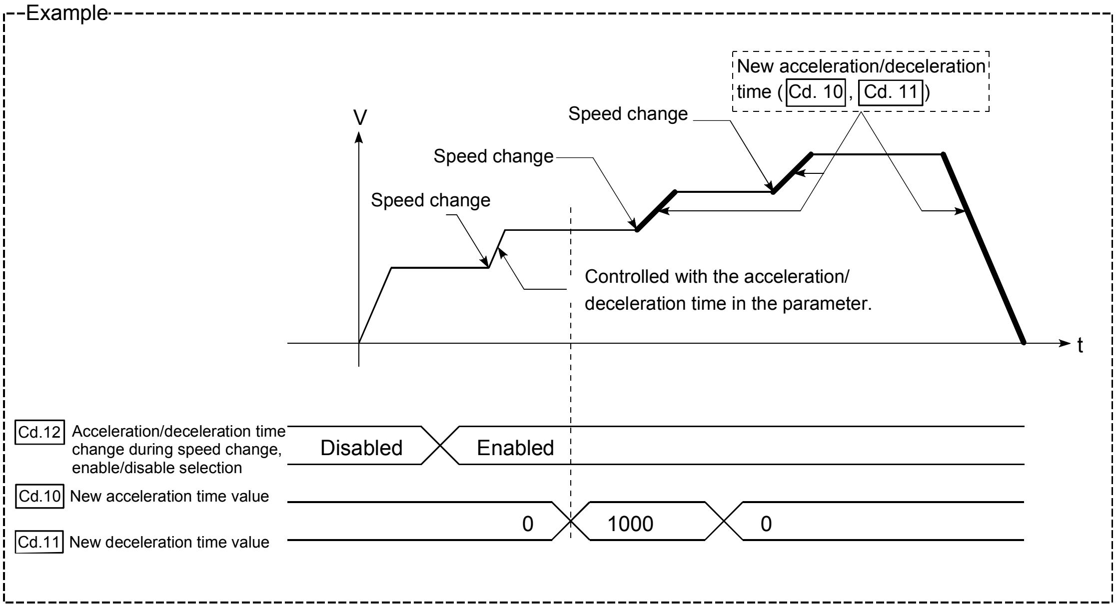
(2) The "new acceleration/deceleration time" is valid during execution of the positioning data for which the speed was changed. In continuous positioning control and continuous path control, the speed is changed and control is carried out with the previously set acceleration/deceleration time at the changeover to the next positioning data, even if the acceleration/deceleration time is changed to the "new acceleration/deceleration time (Cd.10, Cd.11)".

(3) Even if the acceleration/deceleration time change is set to disable after the "new acceleration/deceleration time" is validated, the positioning data for which the "new acceleration/deceleration time" was validated will continue to be controlled with that value. (The next positioning data will be controlled with the previously set acceleration/deceleration time.)

Example



(4) If the "new acceleration/deceleration time" is set to "0" and the speed is changed after the "new acceleration/deceleration time" is validated, the operation will be controlled with the previous "new acceleration/deceleration time".



(5) The acceleration/deceleration change function cannot be used during speed control mode, torque control mode or continuous operation to torque control mode.
Refer to Section 12.1 "Speed-torque control" for the acceleration/deceleration processing during speed control mode or continuous operation to torque control mode.

POINT

If the speed is changed when an acceleration/deceleration change is enabled, the "new acceleration/deceleration time" will become the acceleration/deceleration time of the positioning data being executed. The "new acceleration/deceleration time" remains valid until the changeover to the next positioning data. (The automatic deceleration processing at the completion of the positioning will also be controlled by the "new acceleration/deceleration time".)

[3] Setting the acceleration/deceleration time change function

To use the "acceleration/deceleration time change function", write the data shown in the following table to the Simple Motion module using the sequence program.

The set details are validated when a speed change is executed after the details are written to the Simple Motion module.

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Cd.10	New acceleration time value	→	Set the new acceleration time.	1508+100n 1509+100n	4308+100n 4309+100n
Cd.11	New deceleration time value	→	Set the new deceleration time.	1510+100n 1511+100n	4310+100n 4311+100n
Cd.12	Acceleration/deceleration time change during speed change, enable/disable selection	1	Set "1: Acceleration/deceleration time change enable".	1512+100n	4312+100n

n: Axis No.-1

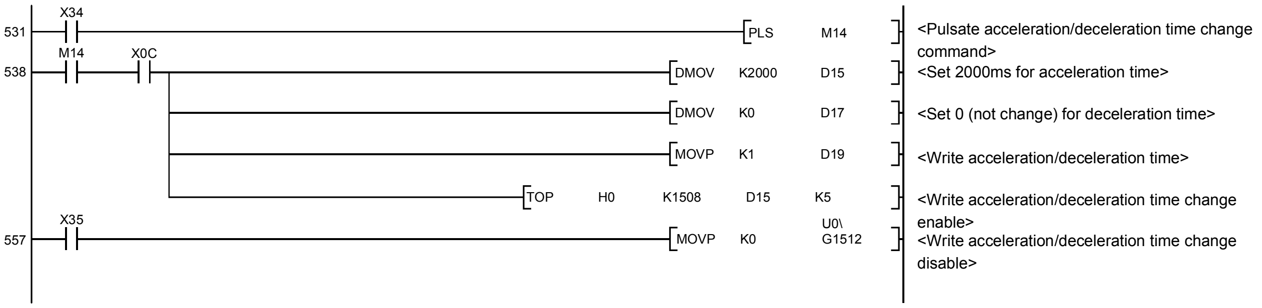
✻: Refer to Section 5.7 "List of control data" for details on the setting details.

[QD77MS4 program example]

✻

✻ No.16 Acceleration/deceleration time change program

✻



13.5.4 Torque change function

The "torque change function" is used to change the torque limit value during torque limiting.
The torque limit value at the control start is the value set in the "Pr.17 Torque limit setting value" or "Cd.101 Torque output setting value".

The following two change methods in the torque change function.

Torque change function	Details
Forward/reverse torque limit value same setting	The forward torque limit value and reverse torque limit value are changed to the same value by the new torque value. (Use this method when they need not be separately set.)
Forward/reverse torque limit value individual setting	The forward torque limit value and reverse torque limit value are individually changed respectively by the forward new torque value and reverse new torque value.

＊: Forward torque limit value: The limit value to the generated torque during CCW regeneration at the CCW driving of the servo motor.
Reverse torque limit value: The limit value to the generated torque during CW regeneration at the CW driving of the servo motor.

Set previously "same setting" or "individual setting" of the forward/reverse torque limit value in "Cd.112 Torque change function switching request".

Torque change function	Setting items		
	Torque change function switching request (Cd.112)	New torque value (Cd.22 , Cd.113)	
Forward/reverse torque limit value same setting	0: Forward/reverse torque limit value same setting	Cd.22	New torque value/ forward new torque value
		Cd.113	Setting invalid
Forward/reverse torque limit value individual setting	1: Forward/reverse torque limit value individual setting	Cd.22	New torque value/ forward new torque value
		Cd.113	Reverse new torque value

The details shown below explain about the "torque change function".
[1] Control details
[2] Precautions during control
[3] Setting the torque change function start signal

[1] Control details

The torque value (forward new torque value/reverse new torque value) of the axis control data can be changed at all times. The torque can be limited with a new torque value from the time the new torque value has been written to the Simple Motion module.

Note that the delay time until a torque control is executed is max. operation cycle after torque change value was written.

The toque limiting is not carried out from the time the power supply is turned ON to the time the PLC READY signal [Y0] is turned ON.

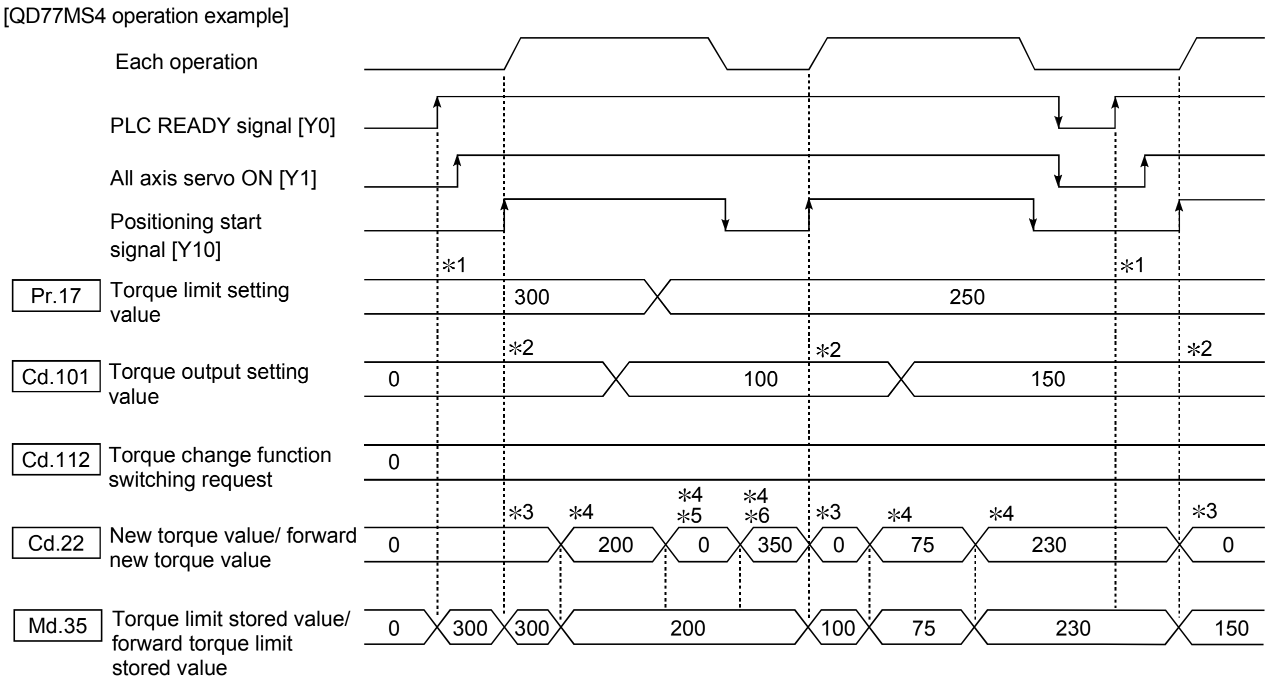
The new torque value (Cd.22, Cd.113) is cleared to zero at the leading edge (OFF to ON) of the positioning start signal [Y10].

The torque setting range is from 0 to "Pr.17 Torque limit setting value".

(When the setting value is 0, a torque change is considered not to be carried out, and it becomes to the value set in "Pr.17 Torque limit setting value" or "Cd.101 Torque output setting value".)

The torque change range is 1 to "Pr.17 Torque limit setting value".

The following drawing shows the operation at the same setting (Figure 13.31) and the operation at the individual setting (Figure 13.32) for the forward new torque value and reverse new torque value.



*1: The torque limit setting value or torque output setting value becomes effective at the PLC READY signal [Y0] rising edge (however, after the servo turned ON.)
If the torque output setting value is "0" or larger than the torque limit setting value, the torque limit setting value will be its value.

*2: The torque limit setting value or torque output setting value becomes effective at the positioning start signal [Y10] rising edge, and the torque limit value is updated.
If the torque output setting value is "0" or larger than the torque limit setting value, the torque limit setting value will be its value.

*3: The torque change value is cleared to "0" at the positioning start signal [Y10] rising edge.

*4: The torque limit value is changed by the torque changed value.

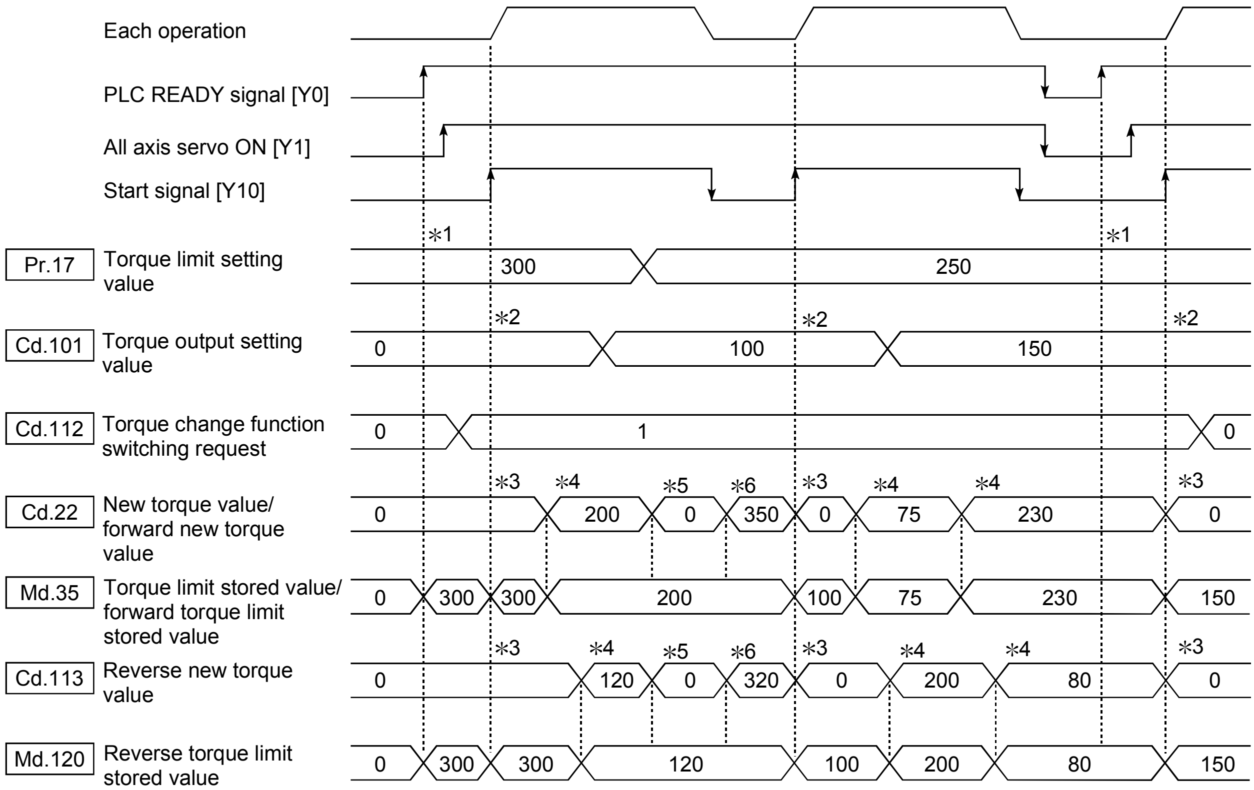
*5: When the new torque value is 0, a torque change is considered not to be carried out.

*6: When the change value is exceeds the torque limit value, a torque change is considered not to be carried out.

(Note): Refer to Section 3.3 for input/output signal and Chapter 5 for buffer memory address of QD77MS16.

Fig. 13.31 Torque change operation (forward/reverse torque limit value same setting) (Axis 1)

[QD77MS4 operation example]



*1: The torque limit setting value or torque output setting value becomes effective at the PLC READY signal [Y0] rising edge (however, after the servo turned ON.)

*2: The torque limit setting value or torque output setting value becomes effective at the positioning start signal [Y10] rising edge, and the torque limit value is updated.

*3: The torque change value is cleared to "0" at the positioning start signal [Y10] rising edge.

*4: The torque limit value is changed by the torque changed value.

*5: When the new torque value is 0, a torque change is considered not to be carried out.

*6: When the change value is exceeds the torque limit value, a torque change is considered not to be carried out.

(Note): Refer to Section 3.3 for input/output signal and Chapter 5 for buffer memory address of QD77MS16.

Fig. 13.32 Torque change operation (forward/reverse torque limit value individual setting) (Axis 1)

[2] Precautions during control

(1) If a value besides "0" is set in the new torque value, the torque generated by the servomotor will be limited by the setting value. To limit the torque with the value set in "Pr.17 Torque limit setting value" or "Cd.101 Torque output setting value", set "0" to the new torque value.

Setting value of "Cd.112 Torque change function switching request"	Setting item (New Torque value)
0: Forward/reverse torque limit value same setting	Cd.22 New torque value/forward new torque value
1: Forward/reverse torque limit value individual setting	Cd.22 New torque value/forward new torque value Cd.113 Reverse new torque value

(2) The "Cd.22 New torque value/forward new torque value" or "Cd.113 Reverse new torque value" is validated when written to the Simple Motion module.
(Note that it is not validated from the time the power supply is turned ON to the time the PLC READY signal [Y0] is turned ON.)

(3) If the setting value of "Cd.22 New torque value/forward new torque value" is outside the setting range, an axis warning "Outside new torque value range/outside forward new torque value range" (warning code: 113) will occur and the torque will not be changed.
If the setting value of "Cd.113 Reverse new torque value" is outside the setting range, an axis warning "Outside reverse new torque value range" (warning code: 115) will occur and the torque will not be changed.

(4) If the time to hold the new torque value is not more than 100ms, a torque change may not be executed.

(5) When changing from "0: Forward/reverse torque limit value same setting" to "1: Forward/reverse torque limit value individual setting" by the torque change function, set "0" or same value set in "Cd.22 New torque value/forward new torque value" in "Cd.113 Reverse new torque value" before change.

[3] Setting the torque change function start signal

To use the "torque change function", write the data shown in the following table to the Simple Motion module using the sequence program.
The set details are validated when written to the Simple Motion module.

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Cd.112	Torque change function switching request	0: Forward/ reverse torque limit value same setting 1: Forward/ reverse torque limit value individual setting	Sets "same setting/individual setting" of the forward torque limit value and reverse torque limit value. ∗: Set "0" normally. (When the forward torque limit value and reverse torque limit value are not divided.) ∗: When a value except "1" is set, it operates as "forward/reverse torque limit value same setting.	1563+100n	4363+100n
Cd.22	New torque value/forward new torque value	0 to Pr.17 Torque limit setting value	When "0" is set to "Cd.112 Torque change function switching request", a new torque limit value is set. (This value is set to the forward torque limit value and reverse torque limit value.) When "1" is set to "Cd.112 Torque change function switching request", a new forward torque limit value is set.	1525+100n	4325+100n
Cd.113	Reverse new torque value	0 to Pr.17 Torque limit setting value	"1" is set in "Cd.112 Torque change function switching request", a new reverse torque limit value is set. ∗: When "0" is set in "Cd.112 Torque change function switching request", the setting value is invalid.	1564+100n	4364+100n

n: Axis No.-1

∗: Refer to Section 5.7 "List of control data" for details on the setting details.

13.5.5 Target position change function

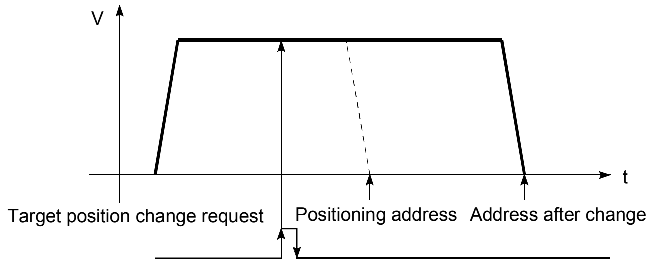
The "target position change function" is a function to change a target position to a newly designated target position at any timing during the position control (1-axis linear control). A command speed can also be changed simultaneously.
The target position and command speed changed are set directly in the buffer memory, and the target position change is executed by "Cd.29 Target position change request flag".

The following shows the details of the "target position change function".
[1] Details of control
[2] Precaution during operation
[3] Method of setting target position change function from PLC CPU

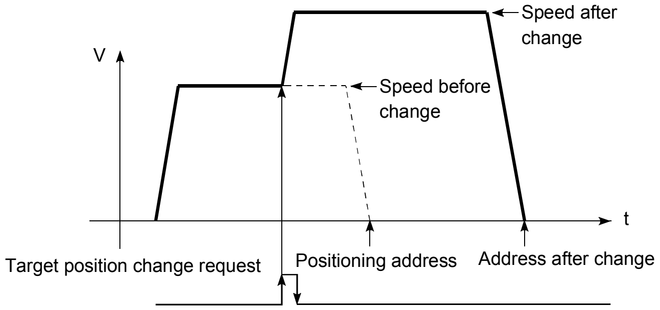
[1] Details of control

The following charts show the details of control of the target position change function.

(a) When the address after change is positioned away from the start point more than the positioning address:



(b) When the speed is changed simultaneously with changing the address:



(c) When the direction of the operation is changed:

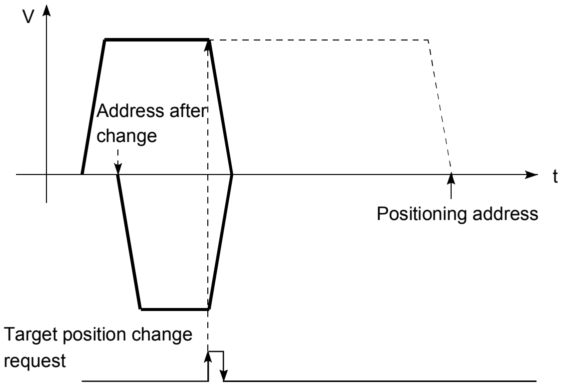


Fig. 13.33 Target position change operation

[2] Precautions during operation

(1) If the positioning movement direction from the stop position to a new target position is reversed, stop the operation once and then position to the new target position. (Refer to Fig. 13.33 (c).)

(2) If a command speed exceeding the speed limit value is set to change the command speed, a warning will be given, and the new command speed will be the speed limit value (warning code: 501).
Also, if the command speed change disables the remaining distance to the target value from being assured, a warning will be given (warning code: 509).

(3) In the following cases, a target position change request given is ignored and a warning occurs. (warning code: 518)

- During interpolation control
- A new target position value (address) is outside the software stroke limit range.
- The axis is decelerating to a stop by a stop cause.
- While the positioning data whose operation pattern is continuous path control is executed.
- When the speed change 0 flag (Md.31 Status: b10) is ON.

(4) When a command speed is changed, the current speed is also changed. When the next positioning speed uses the current speed in the continuous positioning, the next positioning operation is carried out at the new speed value. When the speed is set with the next positioning data, the speed becomes the current speed and the operation is carried out at the current speed.

(5) When a target position change request is given during automatic deceleration in position control, positioning control to a new position is exercised after the axis has stopped once if the moving direction is reversed. If the moving direction is not reversed, the axis is accelerated to the command speed again and positioned to the new position.

(6) If the constant speed status is regained or the output is reversed by a target position change made while "Md.48 Deceleration start flag" is ON, the deceleration start flag remains ON. (For details, refer to Section 13.7.8.)

(7) Carrying out the target position change to the ABS linear 1 in degrees may carry out the positioning to the new target position after the operation decelerates to stop once, even the movement direction is not reversed.

POINT

When carrying out the target position change continuously, take an interval of 100 ms or longer between the times of the target position changes. Also, take an interval of 100 ms or longer when the speed change and override is carried out after changing the target position or the target position change is carried out after the speed change and override.

[3] Method of setting target position change function from PLC CPU

The following table and chart show the example of a data setting and sequence program used to change the target position of the axis 1 by the command from the PLC CPU, respectively. (example in which the target position value and command speed are changed to a new target position of "300.0 μm" and a new command speed of "10000.00 mm/min".)

(1) The following data is set.

(Referring to the target position change time chart shown in item (2) below, carry out the setting with the sequence program shown in item (3).)

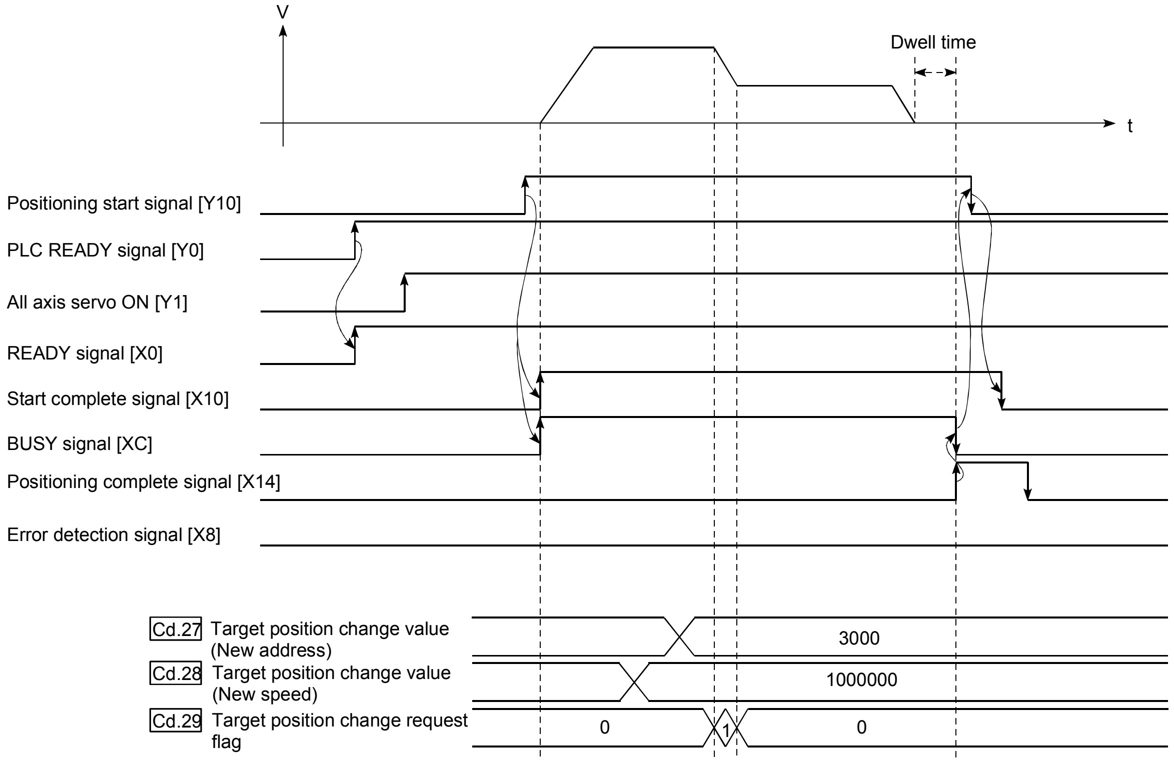
Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Cd.27	Target position change value (New address)	3000	Set the new address.	1534+100n 1535+100n	4334+100n 4335+100n
Cd.28	Target position change value (New speed)	1000000	Set the new speed.	1536+100n 1537+100n	4336+100n 4337+100n
Cd.29	Target position change request flag	1	Set "1: Requests a change in the target position".	1538+100n	4338+100n

n: Axis No.-1

∗: Refer to Section 5.7 "List of control data" for details on the setting details.

(2) The following shows the time chart for target position change.

[QD77MS4 operation example]



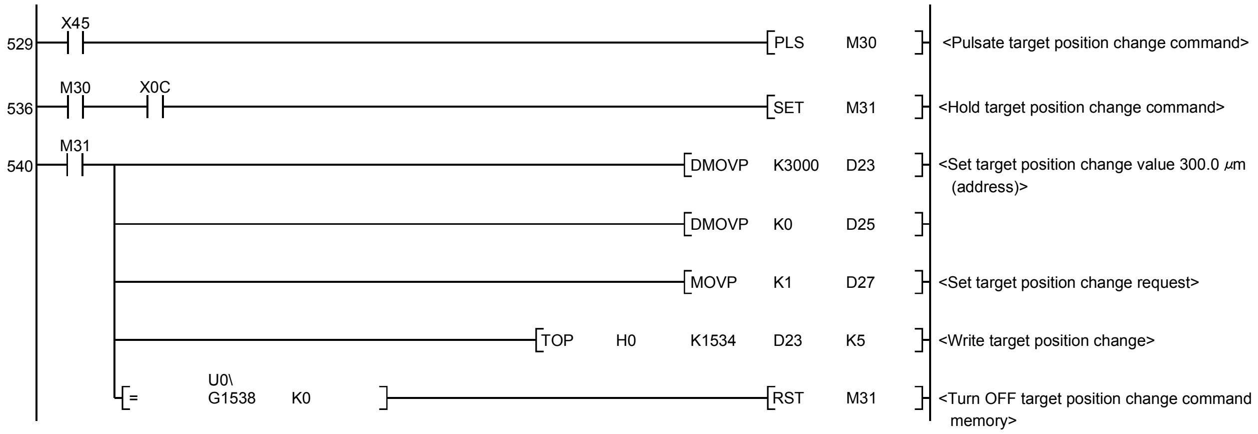
(Note): Refer to Section 3.3 for input/output signal of QD77MS16.

Fig. 13.34 Time chart for target position change from PLC CPU

(3) The following sequence program is added to the control program, and written to the PLC CPU.

[QD77MS4 program example]

```
*
* No.22 Target position change program
*
```



```
529  X45                                [PLS    M30                 ]  <Pulsate target position change command>
536  M30  X0C                           [SET    M31                 ]  <Hold target position change command>
540  M31                                [DMOVP  K3000  D23          ]  <Set target position change value 300.0 μm
                                                                         (address)>
                                        [DMOVP  K0     D25          ]
                                        [MOVP   K1     D27          ]  <Set target position change request>
                          [TOP   H0     K1534   D23    K5           ]  <Write target position change>
         [=  U0\G1538  K0 ]             [RST    M31                 ]  <Turn OFF target position change command
                                                                         memory>
```

13.6 Absolute position system

The Simple Motion module can construct an absolute position system by installing the absolute position system and connecting it through SSCNETⅢ/H.
The following describes precautions when constructing the absolute position system.

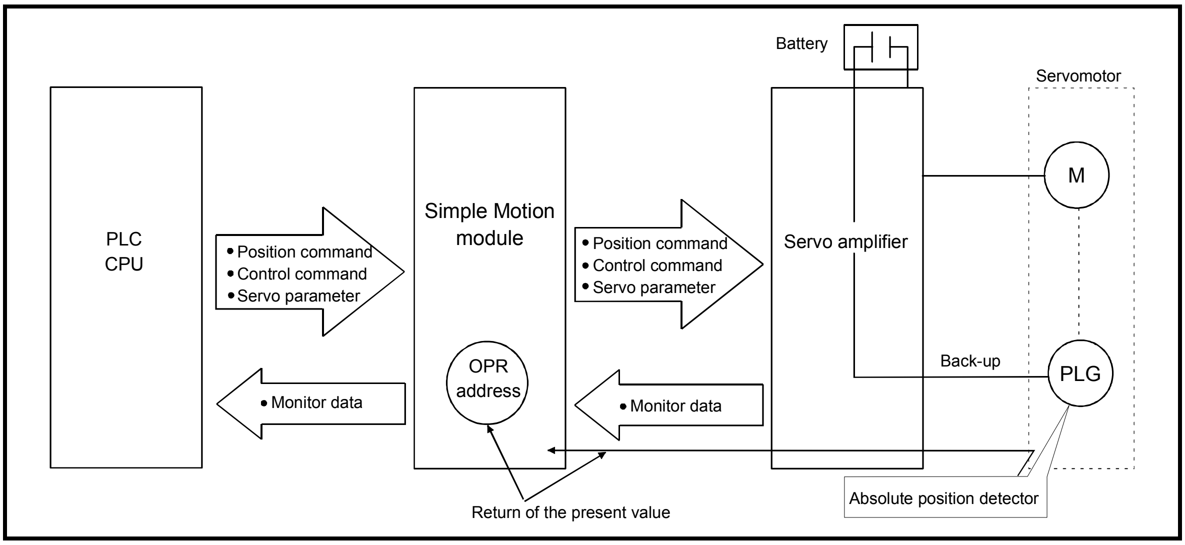


Fig. 13.35 Configuration of absolute position system

[1] Setting for absolute positions

For constructing an absolute position system, use a servo amplifier and a servomotor which enable absolute position detection.
It is also necessary to install a battery for retaining the location of the OPR in the servo amplifier. To use the absolute position system, select "1: Enabled (used in absolute position detection system)" in "Absolute position detection system (PA03)" in the amplifier setting for the servo parameters (basic setting).
Refer to each servo amplifier instruction manual for details of the absolute position system.

	Buffer memory address	
	QD77MS2/QD77MS4	QD77MS16
Absolute position detection system (PA03)	30103+200n	28403+100n

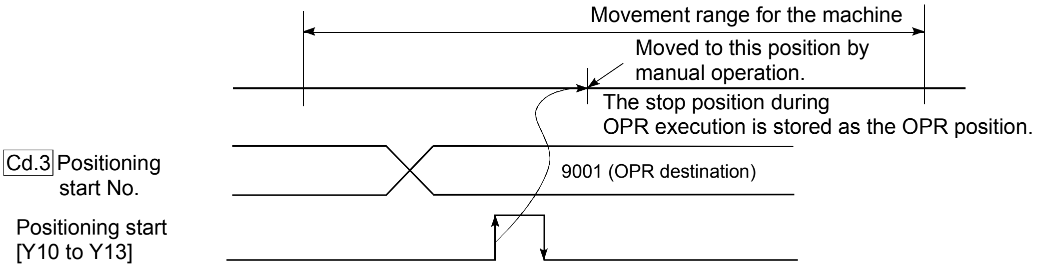
n: Axis No.-1

[2] OPR

The absolute position system can establish the OP position, using "Data set method", "Near-point dog method", "Count method" and "Scale origin signal detection method" OPR method.

In the "Data set method" OPR method, the location to which the location of the OP position is moved by manual operation (JOG operation/manual pulse generator operation) is treated as the OP position.

[QD77MS4 operation example]



(Note): Refer to Section 3.3 for input/output signal of QD77MS16.

Fig. 13.36 Operation of the OPR execution

13.7 Other functions

Other functions include the "step function", "skip function", "M code output function", "teaching function", "command in-position function", "acceleration/deceleration processing function", "pre-reading start function", "deceleration start flag function", "stop command processing for deceleration stop function", "follow up processing function", "speed control 10 × multiplier setting for degree axis function" and "operation setting for incompletion of OPR function". Each function is executed by parameter setting or sequence program creation and writing.

13.7.1 Step function

The "step function" is used to confirm each operation of the positioning control one by one.
It is used in debugging work for major positioning control, etc.
A positioning operation in which a "step function" is used is called a "step operation".
In step operations, the timing for stopping the control can be set. (This is called the "step mode".) Control stopped by a step operation can be continued by setting "step continues (to continue the control)" in the "step start information".

The details shown below explain about the "step function".
[1] Relation between the step function and various controls
[2] Step mode
[3] Step start information
[4] Using the step operation
[5] Control details
[6] Precautions during control
[7] Step function settings

[1] Relation between the step function and various controls

The following table shows the relation between the "step function" and various controls.

Control type			Step function	Step applicability
OPR control	Machine OPR control		×	Step operation not possible
	Fast OPR control		×	
Major positioning control	Position control	1-axis linear control	○	Step operation possible
		2 to 4-axes linear interpolation control	○	
		1-axis fixed-feed control	○	
		2 to 4- axes fixed-feed control (interpolation)	○	
		2-axis circular interpolation control	○	
	1 to 4- axes Speed control		×	Step operation not possible
	Speed-position switching control Position-speed switching control		○	Step operation possible
	Other control	Current value changing	○	
		JUMP instruction, NOP instruction, LOOP to LEND	×	Step operation not possible
Manual control	JOG operation, Inching operation		×	
	Manual pulse generator operation		×	
Expansion control	Speed-torque control		×	

○: Set when required, ×: Setting not possible

[2] Step mode

In step operations, the timing for stopping the control can be set. This is called the "step mode". (The "step mode" is set in the control data "Cd.34 Step mode".)
The following shows the two types of "step mode" functions.

(1) Deceleration unit step

The operation stops at positioning data requiring automatic deceleration. (A normal operation will be carried out until the positioning data requiring automatic deceleration is found. Once found, that positioning data will be executed, and the operation will then automatically decelerate and stop.)

(2) Data No. unit step

The operation automatically decelerates and stops for each positioning data. (Even in continuous path control, an automatic deceleration and stop will be forcibly carried out.)

[3] Step start information

Control stopped by a step operation can be continued by setting "step continues" (to continue the control) in the "step start information". (The "step start information" is set in the control data "Cd.36 Step start information".)
The following table shows the results of starts using the "step start information" during step operation.

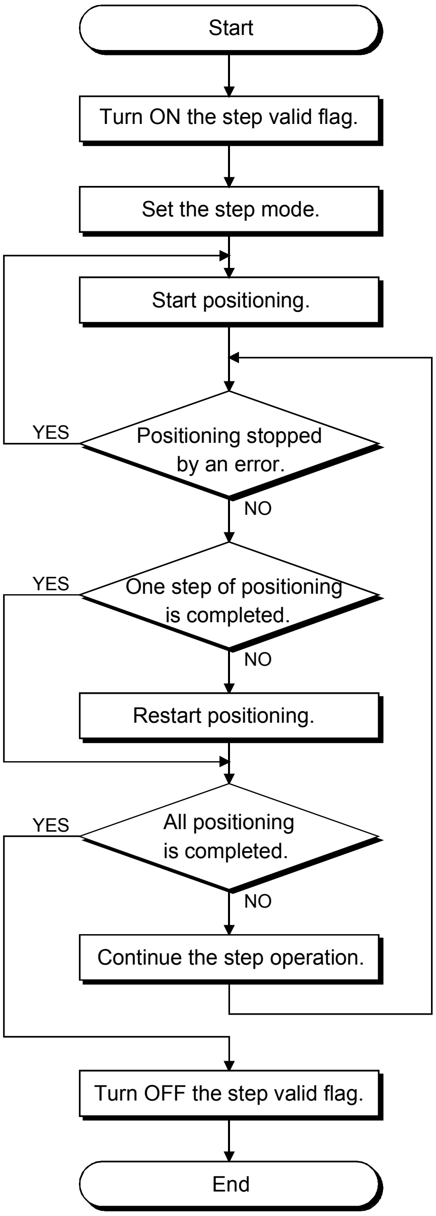
Stop status in the step operation	Md.26 Axis operation status	Cd.36 Step start information	Step start results
1 step of positioning stopped normally	Step standby	1: Continues step operation	The next positioning data is executed.

The warnings "Step not possible (warning code: 511)" will occur if the "Md.26 Axis operation status" is as shown below or the step valid flag is OFF when step start information is set.

Md.26 Axis operation status	Step start results
Standby	Step not continued by warning
Stopped	
Interpolation	
JOG operation	
Manual pulse generator operation	
Analyzing	
Special start standby	
OPR	
Position control	
Speed control	
Speed control in speed-position switching control	
Position control in speed-position switching control	
Speed control in position-speed switching control	
Position control in position-speed switching control	
Synchronous control	
Control mode switch	
Speed control	
Torque control	
Continuous operation to torque control	

[4] Using the step operation

The following shows the procedure for checking positioning data using the step operation.



Write "1" (carry out step operation) in "Cd.35 Step valid flag".

Set in "Cd.34 Step mode".

Write "1" (restart) to "Cd.6 Restart command"
and check whether the positioning data operates normally.

Write "1" (step continue) in "Cd.36 Step start information",
and check whether the next positioning data operates normally.

Write "0" (carry out no step operation) in "Cd.35 Step valid flag".

[5] Control details

(1) The following drawing shows a step operation during a "deceleration unit step".

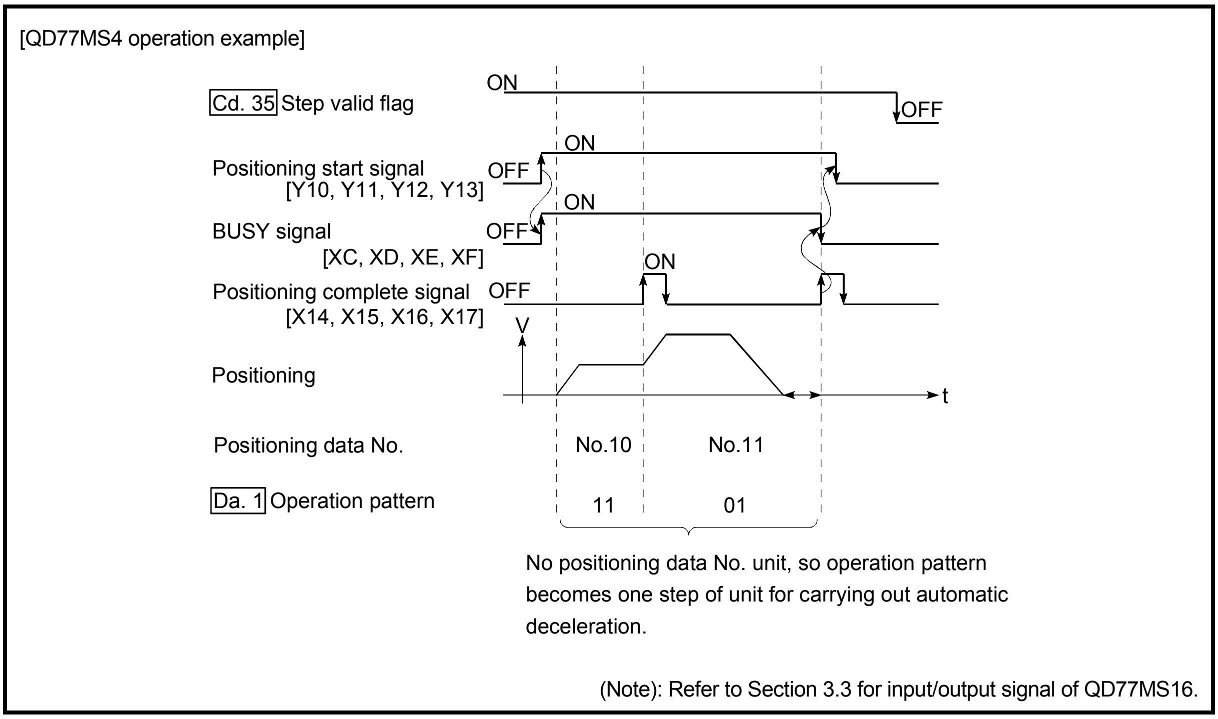


Fig. 13.37 Operation during step execution by deceleration unit step

(2) The following drawing shows a step operation during a "data No. unit step".

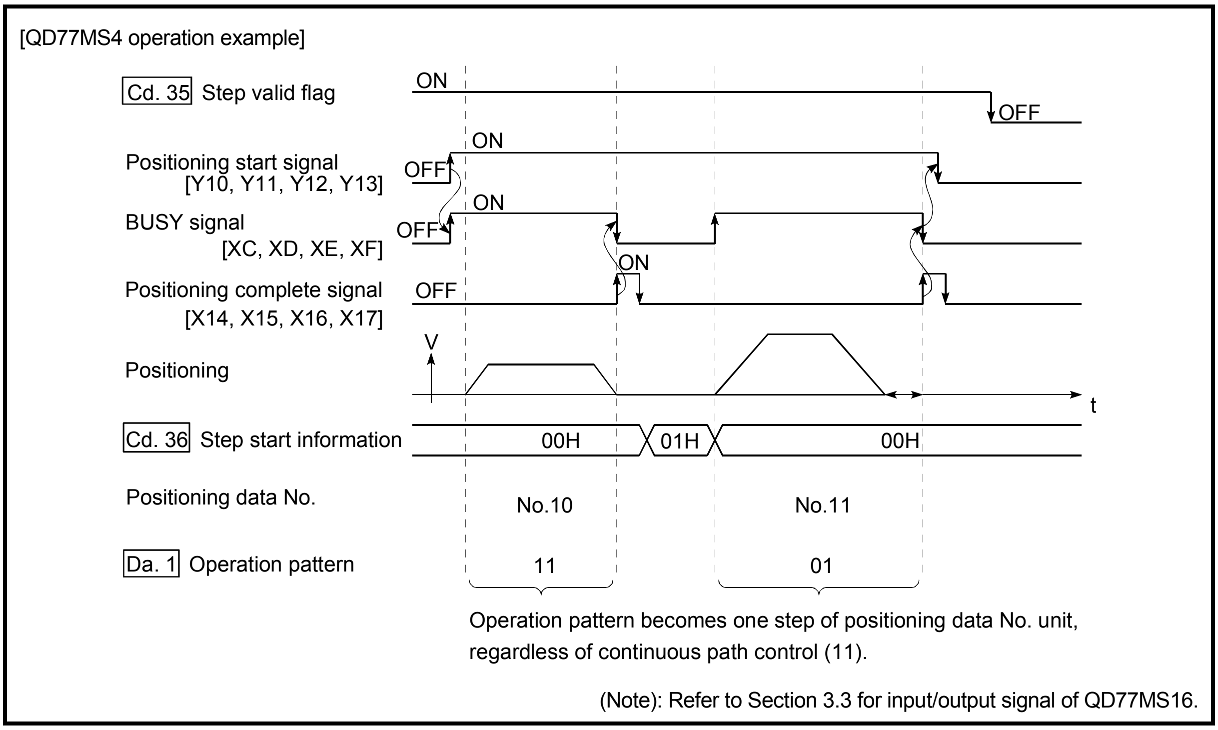


Fig. 13.38 Operation during step execution positioning data No. unit step

[6] Precautions during control

(1) When step operation is carried out using interpolation control positioning data, the step function settings are carried out for the reference axis.

(2) When the step valid flag is ON, the step operation will start from the beginning if the positioning start signal is turned ON while "Md.26 Axis operation status" is "step standby". (The step operation will be carried out from the positioning data set in "Cd.3 Positioning start No.".)

[7] Step function settings

To use the "step function", write the data shown in the following table to the Simple Motion module using the sequence program. Refer to section [4] "Using the step operation" for the timing of the settings.
The set details are validated when written to the Simple Motion module.

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Cd.34	Step mode	→	Set "0: Stepping by deceleration units" or "1: Stepping by data No. units".	1544+100n	4344+100n
Cd.35	Step valid flag	1	Set "1: Validates step operations".	1545+100n	4345+100n
Cd.36	Step start information	→	Set "1: Continues step operation", depending on the stop status.	1546+100n	4346+100n

n: Axis No.-1

＊: Refer to Section 5.7 "List of control data" for details on the setting details.

13.7.2 Skip function

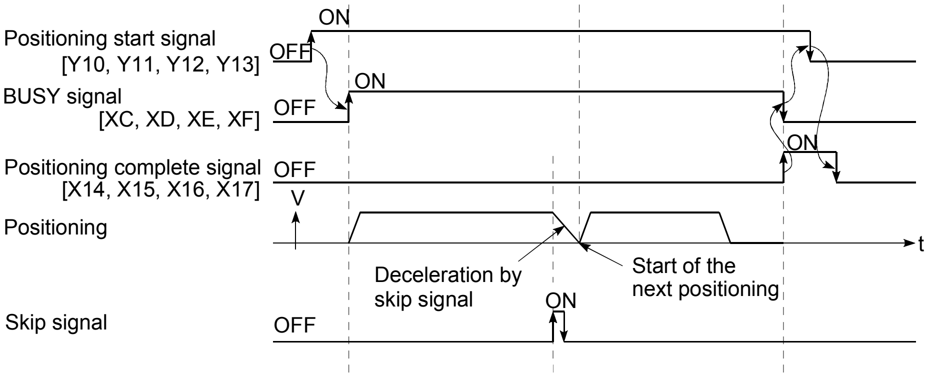
The "skip function" is used to stop (deceleration stop) the control of the positioning data being executed at the time of the skip signal input, and execute the next positioning data.
A skip is executed by a skip command (Cd.37 Skip command) or external command signal.
The "skip function" can be used during control in which positioning data is used.

The details shown below explain about the "skip function".
[1] Control details
[2] Precautions during control
[3] Setting the skip function from the PLC CPU
[4] Setting the skip function using an external command signal

[1] Control details

The following drawing shows the skip function operation.

[QD77MS4 operation example]



(Note): Refer to Section 3.3 for input/output signal of QD77MS16.

Fig. 13.39 Operation when a skip signal is input during positioning control

[2] Precautions during control

(1) If the skip signal is turned ON at the last of an operation, a deceleration stop will occur and the operation will be terminated.
(2) When a control is skipped (when the skip signal is turned ON during a control), the positioning complete signals will not turn ON.
(3) When the skip signal is turned ON during the dwell time, the remaining dwell time will be ignored, and the next positioning data will be executed.
(4) When a control is skipped during interpolation control, the reference axis skip signal is turned ON. When the reference axis skip signal is turned ON, a deceleration stop will be carried out for every axis, and the next reference axis positioning data will be executed.
(5) The M code ON signals will not turn ON when the M code output is set to the AFTER mode (when "1: AFTER mode" is set in "Pr.18 M code ON signal output timing").
(In this case, the M code will not be stored in "Md.25 Valid M code".)

(6) The skip cannot be carried out by the speed control and position-speed switching control.

(7) If the skip signal is turned ON with the M code signal turned ON, the transition to the next data is not carried out until the M code signal is turned OFF.

[3] Setting the skip function from the PLC CPU

The following shows the settings and sequence program example for skipping the control being executed in axis 1 with a command from the PLC CPU.

(1) Set the following data.
(The setting is carried out using the sequence program shown below in section (2)).

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Cd.37	Skip command	1	Set "1: Skip request".	1547+100n	4347+100n

n: Axis No.-1

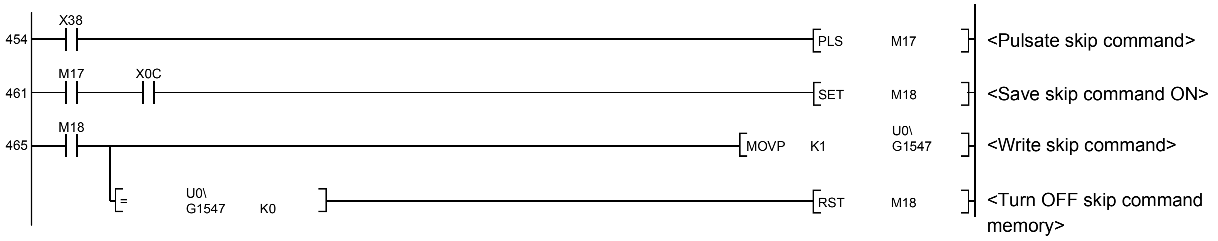
*: Refer to Section 5.7 "List of control data" for details on the setting details.

(2) Add the following sequence program to the control program, and write it to the PLC CPU.

1) When the "skip command" is input, the value "1" (skip request) set in "Cd.37 Skip command" is written to the buffer memory of Simple Motion module.

[QD77MS4 program example]

*
* No.19 Skip program
*



[4] Setting the skip function using an external command signal

The skip function can also be executed using an "external command signal". The following shows the settings and sequence program example for skipping the control being executed in axis 1 using an "external command signal".

(1) Set the following data to execute the skip function using an external command signal.
(The setting is carried out using the sequence program shown below in section (2)).

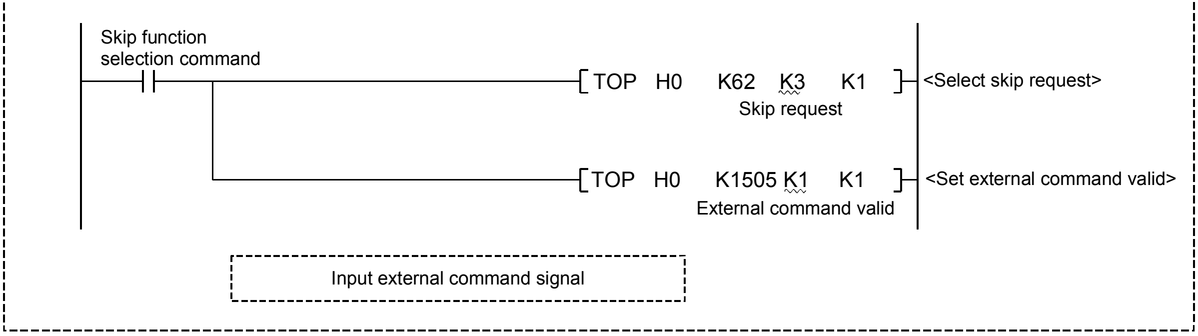
Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Pr.42	External command function selection	3	Set "3: Skip request".	62+150n	
Cd.8	External command valid	1	Set "1: Validate external command".	1505+100n	4305+100n

n: Axis No.-1

*: Refer to Section 5.2 "List of parameter" or Section 5.7 "List of control data" for details on the setting details.

(2) Add the following sequence program to the control program, and write it to the PLC CPU.

[QD77MS4 program example]



13.7.3 M code output function

The "M code output function" is used to command sub work (clamping, drill rotation, tool replacement, etc.) related to the positioning data being executed.
When the M code ON signal is turned ON during positioning execution, a No. called the M code is stored in "Md.25 Valid M code". These "Md.25 Valid M code" are read from the PLC CPU, and used to command auxiliary work. M codes can be set for each positioning data. (Set in setting item "Da.10 M code" of the positioning data.)
The timing for outputting (storing) the M codes can also be set in the "M code output function".

Signal	QD77MS2/QD77MS4	QD77MS16
M code ON signal	X4, X5, X6, X7	M code ON (Md.31 Status: b12)

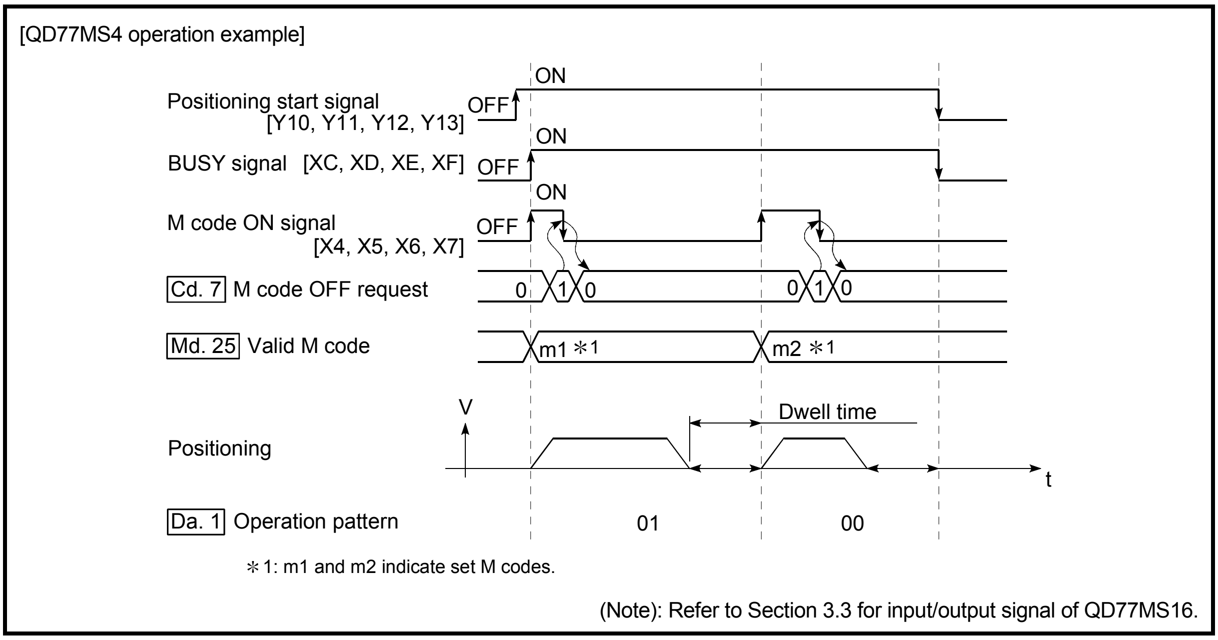
The details shown below explain about the "M code output function".
- [1] M code ON signal output timing
- [2] M code OFF request
- [3] Precautions during control
- [4] Setting the M code output function
- [5] Reading M codes

[1] M code ON signal output timing

The timing for outputting (storing) the M codes can be set in the "M code output function". (The M code is stored in "Md.25 Valid M code" when the M code ON signal is turned ON.)
The following shows the two types of timing for outputting M codes: the "WITH mode" and the "AFTER mode".

(1) WITH mode

The M code ON signal is turned ON at the positioning start, and the M code is stored in "Md.25 Valid M code".



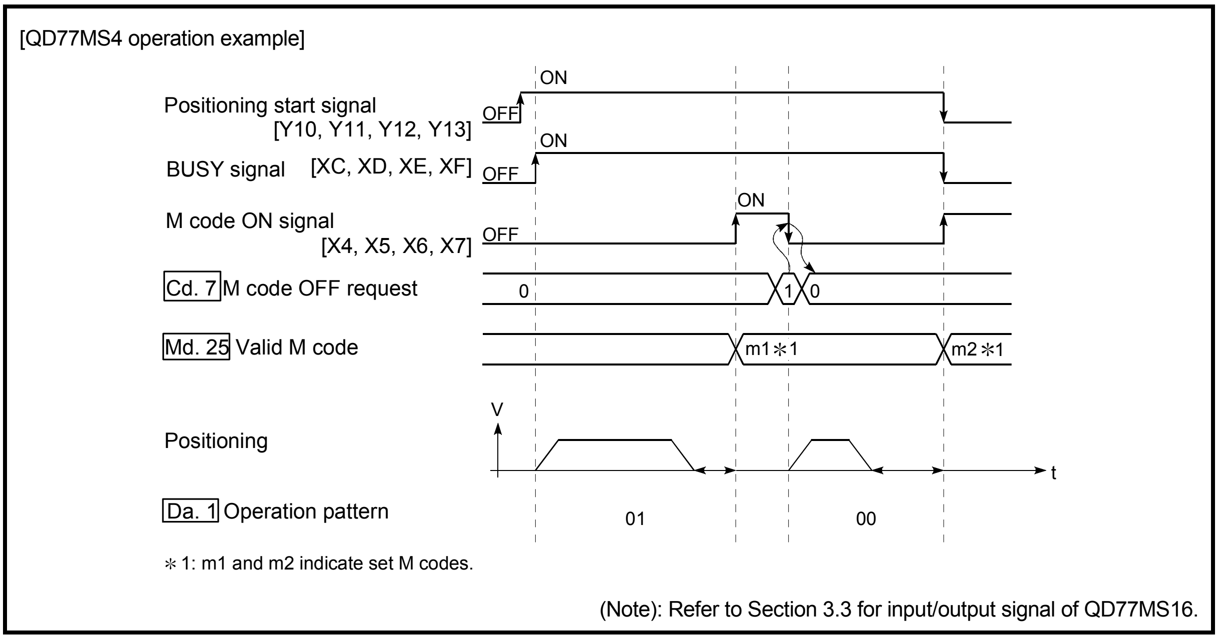
∗1: m1 and m2 indicate set M codes.

(Note): Refer to Section 3.3 for input/output signal of QD77MS16.

Fig. 13.40 M code ON/OFF timing (WITH mode)

(2) AFTER mode

The M code ON signal is turned ON at the positioning completion, and the M code is stored in "Md.25 Valid M code".



∗1: m1 and m2 indicate set M codes.

(Note): Refer to Section 3.3 for input/output signal of QD77MS16.

Fig. 13.41 M code ON/OFF timing (AFTER mode)

[2] M code OFF request

When the M code ON signal is ON, it must be turned OFF by the sequence program.

To turn OFF the M code ON signal, set "1" (turn OFF the M code signal) in "Cd.7 M code OFF request".

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Cd.7	M code OFF request	1	Set "1: Turn OFF the M code ON signal".	1504+100n	4304+100n

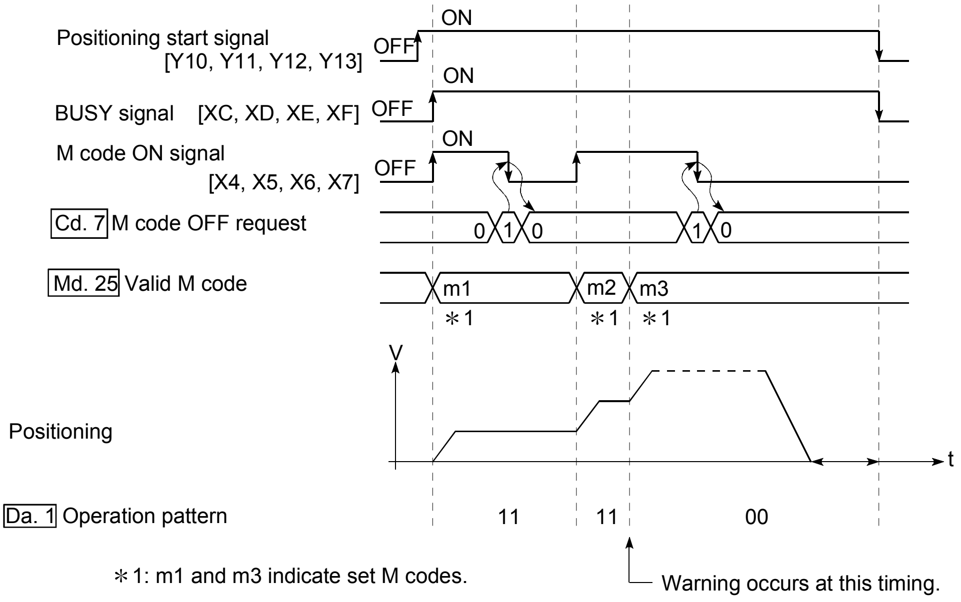
n: Axis No.-1

∗: Refer to Section 5.7 "List of control data" for details on the setting details.

The next positioning data will be processed as follows if the M code ON signal is not turned OFF. (The processing differs according to the Da.1 Operation pattern.)

Da.1 Operation pattern		Processing
00	Independent positioning control (Positioning control)	The next positioning data will not be executed until the M code ON signal is turned OFF.
01	Continuous positioning control	
11	Continuous path control	The next positioning data will be executed. If the M code is set to the next positioning data, a warning "M code ON signal ON start" (warning code: 503) will occur.

[QD77MS4 operation example]



(Note): Refer to Section 3.3 for input/output signal of QD77MS16.

Fig. 13.42 Warning due to an M code ON signal during continuous path control

POINT

If the M code output function is not required, set a "0" in setting item "Da.10 M code" of the positioning data.

[3] Precautions during control

(1) During interpolation control, the reference axis M code ON signal is turned ON.

(2) The M code ON signal will not turn ON if "0" is set in "Da.10 M code". (The M code will not be output, and the previously output value will be held in "Md.25 Valid M code".)

(3) If the M code ON signal is ON at the positioning start, an error "M code signal ON at positioning start (error code: 536)" will occur, and the positioning will not start.

(4) If the PLC READY signal [Y0] is turned OFF, the M code ON signal will turn OFF and "0" will be stored in "Md.25 Valid M code".

(5) If the positioning operation time is short during continuous path control, there will not be enough time to turn OFF the M code ON signal, and a warning "M code signal ON (error code: 503)" may occur. In this case, set a "0" in the "Da.10 M code" of that section's positioning data.

(6) In the AFTER mode during speed control, the M code is not output and the M code ON signal does not turn ON.

(7) If current value changing where "9003" has been set to "Cd.3 Positioning start No." is performed, the M code output function is made invalid.

[4] Setting the M code output function

The following shows the settings to use the "M code output function".

(1) Set the M code No. in the positioning data "Da.10 M code".

(2) Set the timing to output the M code ON signal.

Set the required value in the following parameter, and write it to the Simple Motion module.

The set details are validated at the rising edge (OFF → ON) of the PLC READY signal [Y0].

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Pr.18	M code ON signal output timing	→	Set the timing to output the M code ON signal. 0: WITH mode 1: AFTER mode	27+150n	

n: Axis No.-1

＊: Refer to Section 5.2 "List of parameters" for setting details.

[5] Reading M codes

"M codes" are stored in the following buffer memory when the M code ON signal turns ON.

Monitor item		Monitor value	Storage details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Md.25	Valid M code	→	The M code No. (Da.10 M code) set in the positioning data is stored.	808+100n	2408+100n

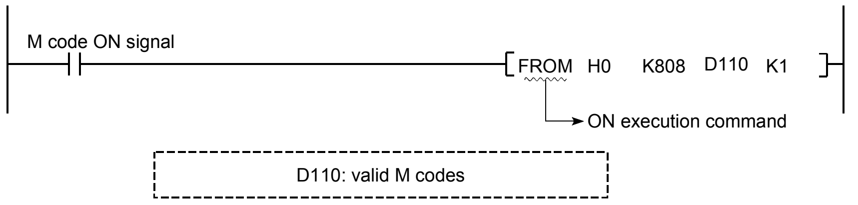
n: Axis No.-1

＊: Refer to Section 5.6 "List of monitor data" for information on the storage details.

The following shows a sequence program example for reading the "Md.25 Valid M code" to the PLC CPU data register (D110). (The read value is used to command the sub work.)

Read M codes not as "rising edge commands", but as "ON execution commands".

[QD77MS4 program example]



13.7.4 Teaching function

The "teaching function" is used to set addresses aligned using the manual control (JOG operation, inching operation manual pulse generator operation) in the positioning data addresses ("Da.6 Positioning address/movement amount", "Da.7 Arc address").

The details shown below explain about the "teaching function".
[1] Control details
[2] Precautions during control
[3] Data used in teaching
[4] Teaching procedure
[5] Teaching program example

[1] Control details

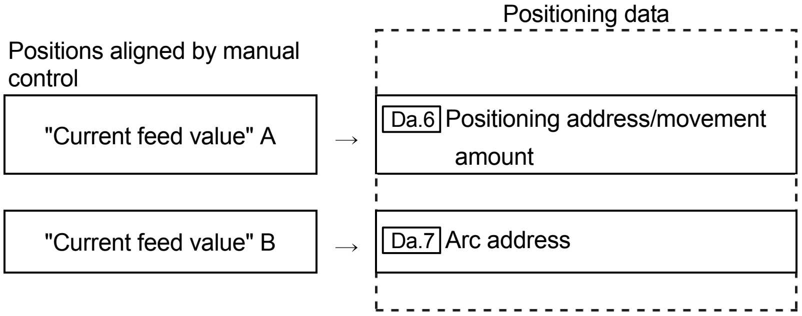
(1) Teaching timing

Teaching is executed using the sequence program when the BUSY signal is OFF. (During manual control, teaching can be carried out as long as the axis is not BUSY, even when an error or warning has occurred.)

Signal	QD77MS2/QD77MS4	QD77MS16
BUSY signal	XC to XF	X10 to X1F

(2) Addresses for which teaching is possible

The addresses for which teaching is possible are "current feed values" (Md.20 Current feed value) having the OP as a reference. The settings of the "movement amount" used in incremental system positioning cannot be used. In the teaching function, these "current feed values" are set in the "Da.6 Positioning address/movement amount" or "Da.7 Arc address".



(3) Dedicated instructions "ZP.TEACH 1, ZP.TEACH 2, ZP.TEACH 3, ZP.TEACH 4"

When the dedicated instructions "ZP.TEACH 1, ZP.TEACH 2, ZP.TEACH 3, ZP.TEACH 4" are used to execute the teaching function, the programming becomes easier. Refer to Chapter 15 "Dedicated Instructions" for details.

[2] Precautions during control

(1) Before teaching, a "machine OPR" must be carried out to establish the OP. (When a current value changing, etc., is carried out, "Md.20 Current feed value" may not show absolute addresses having the OP as a reference.)

(2) Teaching cannot be carried out for positions to which movement cannot be executed by manual control (positions to which the workpiece cannot physically move). (During center point designation circular interpolation control, etc., teaching of "Da.7 Arc address" cannot be carried out if the center point of the arc is not within the moveable range of the workpiece.)

(3) Writing to the flash ROM can be executed up to 100,000 times.
If writing to the flash ROM exceeds 100,000 times, the writing may become impossible (assured value is up to 100,000 times).
If an error (error code: 805) occurs when writing to the flash ROM has been completed, check whether or not the program is created so as to write continuously to the flash ROM.

[3] Data used in teaching

The following control data is used in teaching.

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Cd.1	Flash ROM write request	1	Write the set details to the flash ROM (backup the changed data).	1900	5900
Cd.38	Teaching data selection	→	Sets to which "current feed value" is written. 0: Written to "Da.6 Positioning address/ movement amount". 1: Written to "Da.7 Arc address".	1548+100n	4348+100n
Cd.39	Teaching positioning data No.	→	Designates the data to be taught. (Teaching is carried out when the setting value is 1 to 600.) When teaching has been completed, this data is zero cleared.	1549+100n	4349+100n

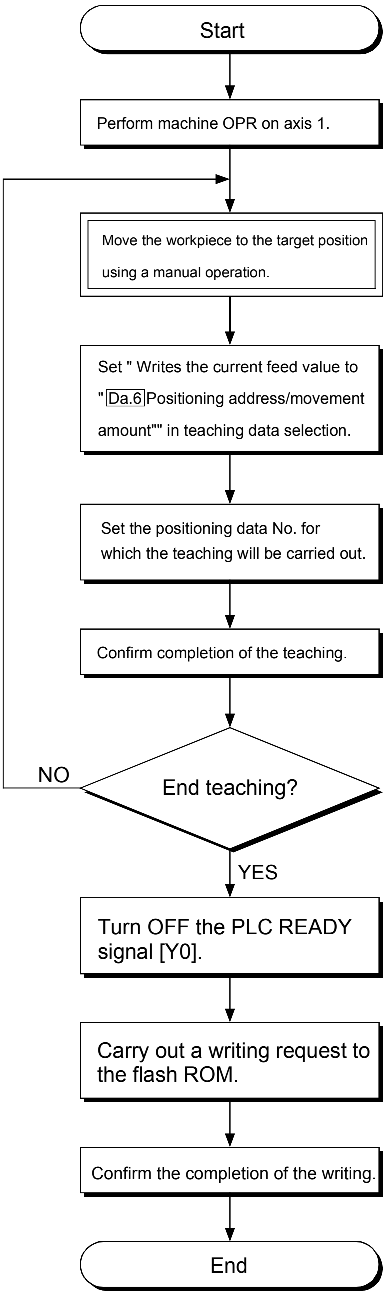
n: Axis No.-1

∗: Refer to Section 5.7 "List of control data" for details on the setting details.

[4] Teaching procedure

The following shows the procedure for a teaching operation.

(1) When teaching to the "Da.6 Positioning address/movement amount"
(Teaching example on QD77MS4 [axis 1])



········ Using a JOG operation, inching operation, or manual pulse generator operation.

········ Set 0 in buffer memory address [1548].

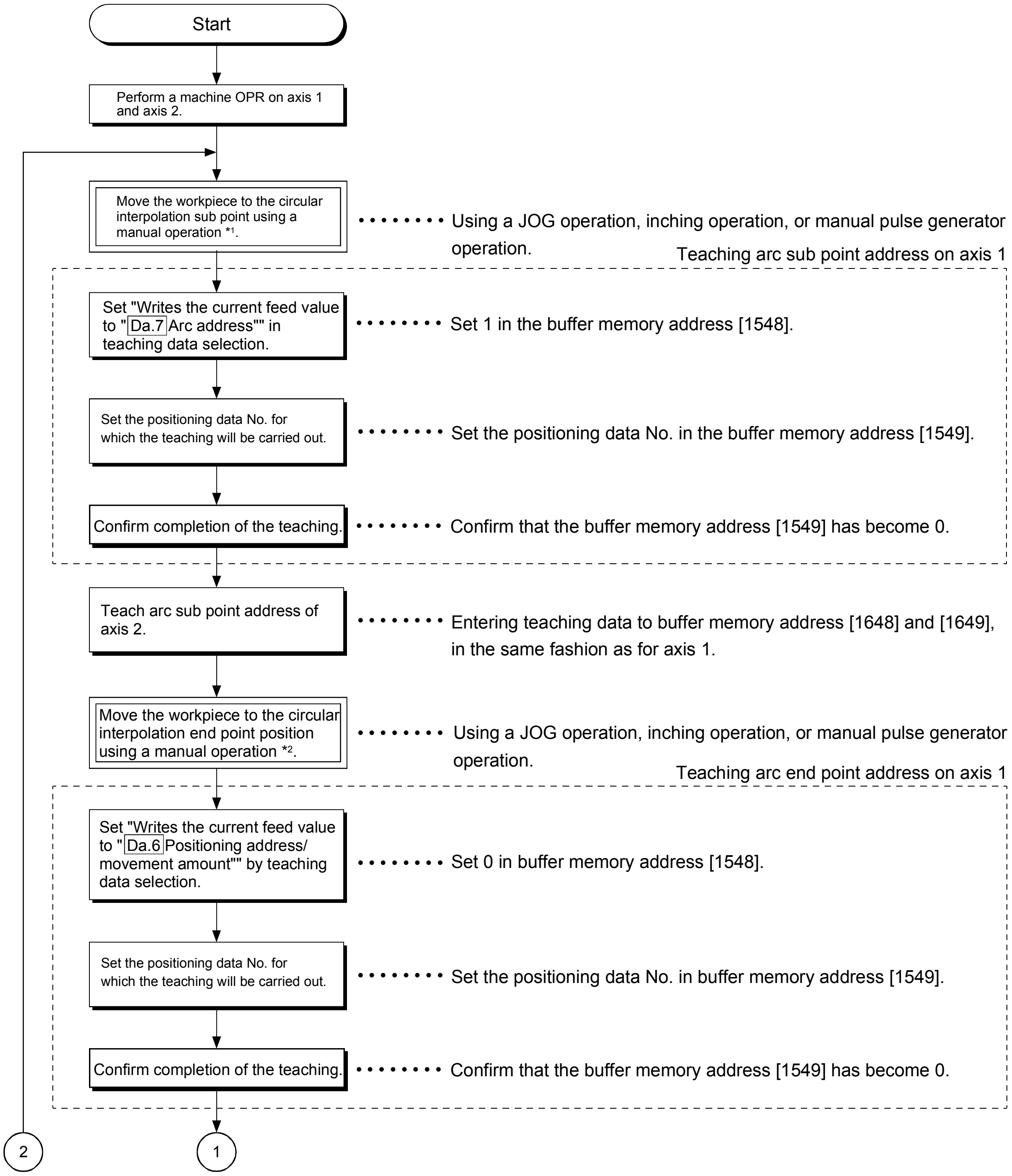
········ Set the positioning data No. in the buffer memory address [1549].

········ Confirm that the buffer memory address [1549] has become 0.

········ Set 1 in the buffer memory address [1900].

········ Confirm that the buffer memory address [1900] has become 0.

(2) When teaching to the "Da.7 Arc address", then teaching to the "Da.6 Positioning address/movement amount"
(Teaching example for 2-axis circular interpolation control with sub point designation on QD77MS4 [axis 1] and [axis 2])



Using a JOG operation, inching operation, or manual pulse generator operation.

Set 1 in the buffer memory address [1548].

Set the positioning data No. in the buffer memory address [1549].

Confirm that the buffer memory address [1549] has become 0.

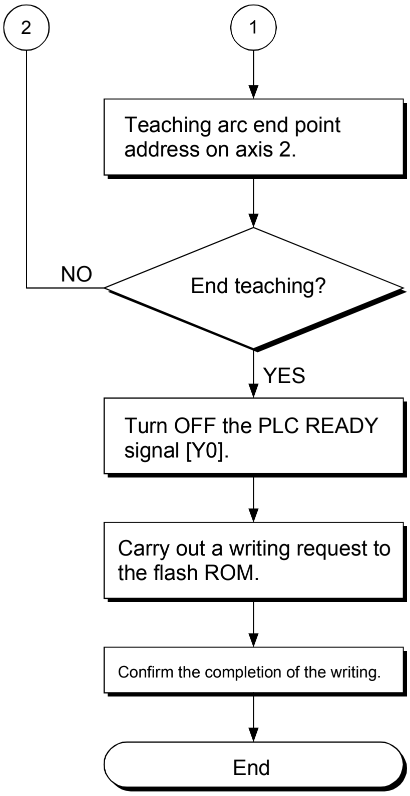
Entering teaching data to buffer memory address [1648] and [1649], in the same fashion as for axis 1.

Using a JOG operation, inching operation, or manual pulse generator operation.

Set 0 in buffer memory address [1548].

Set the positioning data No. in buffer memory address [1549].

Confirm that the buffer memory address [1549] has become 0.

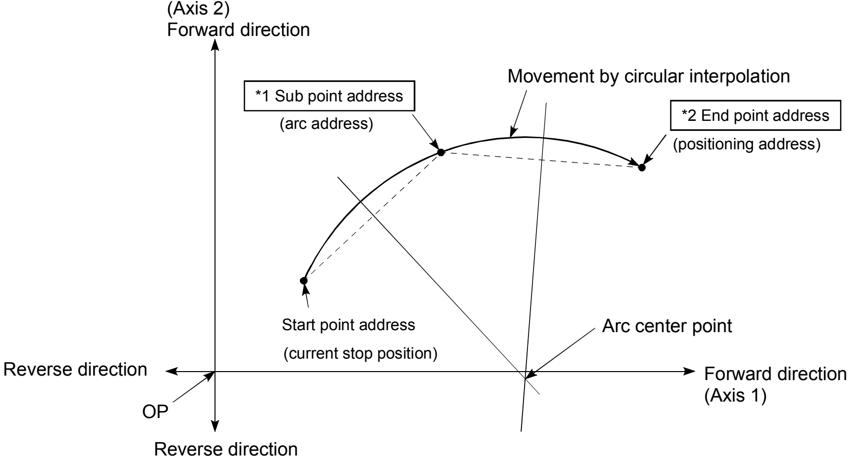


• • • • • • • • Entering teaching data to buffer memory address [1648] and [1649], in the same fashion as for axis 1.

• • • • • • • • Set 1 in the buffer memory address [1900].

• • • • • • • • Confirm that the buffer memory address [1900] has become 0.

[Motion path]



[5] Teaching program example

The following shows a sequence program example for setting (writing) the positioning data obtained with the teaching function to the Simple Motion module.

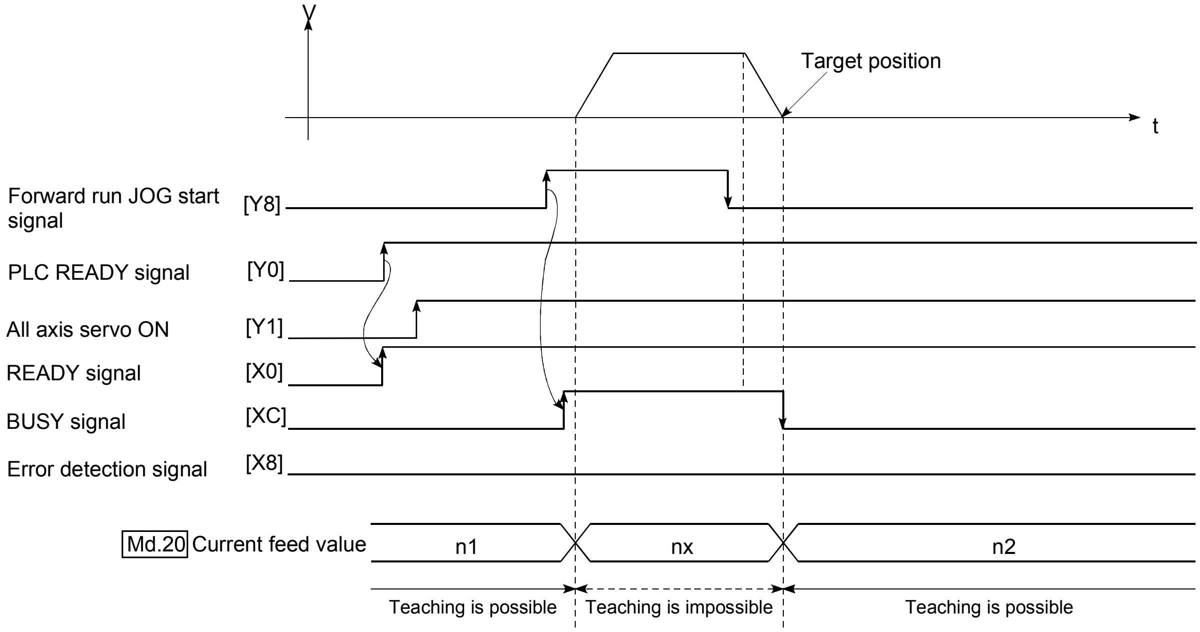
(1) Setting conditions

- When setting the current feed value as the positioning address, write it when the BUSY signal is OFF.

(2) Program example

- The following example shows a program to carry out the teaching of axis 1 by the dedicated instruction "ZP.TEACH 1".
  1) Move the workpiece to the target position using a JOG operation (or an inching operation, a manual pulse generator operation).

[QD77MS4 operation example]

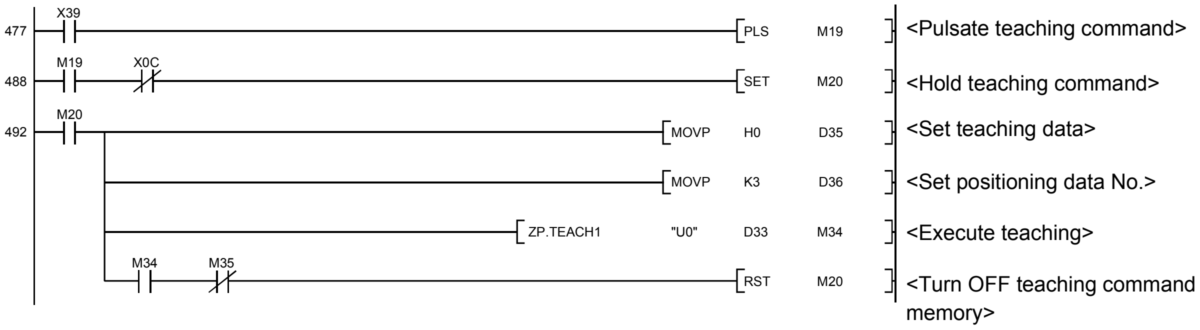


(Note): Refer to Section 3.3 for input/output signal of QD77MS16.

2) Carry out the teaching operation with the following program.

[QD77MS4 program example]

```
*
* No.20 Teaching program
*
*       •Position to the target position with manual operation.
*
*
*
```



POINT

(1) Confirm the teaching function and teaching procedure before setting the positioning data.

(2) The positioning addresses that are written are absolute address (ABS) values.

(3) The positioning data written by the teaching function overwrites the data of buffer memory only. Therefore, read from buffer memory and write to flash ROM before turning the power OFF as necessary.

13.7.5 Command in-position function

The "command in-position function" checks the remaining distance to the stop position during the automatic deceleration of positioning control, and sets "1". This flag is called the "command in-position flag". The command in-position flag is used as a front-loading signal indicating beforehand the completion of the position control.

The details shown below explain about the "command in-position function".

[1] Control details
[2] Precautions during control
[3] Setting the command in-position function
[4] Confirming the command in-position flag

[1] Control details

The following shows control details of the command in-position function.

(1) When the remaining distance to the stop position during the automatic deceleration of positioning control becomes equal to or less than the value set in "Pr.16 Command in-position width", "1" is stored in the command in-position flag (Md.31 Status: b2).

(Command in-position width check)

Remaining distance ≤ "Pr.16 Command in-position width" setting value

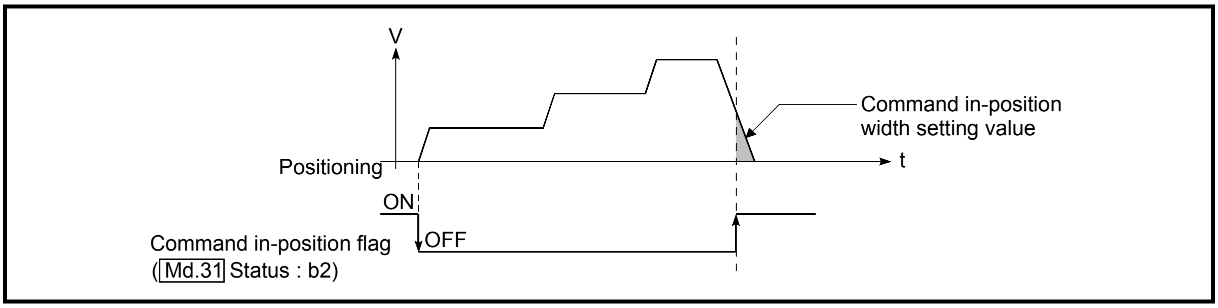


Fig. 13.43 Command in-position operation

(2) A command in-position width check is carried out every operation cycle.

[2] Precautions during control

(1) A command in-position width check will not be carried out in the following cases.
- During speed control
- During speed control in speed-position switching control
- During speed control in position-speed switching control
- During speed control mode
- During torque control mode
- During continuous operation to torque control mode

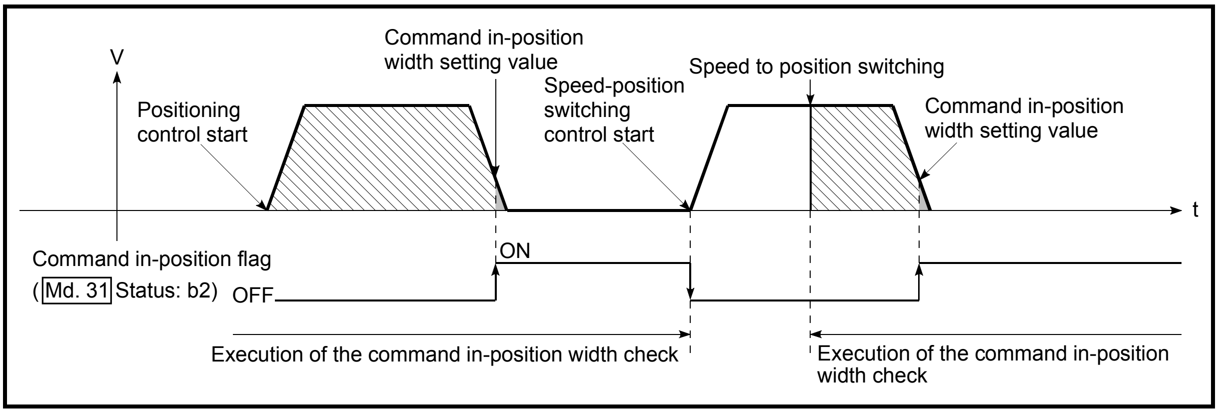


Fig. 13.44 Command in-position width check

(2) The command in-position flag will be turned OFF in the following cases. ("0" will be stored in "Md.31 Status: b2".)
- At the positioning control start
- At the speed control start
- At the speed-position switching control, position-speed switching control start
- At the OPR control start
- At the JOG operation start
- At the inching operation start
- When the manual pulse generator operation is enabled

(3) The "Pr.16 Command in-position width" and command in-position flag (Md.31 Status: b2) of the reference axis are used during interpolation control. When the "Pr.20 Interpolation speed designation method" is "Composite speed", the command in-position width check is carried out in the remaining distance on the composite axis (line/arc connecting the start point address and end point address).

[3] Setting the command in-position function

To use the "command in-position function", set the required value in the parameter shown in the following table, and write it to the Simple Motion module.
The set details are validated at the rising edge (OFF → ON) of the PLC READY signal [Y0].

Setting item		Setting value	Setting details	Factory-set initial value
Pr.16	Command in-position width	→	Turn ON the command in-position flag, and set the remaining distance to the stop position of the position control.	100

∗: Refer to Section 5.2 "List of parameters" for setting details.

[4] Confirming the command in-position flag

The "command in-position flag" is stored in the following buffer memory.

Monitor item		Monitor value	Storage details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Md.31	Status	→	The command in-position flag is stored in the "b2" position.	817+100n	2417+100n

n: Axis No.-1

∗: Refer to Section 5.6 "List of monitor data" for information on the storage details.

REMARK

- Parameters are set for each axis.
- It is recommended that the parameters be set whenever possible with GX Works2. Execution by sequence program uses many sequence programs and devices. The execution becomes complicated, and the scan times will increase.

13.7.6 Acceleration/deceleration processing function

The "acceleration/deceleration processing function" adjusts the acceleration/deceleration of each control to the acceleration/deceleration curve suitable for device.
Setting the acceleration/deceleration time changes the slope of the acceleration/deceleration curve.
The following two methods can be selected for the acceleration/deceleration curve:

- Trapezoidal acceleration/deceleration
- S-curve acceleration/deceleration

Refer to Section 12.1 "Speed-torque control" for acceleration/deceleration processing of speed-torque control.

The details shown below explain about the "acceleration/deceleration processing function".
[1] "Acceleration/deceleration time 0 to 3" control details and setting
[2] "Acceleration/deceleration method setting" control details and setting

[1] "Acceleration/deceleration time 0 to 3" control details and setting

In the Simple Motion module, four types each of acceleration time and deceleration time can be set. By using separate acceleration/deceleration times, control can be carried out with different acceleration/deceleration times for positioning control, JOG operation, OPR, etc.
Set the required values for the acceleration/deceleration time in the parameters shown in the following table, and write them to the Simple Motion module.
The set details are validated when written to the Simple Motion module.

Setting item		Setting value	Setting details	Factory-set initial value
Pr.9	Acceleration time 0	→	Set the acceleration time at a value within the range of 1 to 8388608 ms.	1000
Pr.25	Acceleration time 1	→		1000
Pr.26	Acceleration time 2	→		1000
Pr.27	Acceleration time 3	→		1000
Pr.10	Deceleration time 0	→	Set the deceleration time at a value within the range of 1 to 8388608 ms.	1000
Pr.28	Deceleration time 1	→		1000
Pr.29	Deceleration time 2	→		1000
Pr.30	Deceleration time 3	→		1000

*: Refer to Section 5.2 "List of parameters" for setting details.

[2] "Acceleration/deceleration method setting" control details and setting

In the "acceleration/deceleration method setting", the acceleration/deceleration processing method is selected and set. The set acceleration/deceleration processing is applied to all acceleration/deceleration. (except for inching operation, manual pulse generator operation and speed-torque control.)

The two types of "acceleration/deceleration processing method" are shown below.

(1) Trapezoidal acceleration/deceleration processing method

This is a method in which linear acceleration/deceleration is carried out based on the acceleration time, deceleration time, and speed limit value set by the user.

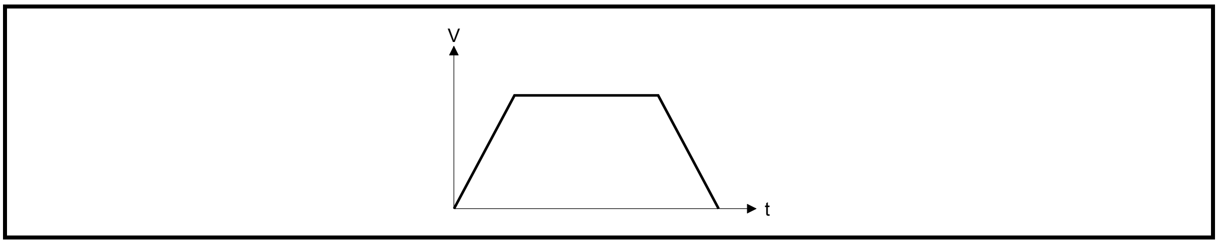


Fig. 13.45 Trapezoidal acceleration/deceleration processing method

(2) S-curve acceleration/deceleration processing method

In this method, the motor burden is reduced during starting and stopping. This is a method in which acceleration/deceleration is carried out gradually, based on the acceleration time, deceleration time, speed limit value, and "Pr.35 S-curve ratio" (1 to 100%) set by the user.

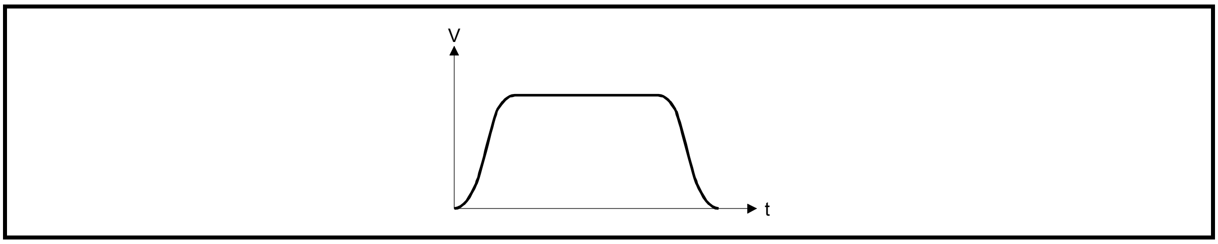


Fig. 13.46 S-curve acceleration/deceleration processing method

When a speed change request or override request is given during S-curve acceleration/ deceleration processing, S-curve acceleration/deceleration processing begins at a speed change request or override request start.

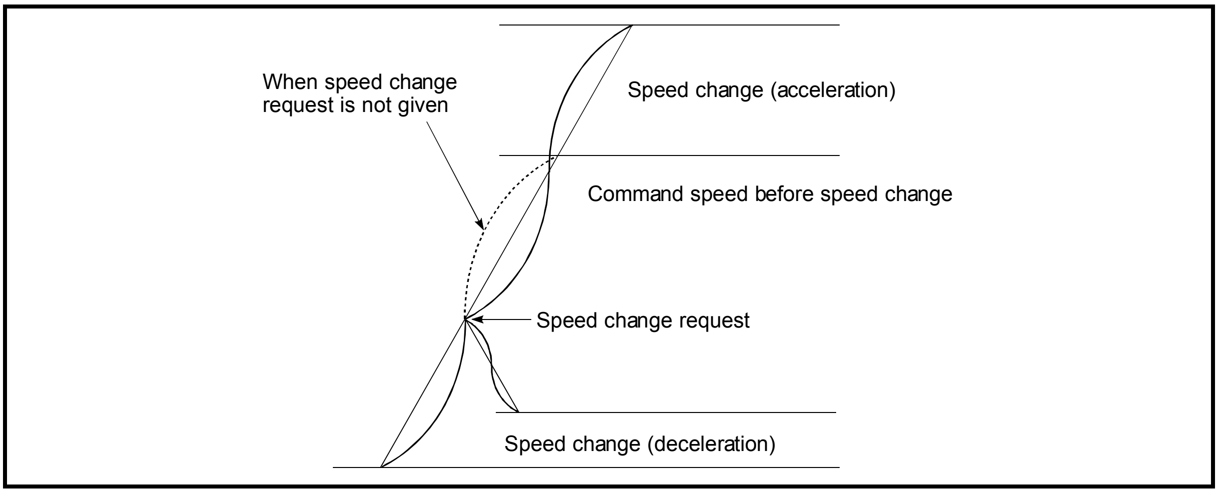


Fig. 13.47 Speed change during S-curve acceleration/deceleration processing

Set the required values for the "acceleration/deceleration method setting" in the parameters shown in the following table, and write them to the Simple Motion module.

The set details are validated when written to the Simple Motion module.

Setting item		Setting value	Setting details	Factory-set initial value
Pr.34	Acceleration/ deceleration process selection	→	Set the acceleration/deceleration method. 0: Trapezoidal acceleration/deceleration processing 1: S-curve acceleration/deceleration processing	0
Pr.35	S-curve ratio	→	Set the acceleration/deceleration curve when "1" is set in " Pr.34 Acceleration/deceleration process selection".	100

*: Refer to Section 5.2 "List of parameters" for setting details.

REMARK

- Parameters are set for each axis.
- It is recommended that the parameters be set whenever possible with GX Works2. Execution by sequence program uses many sequence programs and devices. The execution becomes complicated, and the scan times will increase.

13.7.7 Pre-reading start function

The "pre-reading start function" does not start servo while the execution prohibition flag is ON if a positioning start request is given with the execution prohibition flag ON, and starts servo within operation cycle after OFF of the execution prohibition flag is detected. The positioning start request is given when the axis is in a standby status, and the execution prohibition flag is turned OFF at the axis operating timing.

The "pre-reading start function" will be explained below.

[1] Controls
[2] Precautions during control
[3] Program examples

[1] Controls

The pre-reading start function is performed by turning ON the positioning start signal with the execution prohibition flag ON, or by executing the dedicated instruction (ZP.PSTRT1, ZP.PSTRT2, ZP.PSTRT3, and ZP.PSTRT4). However, if positioning is started with the execution prohibition flag ON, the positioning data is analyzed but servo start is not provided. While the execution prohibition flag is ON, "Md.26 Axis operation status" remains unchanged from "5: Analyzing". The servo starts within operation cycle after the execution prohibition flag has turned OFF, and "Md.26 Axis operation status" changes to the status (e.g. position control, speed control) that matches the control system. (Refer to Fig.13.48)

Signal	QD77MS2/QD77MS4	QD77MS16
Execution prohibition flag	Y14, Y15, Y16, Y17	Cd.183 Execution prohibition flag

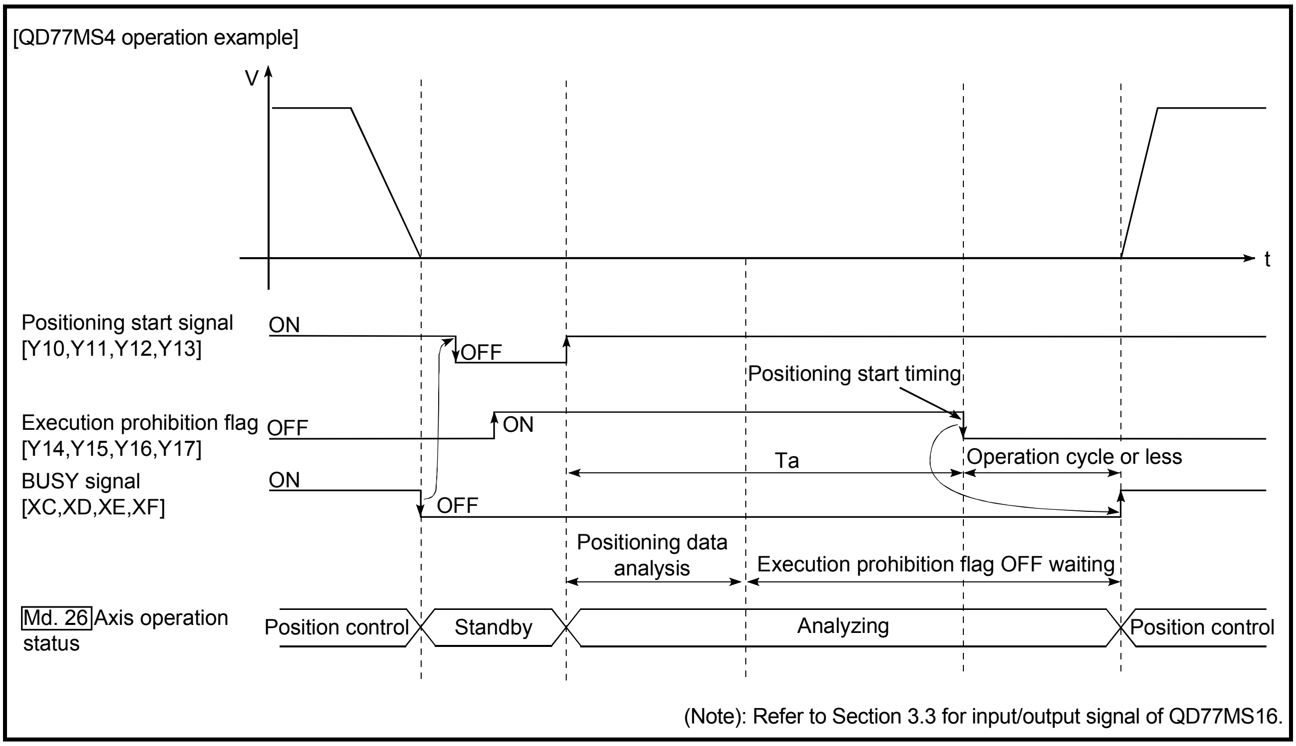


Fig. 13.48 Operations of pre-reading start function

[2] Precautions during control

(1) The time required to analyze the positioning data is up to 0.88ms (QD77MS2/QD77MS4)/3.55ms(QD77MS16).

(2) After positioning data analysis, the system is put in an execution prohibition flag OFF waiting status. Any change made to the positioning data in the execution prohibition flag OFF waiting status is not reflected on the positioning data. Change the positioning data before turning ON the positioning start signal.

(3) The pre-reading start function is invalid if the execution prohibition flag is turned OFF between when the positioning start signal has turned ON and when positioning data analysis is completed (Ta<start time, Ta: Refer to Fig. 13.48).

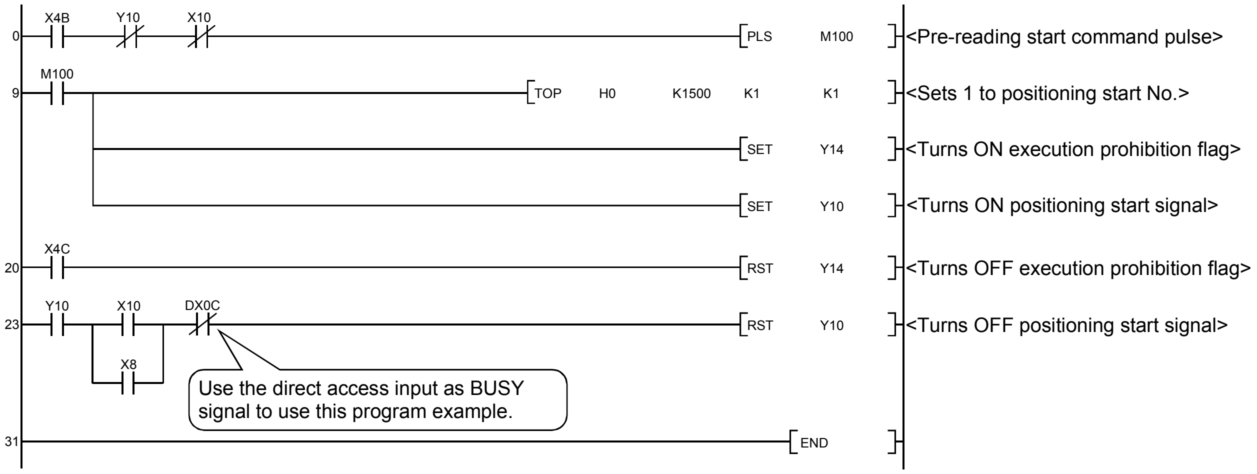
(4) The data No. which can be executed positioning start using "Cd.3 Positioning start No." with the pre-reading start function are No. 1 to 600 only. Performing the pre-reading start function at the setting of No. 7000 to 7004 or 9001 to 9004 will result in an outside start No. range error (Error code: 543).

(5) Always turn ON the execution prohibition flag at the same time or before turning ON the positioning start signal. Pre-reading may not be started if the execution prohibition flag is turned ON during Ta after the positioning start signal is turned ON. The pre-reading start function is invalid if the execution prohibition flag is turned ON after positioning start with the execution prohibition flag OFF. (It is made valid at the next positioning start.)

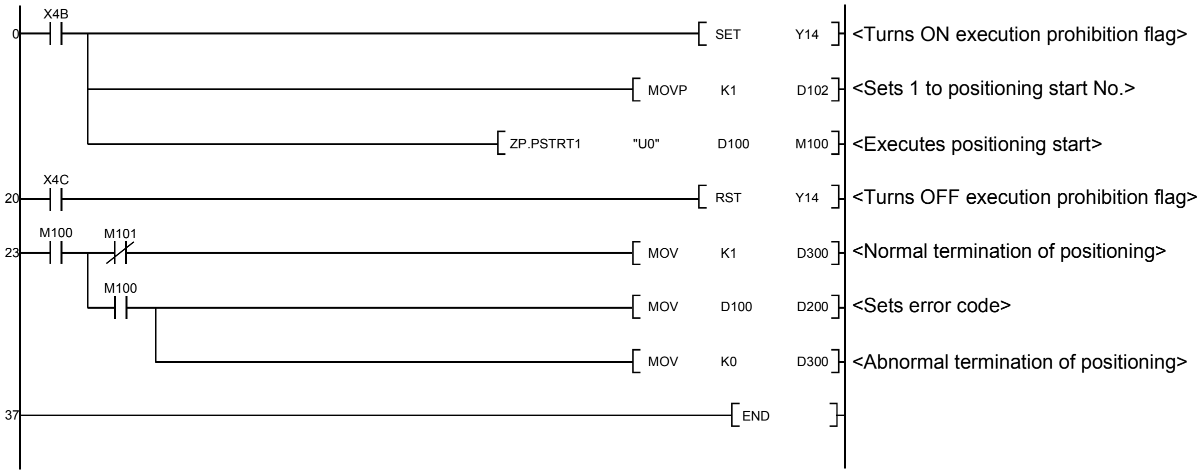
[3] Program examples

[QD77MS4 program example]

＊
＊ Pre-reading start program (when positioning start signal Y10 is used)
＊



＊
＊ Pre-reading start program (when dedicated instruction ZP.PSTRT1 is used)
＊



13.7.8 Deceleration start flag function

The "deceleration start flag function" turns ON the flag when the constant speed status or acceleration status switches to the deceleration status during position control whose operation pattern is "Positioning complete". This function can be used as a signal to start the operation to be performed by other equipment at each end of position control or to perform preparatory operation, etc. for the next position control.

For the "deceleration start flag function", the following will be explained.

[1] Control details
[2] Precautions during control
[3] Deceleration start flag function setting method
[4] Checking of deceleration start flag

[1] Control details

When deceleration for a stop is started in the position control whose operation pattern is "Positioning complete", "1" is stored into "Md.48 Deceleration start flag". When the next operation start is made or the manual pulse generator operation enable status is gained, "0" is stored. (Refer to Fig. 13.49.)

(1) Start made with positioning data No. specified

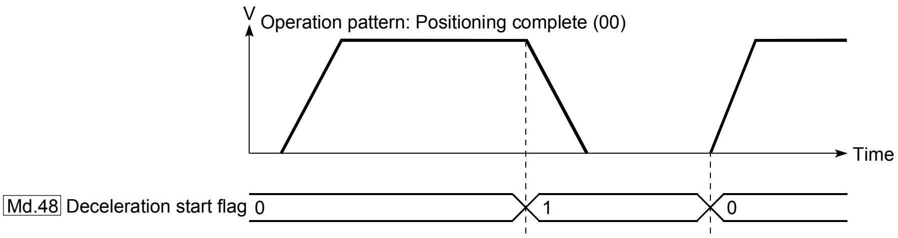


Fig. 13.49 Operation of deceleration start flag

(2) Block start

At a block start, this function is valid for only the position control whose operation pattern is "Positioning complete" at the point whose shape has been set to "End". (Refer to Fig. 13.50.)

The following table indicates the operation of the deceleration start flag in the case of the following block start data and positioning data.

Block start data	Da.11 Shape	Da.12 Start data No.	Da.13 Special start instruction
1st point	1: Continue	1	0: Block start
2nd point	1: Continue	3	0: Block start
3rd point	0: End	4	0: Block start
•			
•			

Positioning Data No.	Da.1 Operation pattern
1	01: Continuous positioning control
2	00: Positioning complete
3	00: Positioning complete
4	11: Continuous path control
5	00: Positioning complete
•	
•	

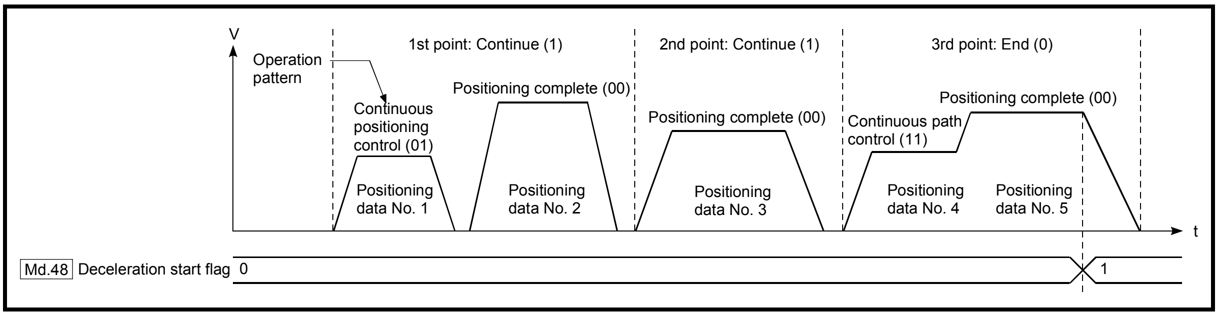


Fig. 13.50 Operation of deceleration start flag at block start

[2] Precautions during control

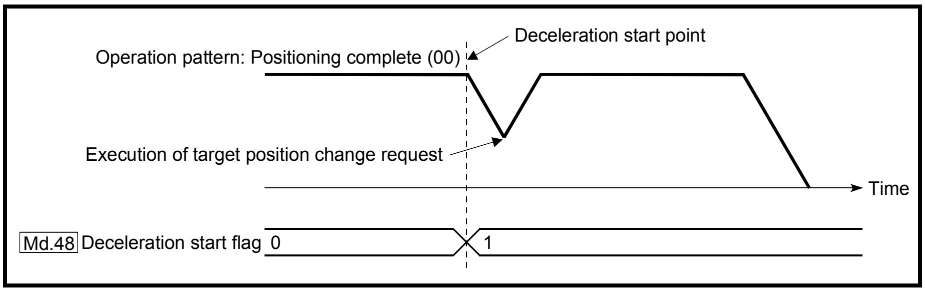
(1) The deceleration start flag function is valid for the control system of "1-axis linear control", "2-axis linear interpolation control", "3-axis linear interpolation control", "4-axis linear interpolation control", "speed-position switching control" or "position-speed switching control". (In the case of linear interpolation control, the function is valid for only the reference axis.) Refer to Section 3.2.5 "Combination of QD77MS main functions and sub functions".

(2) The deceleration start flag does not turn ON when the operation pattern is "continuous positioning control" or "continuous path control".

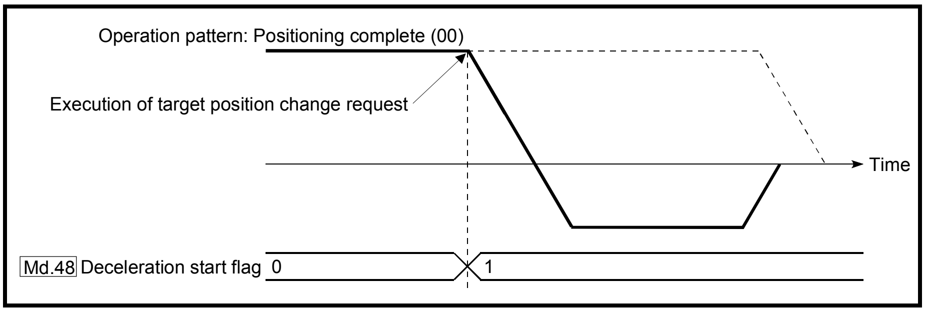
(3) The deceleration start flag function is invalid for an OPR, JOG operation, inching operation, manual pulse generator operation, speed-torque control and deceleration made with a stop signal.

(4) The deceleration start flag does not turn ON when a speed change or override is used to make deceleration.

(5) If a target position change is made while the deceleration start flag is ON, the deceleration start flag remains ON.



(6) When the movement direction is reversed by a target position change, the deceleration start flag turns ON.



(7) During position control of position-speed switching control, the deceleration start flag is turned ON by automatic deceleration.
The deceleration start flag remains ON if position control is switched to speed control by the position-speed switching signal after the deceleration start flag has turned ON.

(8) If the condition start of a block start is not made since the condition is not satisfied, the deceleration start flag turns ON when the shape is "End".

(9) When an interrupt request during continuous operation is issued, the deceleration start flag turns ON at a start of deceleration in the positioning data being executed.

[3] Deceleration start flag function setting method

To use the "deceleration start flag function", set "1" to the following control data using a sequence program.
The set data is made valid on the rising edge (OFF to ON) of the PLC READY signal [Y0].

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Cd.41	Deceleration start flag valid	→	Set whether the deceleration start flag function is made valid or invalid. 0: Deceleration start flag invalid 1: Deceleration start flag valid	1905	5905

*: Refer to Section 5.7 "List of control data" for details on the setting details.

[4] Checking of deceleration start flag

The "deceleration start flag" is stored into the following buffer memory addresses.

Monitor item		Monitor value	Storage details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Md.48	Deceleration start flag	→	0: Status other than below 1: Status from deceleration start to next operation start or manual pulse generator operation enable	899+100n	2499+100n

n: Axis No.-1

*: Refer to Section 5.6 "List of monitor data" for information on the storage details.

13.7.9 Stop command processing for deceleration stop function

The "stop command processing for deceleration stop function" is provided to set the deceleration curve if a stop cause occurs during deceleration stop processing (including automatic deceleration).
This function is valid for both trapezoidal and S-curve acceleration/deceleration processing methods.
(For the stop cause, refer to Section 1.2.3 "Outline of stopping".)

The "stop command processing for deceleration stop function" performs the following two operations:

(1) Deceleration curve re-processing

Re-processes a deceleration curve starting from the speed at stop cause occurrence until at a stop, according to the preset deceleration time.

(2) Deceleration curve continuation

Continues the current deceleration curve after a stop cause has occurred.

This section explains the "stop command processing for deceleration stop function" as follows:

[1] Control
[2] Precautions for control
[3] Setting method

[1] Control

The operation of "stop command processing for deceleration stop function" is explained below.

(1) Deceleration curve re-processing

A deceleration curve is re-processed starting from the speed at stop cause occurrence until at a stop, according to the preset deceleration time.
If a stop cause occurs during automatic deceleration of position control, the deceleration stop processing stops as soon as the target has reached the positioning address specified in the positioning data that is currently executed.

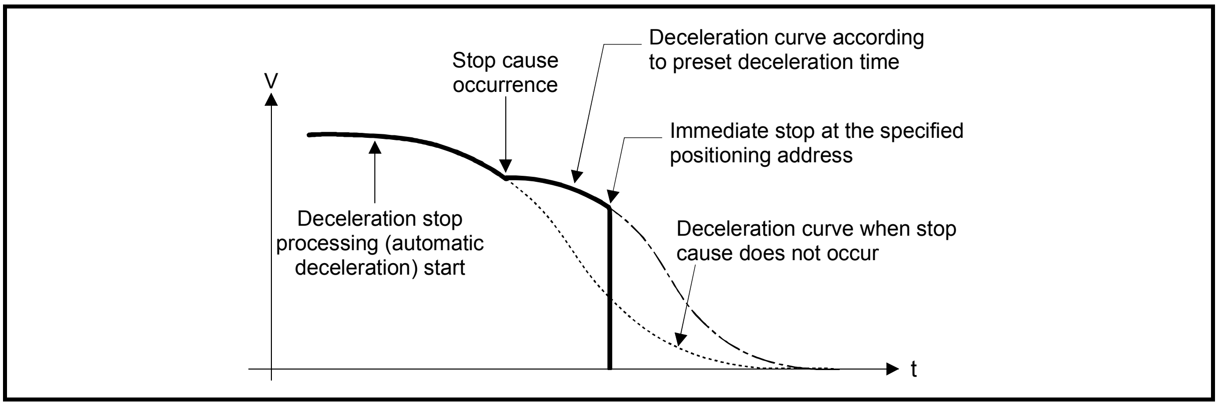


Fig. 13.51 Deceleration curve re-processing operation (for position control or S-curve acceleration/deceleration processing)

(2) Deceleration curve continuation

The current deceleration curve is continued after a stop cause has occurred. If a stop cause occurs during automatic deceleration of position control, the deceleration stop processing may be complete before the target has reached the positioning address specified in the positioning data that is currently executed.

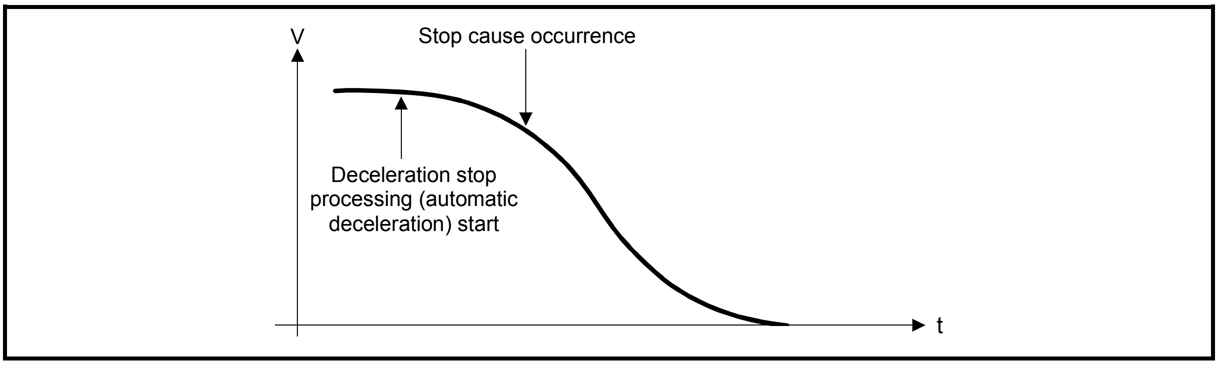


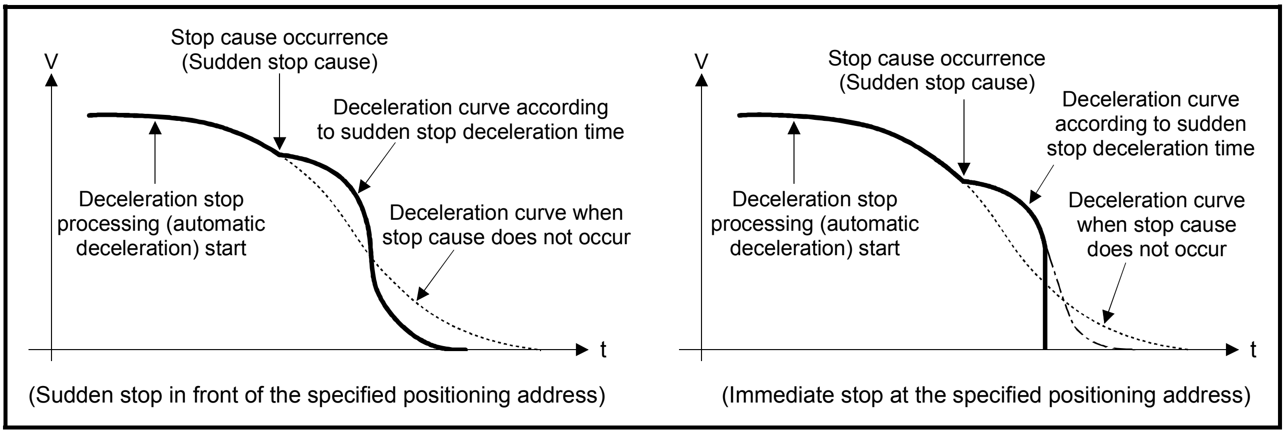
Fig. 13.52 Deceleration curve continuation operation (for position control or S-curve acceleration/deceleration processing)

[2] Precautions for control

(1) In manual control (JOG operation, inching operation, manual pulse generator operation) and speed-torque control, the stop command processing for deceleration stop function is invalid.

(2) The stop command processing for deceleration stop function is valid when "0: Normal deceleration stop" is set in "Pr.37 Stop group 1 sudden stop selection" to "Pr.39 Stop group 3 sudden stop selection" as the stopping method for stop cause occurrence.

(3) The stop command processing for deceleration stop function is invalid when "1: Sudden stop" is set in "Pr.37 Stop group 1 sudden stop selection" to "Pr.39 Stop group 3 sudden stop selection". (A deceleration curve is re-processed starting from the speed at stop cause occurrence until at a stop, according to the "Pr.36 Sudden stop deceleration time".)
In the position control (including position control of speed/position changeover control or position/speed changeover control) mode, positioning may stop immediately depending on the stop cause occurrence timing and "Pr.36 Sudden stop deceleration time" setting.



(Sudden stop in front of the specified positioning address)

(Immediate stop at the specified positioning address)

Fig. 13.53 Sudden stop operation (for position control or S-curve acceleration/deceleration processing)

[3] Setting method

To use the "stop command processing for deceleration stop function", set the following control data in a sequence program.
The set data are made valid as soon as they are written to the buffer memory.
The PLC ready signal [Y0] is irrelevant.

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Cd.42	Stop command processing for deceleration stop selection	→	Set the stop command processing for deceleration stop function. 0: Deceleration curve re-processing 1: Deceleration curve continuation	1907	5907

＊: For details of the setting details, refer to Section 5.7 "List of control data".

13.7.10 Speed control 10 x multiplier setting for degree axis function

The "Speed control 10 x multiplier setting for degree axis function" is provided to execute the positioning control by 10 x speed of the setting value in the command speed and the speed limit value when the setting unit is "degree".

This section explains the "speed control 10 multiplier specifying function for degree axis" as follows:
[1] Control details
[2] Setting method of "Speed control 10 x multiplier setting for degree axis function"

[1] Control details

When "Speed control 10 multiplier specifying function for degree axis" is valid, this function related to the command speed, monitor data, speed limit value, is shown below.

(1) Command speed

(a) Parameters

- "Pr.7 Bias speed at start"
- "Pr.46 OPR speed"
- "Pr.47 Creep speed"
- "Cd.14 New speed value"
- "Cd.17 JOG speed"
- "Cd.25 Position-speed switching control speed change register"
- "Cd.28 Target position change value (New speed)"
- "Cd.140 Command speed at speed control mode"
- "Da.8 Command speed"

(b) Major positioning control

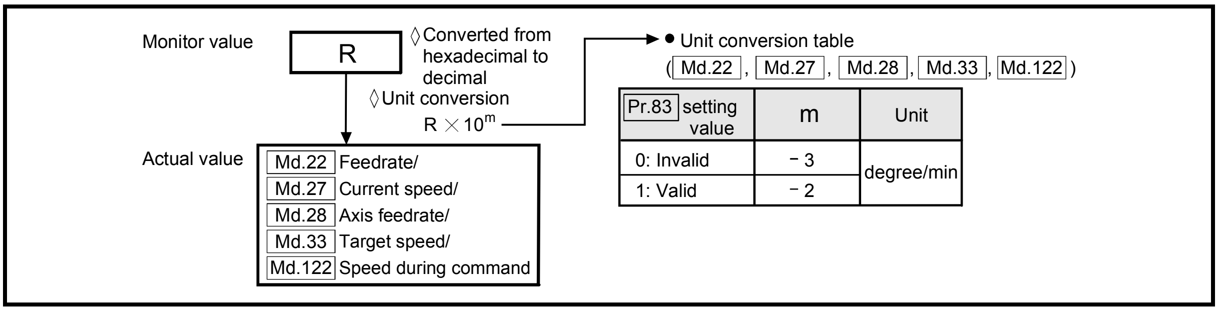
1) For "2 to 4 axis linear interpolation control" and "2 to 4 axis fixed-feed control", the positioning control is performed at decuple speed of command speed, when "Pr.83 Speed control 10 x multiplier setting for degree axis" of reference axis is valid.

2) For "2 to 4 axis speed control", "Pr.83 Speed control 10 x multiplier setting for degree axis" is evaluated whether it is valid for each axis.
If valid, the positioning control will be performed at decuple speed of command speed.

(2) Monitor data

- "Md.22 Feedrate"
- "Md.27 Current speed"
- "Md.28 Axis feedrate"
- "Md.33 Target speed"
- "Md.122 Speed during command"

＊: For the above monitoring data, "Pr.83 Speed control 10 x multiplier setting for degree axis" is evaluated whether it is valid for each axis. If valid, unit conversion value is changed (×10^{-3} → ×10^{-2}). The unit conversion table of monitor value is shown below.



Pr.83 setting value	m	Unit
0: Invalid	−3	degree/min
1: Valid	−2	

(3) Speed limit value

- "Pr.8 Speed limit value"
- "Pr.31 JOG speed limit value"
- "Cd.146 Speed limit value at torque control mode"
- "Cd.147 Speed limit value at continuous operation to torque control mode"

＊: For the speed limit value, "Pr.83 Speed control 10 x multiplier setting for degree axis" is evaluated whether it is valid for each axis. If valid, the positioning control will be performed at decuple speed of setting value (max. speed).

[2] Setting method of "Speed control 10 x multiplier setting for degree axis function"

Normally, the speed specification range is 0.001 to 2000000.000[degree/min], but it will be decupled and become 0.01 to 20000000.00[degree/min] by setting "Pr.83 Speed control 10 x multiplier setting for degree axis" to valid.
To use the "Speed control 10 x multiplier setting for degree axis function", set the parameters shown in the following table.

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Pr.83	Speed control 10 x multiplier setting for degree axis	→	Set the speed control 10 x multiplier setting for degree axis. 0: Invalid 1: Valid	63+150n	

n: Axis No.-1

∗: Refer to Section 5.2.4 "Detailed parameters 2" for details on the setting details.

13.7.11 Operation setting for incompletion of OPR function

The "Operation setting for incompletion of OPR function" is provided to select whether positioning control is operated or not, when OPR request flag is ON.

This section explains the "Operation setting for incompletion of OPR function" as follows:

[1] Control details
[2] Precautions during control
[3] Setting method of "Operation setting for incompletion of OPR function"

[1] Control details

When "Pr.55 Operation setting for incompletion of OPR" is valid, this function related to the command speed, monitor data, speed limit value, is shown below.

Item	Pr.55 Operation setting for incompletion of OPR	
	"0: Positioning control is not executed." and "OPR request flag ON"	"1: Positioning control is executed." and "OPR request flag ON"
• Machine OPR • JOG operation • Inching operation • Manual pulse generator operation • Current value changing using current value changing start No. (No. 9003).	○	○
The positioning control is impossible to start/restart in the following case. • 1-axis linear control • 2/3/4-axis linear interpolation control • 1/2/3/4-axis fixed-feed control • 2-axis circular interpolation control with sub point designation • 2-axis circular interpolation control with center point designation • 1/2/3/4-axis speed control • Speed-position switching control (INC mode/ ABS mode) • Position-speed switching control • Current value changing using positioning data No. (No.1 to 600).	×	○
Control mode switching	×	○

○: Positioning start possible (Execution possible)
×: Positioning start impossible (Execution not possible)

[2] Precautions during control

(1) The "Operation starting at incompletion of OPR" error (error code: 547) occurs if OPR request flag (Md.31 Status: b3) is executed the positioning control by turning on, when "0: Positioning control is not executed" is selected the operation setting for incompletion of OPR setting, and positioning control will not be performed. At this time, operation with the manual control (JOG operation, inching operation, manual pulse generator operation) is available.

(2) When OPR request flag (Md.31 Status: b3) is ON, starting Fast OPR will result in an "Home positioning return (OPR) request flag ON" error (error code: 207) despite the setting value of "Pr.55 Operation setting for incompletion of OPR", and Fast OPR will not be performed.

[3] Setting method of "Operation setting for incompletion of OPR"

To use the "Operation setting for incompletion of OPR", set the following parameters using a sequence program.

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Pr.55	Operation setting for incompletion of OPR	→	Set the operation setting for incompletion of OPR. 0: Positioning control is not executed. 1: Positioning control is executed.	87+150n	

n: Axis No.-1

∗: Refer to Section 5.2.6 "OPR detailed parameters" for details on the setting details.

13.8 Servo ON/OFF

13.8.1 Servo ON/OFF

This function executes servo ON/OFF of the servo amplifiers connected to the Simple Motion module.
By establishing the servo ON status with the servo ON command, servo motor operation is enabled.

The following two signals can be used to execute servo ON/OFF.

- All axis servo ON [Y1]
- Cd.100 Servo OFF command (Buffer memory addresses: 1551+100n[QD77MS2/QD77MS4]/4351+100n[QD77MS16])

A list of the "All axis servo ON [Y1]" and "Cd.100 Servo OFF command" is given below.

		Cd.100 Servo OFF command			
		Setting value "0"		Setting value "1"	
			Command to servo amplifier		Command to servo amplifier
All axis servo ON: Y1	OFF	×	Servo ON command: OFF Ready ON command: OFF	×	Servo ON command: OFF Ready ON command: OFF
	ON	○	Servo ON command: ON Ready ON command: ON	×	Servo ON command: OFF Ready ON command: ON

○: Servo ON (Servo operation enabled) , ×: Servo OFF (Servo operation disabled)

POINT

When the delay time of "Electromagnetic brake sequence output (PC02)" is used, execute the servo ON to OFF by "Cd.100 Servo OFF command". (When all axis servo ON [Y1] is turned ON to OFF, execute the servo OFF and turn off [Y1] after delay time passes.)
Refer to the "Servo Amplifier Instruction Manual" for details of servo ON command OFF and ready ON command OFF from Simple Motion module.

[1] Servo ON (Servo operation enabled)

The following shows the procedure for servo ON.

(1) Make sure that the servo LED indicates "b□".
(The initial value for "All axis servo ON [Y1]" is "OFF".)
(2) Set "0" for "Cd.100 Servo OFF command".
(3) Turn ON "All axis servo ON [Y1]".
Now the servo amplifier turns ON the servo (servo operation enabled state).
(The servo LED indicates "d□".)

[2] Servo OFF (Servo operation disabled)

The following shows the procedure for servo OFF.

(1) Set "1" for "Cd.100 Servo OFF command". (The servo LED indicates "c□".)
(If the "Cd.100 Servo OFF command" set "0" again, after the servo operation enabled.)
(2) Turn OFF "All axis servo ON [Y1]".
(The servo LED indicates "b□".)

POINT

- If the servomotor is rotated by external force during the servo OFF status, follow up processing is performed.
- Change between servo ON or OFF status while operation is stopped (position control mode).
  The servo OFF command of during positioning in position control mode, manual pulse control, OPR, speed control mode, torque control mode and continuous operation to torque control mode will be ignored.
- When the servo OFF is given to all axes, "All axis servo ON [Y1]" is applied even if all axis servo ON command is turned ON to OFF with "Cd.100 Servo OFF command" set "0".

13.8.2 Follow up function

(1) Follow up function

The follow up function monitors the number of motor rotations (actual present value) with the servo OFF and reflects the value in the present feed value.

If the servomotor rotates during the servo OFF, the servomotor will not just rotate for the amount of droop pulses at switching the servo ON next time, so that the positioning can be performed from the stop position.

(2) Execution of follow up

Follow up function is executed continually during the servo OFF status.

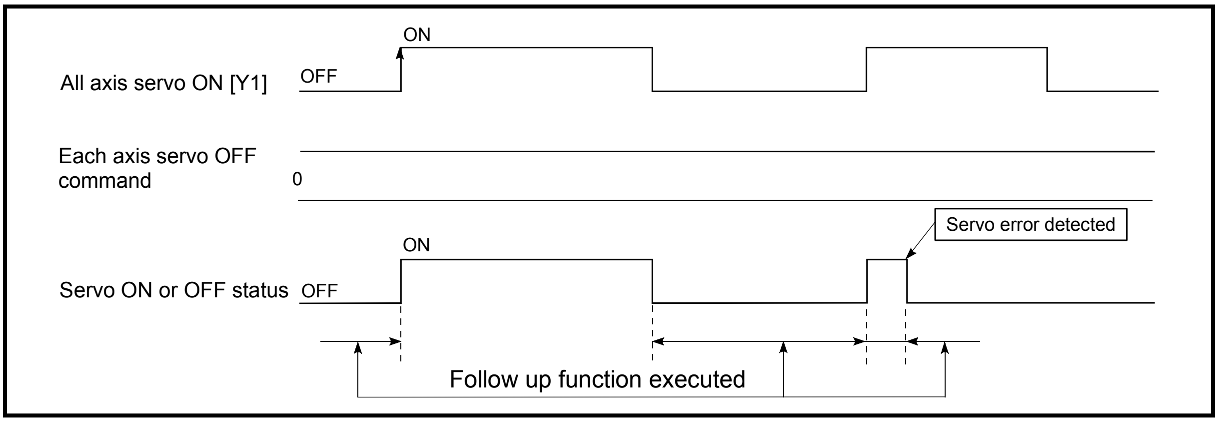


Fig. 13.54 Operation timings of follow up function

POINT

- The follow-up function performs the process if the "Simple Motion module and the servo amplifier is turned ON" and "servo OFF" regardless of the presence of the absolute position system.

Chapter 14 Common Functions

The details and usage of the "common functions" executed according to the user's requirements are explained in this chapter.

Common functions include functions required when using the Simple Motion module, such as parameter initialization and execution data backup.
Read the setting and execution procedures for each common function indicated in this chapter thoroughly, and execute the appropriate function where required.

14.1 Outline of common functions

"Common functions" are executed according to the user's requirements, regardless of the control system, etc. These common functions are executed by GX Works2 or sequence programs.

The following table shows the functions included in the "common functions".

Common function	Details	Means	
		Sequence program	GX Works2
Parameter initialization function	This function returns the parameter stored in the buffer memory/internal memory and flash ROM/internal memory (nonvolatile) of Simple Motion module to the factory-set initial value.	○	○
Execution data backup function	This function writes the "execution data", currently being used for control, to the flash ROM/internal memory (nonvolatile).	○	○
External signal selection function	This function is used to select from the following signals when using the upper/lower limit signal, near-point dog signal, and stop signal. • External input signal of QD77MS • External input signal of servo amplifier • External input signal via CPU (the buffer memory of QD77MS)	○	○
External I/O signal logic switching function	This function switches I/O signal logic according to the equipment connected to the Simple Motion module. For the system in which with b-contact, upper limit switch, and lower limit switch are not used, the parameter logic setting can be controlled without wiring if it is changed to a "positive logic".	○	○
History monitor function	This function monitors errors, warnings and start history of all axes.	—	○
Amplifier-less operation function	This function executes the positioning control of Simple Motion module without connecting to the servo amplifiers. It is used to debug the program at the start-up of the device or simulate the positioning operation.	○	—
Virtual servo amplifier function	This function executes the operation as the axis (virtual servo amplifier axis) that operates only command (instruction) virtually without servo amplifiers.	○	○
Driver communication function	This function uses the "Master-slave operation function" of servo amplifier. The Simple Motion module controls the master axis and the slave axis is controlled by data communication between servo amplifiers (driver communication) without Simple Motion module.	○	○
Mark detection function	This function is used to latch any data at the input timing of the mark detection signal (DI1 to DI4).	○	○
Optional data monitor function	This function is used to store the data selected by user up to 4 data per axis to buffer memory and monitor them.	○	○

Common function	Details	Means	
		Sequence program	GX Works2
Module error collection function	This function collects errors occurred in the Simple Motion module in the PLC CPU. Holding the error contents in the PLC CPU, this function enables to check the error history even after the PLC CPU in powered off or reset.	—	○
Connect/disconnect function of SSCNET communication	Temporarily connect/disconnect of SSCNET communication is executed during system's power supply ON. This function is used to exchange the servo amplifiers or SSCNETⅢ cables.	○	—
QD75MH initial value setting function	This function is used to set the factory-set initial value of QD75MH in the setting data set in the QD77MS buffer memory/internal memory and flash ROM/internal memory (nonvolatile).	○	—

14.2 Parameter initialization function

The "parameter initialization function" is used to return the setting data set in the buffer memory/internal memory and flash ROM/internal memory (nonvolatile) of Simple Motion module to their factory-set initial values.

The details shown below explain about the "parameter initialization function".
[1] Parameter initialization means
[2] Control details
[3] Precautions during control
[4] Parameter initialization method

[1] Parameter initialization means

- Initialization is executed with a sequence program.
- Initialization is executed by GX Works2.

Refer to the "Simple Motion Module Setting Tool Help" of GX Works2 for the execution method by GX Works2.

[2] Control details

The following table shows the setting data initialized by the "parameter initialization function".
(The data initialized are "buffer memory/internal memory" and "flash ROM/internal memory (nonvolatile)" setting data.)

Setting data
Basic parameters (Pr.1 to Pr.10)
Detailed parameters (Pr.11 to Pr.42, Pr.80 to Pr.90, Pr.95)
OPR basic parameters (Pr.43 to Pr.48)
OPR detailed parameters (Pr.50 to Pr.57)
Expansion parameters (Pr.91 to Pr.94, Pr.96, Pr.97, Pr.114)
Servo parameters (Pr.100, PA, PB, PC, PD, PE, PS, PF, Po, PL)
Positioning data (No.1 to 600)
Block start data (No.7000 to 7004)

[3] Precautions during control

(1) Parameter initialization is only executed when the positioning control is not carried out (when the PLC READY signal [Y0] is OFF).
A warning "In PLC READY (warning code: 111)" will occur if executed when the PLC READY signal [Y0] is ON.

(2) Writing to the flash ROM is up to 100,000 times. If writing to the flash ROM exceeds 100,000 times, the writing may become impossible, and "Flash ROM write error (error code: 801)" will occur.

(3) A "PLC CPU reset" or "PLC CPU power restart" must be carried out after the parameters are initialized.

(4) If an error occurs on the parameter set in the Simple Motion module when the PLC READY signal [Y0] is turned ON, the READY signal [X0] will not be turned ON and the control cannot be carried out.

Important

Parameter initialization takes about 10 seconds. (Up to 30 seconds are sometimes required.)
Do not turn the power ON/OFF or reset the PLC CPU during parameter initialization. If the power is turned OFF or the PLC CPU module is reset to forcibly end the process, the data backed up in the flash ROM/internal memory (nonvolatile) will be lost.

[4] Parameter initialization method

(1) Parameter initialization is carried out using the dedicated instruction "ZP.PINIT".
(Refer to Chapter 15 "Dedicated Instructions" for details.)

(2) Parameter initialization can also be carried out by the writing of the data shown in the table below to the buffer memory of Simple Motion module using the TO command/intelligent function device.
The initialization of the parameter is executed at the time point the data is written to the buffer memory of Simple Motion module.

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Cd.2	Parameter initialization request	1	Set "1" (parameter initialization request).	1901	5901

*: Refer to Section 5.7 "List of control data" for details on the setting details.

When the initialization is complete, "0" will be set in "Cd.2 Parameter initialization request" by the Simple Motion module automatically.

14.3 Execution data backup function

When the buffer memory data of Simple Motion module is rewritten from the PLC CPU, "the data backed up in the flash ROM/internal memory (nonvolatile)" of Simple Motion module may differ from "the data (buffer memory data) for which control is being executed".
In cases like these, the data being executed will be lost when the PLC power is turned OFF. (Refer to Chapter 7 "Memory Configuration and Data Process".)
In cases like these, the "execution data backup function" backs up the data being executed by writing it to the flash ROM/internal memory (nonvolatile). The data that was backed up is then written to the buffer memory when the power is turned ON next.

The details shown below explain about the "execution data backup function".
[1] Execution data backup (written to flash ROM) means
[2] Control details
[3] Precautions during control
[4] Execution data backup method

[1] Execution data backup (written to flash ROM) means

- The backup is executed with a sequence program.
- The backup is executed by GX Works2.

Refer to the "Simple Motion Module Setting Tool Help" of GX Works2 for execution data backup method by GX Works2.

[2] Control details

The following shows the data that can be written to the flash ROM/internal memory (nonvolatile) using the "execution data backup function".

Buffer memory/Internal memory		Flash ROM/Internal memory (nonvolatile)
Parameters (Pr.1 to Pr.57, Pr.80 to Pr.97, Pr.114)		Parameters (Pr.1 to Pr.57, Pr.80 to Pr.97, Pr.114)
Positioning data (No. 1 to 600)		Positioning data (No. 1 to 600)
Block start data (No. 7000 to 7004)	→	Block start data (No. 7000 to 7004)
Servo parameters (Pr.100, PA, PB, PC, PD, PE, PS, PF, Po, PL)		Servo parameters (Pr.100, PA, PB, PC, PD, PE, PS, PF, Po, PL)

[3] Precautions during control

(1) Data can only be written to the flash ROM when the positioning control is not carried out (when the PLC READY signal [Y0] is OFF).
A warning "In PLC READY (warning code: 111)" will occur if executed when the PLC READY signal [Y0] is ON.

(2) Writing to the flash ROM can be executed up to 100,000 times.
If writing to the flash ROM exceeds 100,000 times, the writing may become impossible, and a "flash ROM writing error (error code: 801)" will occur.

(3) After one power ON/PLC CPU reset operation, writing to the flash ROM using a sequence program is limited to up to 25 times.
If the 26th writing is executed, a "flash ROM write number error (error code: 805)" will occur. If this error occurs, carry out the error reset or power OFF→ON/PLC CPU reset operation again.
Refer to "Md.19 Number of write accesses to flash ROM" of Section 5.1.9 "Types and roles of monitor data" for details.

Important

Do not turn the power ON/OFF or reset the PLC CPU during executing the flash ROM writing. If the power is turned OFF or the PLC CPU module is reset to forcibly end the process, the data backed up in the flash ROM/internal memory (nonvolatile) will be lost.

[4] Execution data backup method

(1) Execution data backup (writing to the flash ROM/internal memory (nonvolatile)) is carried out using the dedicated instruction "ZP.PFWRT". (Refer to Chapter 15 "Dedicated Instructions" for details.)

(2) Refer to Section 7.2 "Data transmission process" for the data transmission processing at the backup of the execution data.

(3) Execution data backup can also be carried out by the writing of the data shown in the table below to the buffer memory of Simple Motion module using the TO command/intelligent function device.
The writing to the flash ROM/internal memory (nonvolatile) is executed at the time point the data is written to the buffer memory of Simple Motion module.

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Cd.1	Flash ROM write request	1	Set "1" (flash ROM write request).	1900	5900

＊: Refer to Section 5.7 "List of control data" for details on the setting details.

When the writing to the flash ROM/internal memory (nonvolatile) is complete, "0" will be set in "Cd.1 Flash ROM write request" by the Simple Motion module automatically.

14.4 External signal selection function

The "external signal selection function" is used to select from the following signals when using the upper/lower limit signal, near-point dog signal, and stop signal.

- External input signal of QD77MS
- External input signal of servo amplifier
- External input signal via CPU (buffer memory of QD77MS)

When the external input signal via CPU (the buffer memory of QD77MS) is used, the external input signal status of Simple Motion module can be operated by connecting the limit switch to input module and by operating the buffer memory of sequence program. When the external input signal via CPU (the buffer memory of QD77MS) is used, operation is affected by the PLC scan time.

The details shown below explain about the "External signal selection function".

[1] Parameter setting details

[2] Precautions during parameter setting

[3] Control details

[1] Parameter setting details

The setting details of the "External signal selection function" are shown in the following table.

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Pr.80	External input signal selection	QD77MS2 : 0 QD77MS4 : 0 QD77MS16: 1	Set the external signal selection. 0: External input signal of QD77MS QD77MS2 QD77MS4 1: External input signal of servo amplifier 2: Buffer memory of QD77MS 3: External input signal 1 of QD77MS QD77MS16 4: External input signal 2 of QD77MS QD77MS16 5: External input signal 3 of QD77MS QD77MS16 6: External input signal 4 of QD77MS QD77MS16	32+150n	

n: Axis No.-1

(1) When "0: External input signal of QD77MS", "3: External input signal 1 of QD77MS", "4: External input signal 2 of QD77MS", "5: External input signal 3 of QD77MS", or "6: External input signal 4 of QD77MS" is set, set the Pin No. of external input signal of QD77MS shown in the following table.

	Axis No. or signal No.	Pin No.	Signal name
QD77MS	Axis 1 QD77MS2 QD77MS4 External input signal 1 QD77MS16	1A3	DOG
		1A2	RLS
		1A1	FLS
		1A4	STOP
	Axis 2 QD77MS2 QD77MS4 External input signal 2 QD77MS16	1B3	DOG
		1B2	RLS
		1B1	FLS
		1B4	STOP
	Axis 3 QD77MS4 External input signal 3 QD77MS16	2A3	DOG
		2A2	RLS
		2A1	FLS
		2A4	STOP
	Axis 4 QD77MS4 External input signal 4 QD77MS16	2B3	DOG
		2B2	RLS
		2B1	FLS
		2B4	STOP

(2) When "1: External input signal of servo amplifier" is set, set the Pin No. of external input signal of servo amplifier shown in the following table.

	Pin No.	Signal name
Servo amplifier	CN3-19 (DI3)	DOG
	CN3-12 (DI2)	RLS
	CN3-2 (DI1)	FLS

∗1: Refer to the "Servo Amplifier Instruction Manual" for details on the pin No. of servo amplifier.

∗2: The stop signal cannot be input from the external input signal of servo amplifier.

(3) When "2: Buffer memory of QD77MS" is set, use the following control data to operate the external input signal (upper/lower limit signal, near-point dog signal and stop signal).

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Cd.44	External input signal operation device	→	Set the status of the upper/lower limit signal, the near-point dog signal and the stop signal.	1928	5928 to 5931

∗: Refer to Section 5.7 "List of control data" for details on the setting details.

[2] Precautions during parameter setting

(1) When the "3: External input signal 1 of QD77MS", "4: External input signal 2 of QD77MS", "5: External input signal 3 of QD77MS", or "6: External input signal 4 of QD77MS" is set in the QD77MS2/QD77MS4, "External input signal selection error" (error code: 936) occurs at turning the PLC READY signal [Y0] ON, and the READY signal [X0] is not turned ON.
Set "0: External input signal of QD77MS" to use the external input signal of QD77MS2/QD77MS4.

(2) When the "0: External input signal of QD77MS" is set in the QD77MS16, "External input signal selection error" (error code: 936) occurs at turning the PLC READY signal [Y0] ON, and the READY signal [X0] is not turned ON.
Set "3: External input signal 1 of QD77MS", "4: External input signal 2 of QD77MS", "5: External input signal 3 of QD77MS", or "6: External input signal 4 of QD77MS" to use the external input signal of QD77MS16.

[3] Control details

The following table shows the external signal that becomes valid by setting "Pr.80 External input signal selection".

"Pr.80 External input signal selection"	External signal that becomes valid
External input signal of QD77MS (Setting value: 0, 3, 4, 5, 6)	Upper/lower stroke limit signal : External input signal of QD77MS (FLS, RLS) Near-point dog signal : External input signal of QD77MS (DOG) Stop signal : External input signal of QD77MS (STOP) External command/switching signal: External input signal of QD77MS (DI)
External input signal of servo amplifier (Setting value: 1)	Upper/lower stroke limit signal : External input signal of servo amplifier (FLS, RLS) Near-point dog signal : External input signal of servo amplifier (DOG) Stop signal : External input signal of QD77MS (STOP) QD77MS2 QD77MS4 / Buffer memory of QD77MS (STOP) QD77MS16 External command/switching signal: External input signal of QD77MS (DI)
Buffer memory of QD77MS (Setting value: 2)	Upper/lower stroke limit signal : Buffer memory of QD77MS (FLS, RLS) Near-point dog signal : Buffer memory of QD77MS (DOG) Stop signal : Buffer memory of QD77MS (STOP) External command/switching signal: External input signal of QD77MS (DI)

14.5 External I/O signal logic switching function

This function switches the signal logic according to the following signals.

- External equipment connected to Simple Motion module
- Cd.44 External input signal operation device
- External input signal of servo amplifier (upper/lower limit switch, near-point dog)

For the system in which b-contact, upper limit switch, and lower limit switch are not used, the parameter logic setting can be controlled without wiring if it is changed to a "positive logic".
When the upper limit switch, and lower limit switch are used, ensure to use them with negative logic (b-contact).

The details shown below explain about the "External I/O signal logic switching function".
[1] Parameter setting details
[2] Precautions on parameter setting

[1] Parameter setting details

To use the "External I/O signal logic switching function", set the parameters shown in the following table.

Setting item		Setting details			Factory-set initial value	Buffer memory address	
						QD77MS2 QD77MS4	QD77MS16
Pr.22	Input signal logic selection	• Selection of logic of signals input from external device to Simple Motion module			0	31+150n	
		b0	Lower limit	0: Negative logic, 1: Positive logic			
		b1	Upper limit				
		b2	Not used	Set "0".			
		b3	Stop signal	0: Negative logic, 1: Positive logic			
		b4	External command/ switching signal	0: Negative logic, 1: Positive logic			
		b5	Not used	Set "0".			
		b6	Near-point dog signal	0: Negative logic, 1: Positive logic			
		b7	Not used	Set "0".			
		b8	Manual pulse generator input *1	0: Negative logic, 1: Positive logic			
		b9 to b15	Not used	Set "0".			

n: Axis No.-1

*1: Only the value specified against the axis 1 is valid for the logic selection of manual pulse generator input (b8).
*: Refer to Section 5.2 "List of parameters" for the information on detail settings.

[2] Precautions on parameter setting

(1) The external I/O signal logic switching parameters are validated when the PLC READY signal [Y0] is turned OFF to ON. (The logic is negative right after power-on.)

(2) If the logic of each signal is set erroneously, the operation may not be carried out correctly.
Before setting, check the specifications of the equipment to be used.

(3) When the same external input signal is set to use to the multiple axes in "Pr.80 External input signal selection" or "Pr.95 External command signal selection" in the QD77MS16, "Input signal logic selection" of those axes should be the same. Otherwise, "Input signal logic selection error" (error code: 938) occurs when the PLC READY signal [Y0] is turned ON, and the READY signal [X0] will not be turned ON.

14.6 History monitor function

This function monitors starting history, error history, and warning history stored in the buffer memory of Simple Motion module during operation.

[1] Starting history

Sixteen starting history logs of operations such as positioning operation, JOG operation, and manual pulse generator operation can be monitored. The latest history 16 logs can be monitored all the time. This function allows users to check the operation sequence (whether the operations have been started in a predetermined sequence) at system start-up.

For the starting history check method, refer to the "Simple Motion Module Setting Tool Help" of GX Works2.

[2] Error history, warning history

Sixteen error history logs and sixteen warning history logs can be monitored. The latest history 16 logs can be monitored all the time.

For the error and warning history check method, refer to the "Simple Motion Module Setting Tool Help" of GX Works2.

POINT

Set the clock of PLC CPU. Refer to the "GX Works2 Version1 Operating Manual (Common)" for setting method.

14.7 Amplifier-less operation function

The positioning control of Simple Motion module without servo amplifiers connection can be executed in the amplifier-less function. This function is used to debug of user program or simulate of positioning operation at the start.

The details shown below explain about the "Amplifier-less operation function".
[1] Control details
[2] Restrictions
[3] Buffer memory list
[4] Operation mode switching procedure

[1] Control details

Switch the mode from the normal operation mode (with servo amplifier connection) to the amplifier-less operation mode (without servo amplifier connection) to use the amplifier-less operation function.
Operation for each axis without servo amplifier connection as the normal operation mode can be executed during amplifier-less operation mode. The start method of positioning control is also the same procedure of normal operation mode.
The normal operation (with servo amplifier connection) is possible by switching from the amplifier-less operation mode to the normal operation mode after amplifier-less operation.
The current value management (current feed value, machine feed value) at the switching the normal operation mode and amplifier-less operation mode is shown below.

"Absolute position detection system (PA03)"	Current value management at the operation mode switching	
	Normal operation mode → Amplifier-less operation mode	Amplifier-less operation mode → Normal operation mode
"0: Disabled"	The current feed value and machine feed value are "0".	The current feed value and machine feed value are "0". (At the communication start to the servo amplifiers)
"1: Enabled"	The amplifier-less operation mode starts with the address that the servo amplifier's power supply was finally turned OFF. However, the OP position is not established in the normal operation mode, the current feed value and machine feed value are "0".	The current feed value and machine feed value are restored according the actual position of servomotor. (At the communication start to the servo amplifiers) However, when the OP position is not established in the normal operation mode before switching to the amplifier-less operation mode, the current feed value and machine feed value are not restored. Execute the OPR. When the mode is switched to the normal operation mode after moving that exceeds the range "-2147483648(-2^{31}) to 2147483647(2^{31}-1) [PLS]" from the actual position of servo motor during amplifier-less operation mode, the current feed value and machine feed value might be not restored correctly.

POINT

(1) Switch of the normal operation mode and amplifier-less operation mode is executed by the batch of all axes. Switch of the operation mode for each axis cannot be executed.

(2) Only axis that operated either the followings before switching to the amplifier-less operation mode becomes the connection status during amplifier-less operation.
- "Pr.100 Servo series" is set, and then the written to flash ROM is executed. (Turn the power supply ON or PLC CPU reset after written to flash ROM.)
- "Pr.100 Servo series" is set, and then the PLC ready signal is turned ON.) (Servo amplifier connection is unnecessary.)

(3) Suppose the following servo amplifier and servo motor are connected during amplifier-less operation mode.
When "1: SSCNETⅢ/H" is set in "Pr.97 SSCNET setting"
  Servo amplifier type: MR-J4-10B
  Motor type: HG-KR053 (Resolution per servo motor rotation: 4194304PLS)
When "0: SSCNETⅢ" is set in "Pr.97 SSCNET setting"
  Servo amplifier type: MR-J3-10B
  Motor type: HF-KP053 (Resolution per servo motor rotation: 262144PLS)

[2] Restrictions

(1) The following monitor data cannot be used during amplifier-less operation mode.

Storage item		Storage details	Buffer memory address	
			QD77MS2 QD77MS4	QD77MS16
Md.102	Deviation counter value	Always "0" during amplifier-less operation mode.	852+100n 853+100n	2452+100n 2453+100n
Md.106	Servo amplifier software No.	Always "0" during amplifier-less operation mode.	864+100n to 869+100n	2464+100n to 2469+100n
Md.107	Parameter error No.	Always "0" during amplifier-less operation mode.	870+100n	2470+100n
Md.108	Servo status	As follows during amplifier-less operation mode. • Zero point pass (b0) : Always ON • Zero speed (b3) : Changed depending on the command speed • Speed limit (b4) : Always ON when other than "0" is set to the command torque at torque control mode. Otherwise, always OFF. • PID control (b8) : Always OFF	876+100n	2476+100n
		As follows during amplifier-less operation mode. • READY ON(b0), Servo ON(b1): Changed depending on the all axis servo ON signal[Y1] and "Cd.100 Servo OFF command". • Control mode (b2, b3) : Indicates control mode. • Servo alarm(b7) : Always OFF • In-position(b12) : Always ON • Torque limit(b13) : Changed depending on "Md.104 Motor current value". (Refer to "Restrictions (2) and (3)" for details.) • Absolute position lost(b14) : Always OFF • Servo warning(b15) : Always OFF	877+100n	2477+100n
Md.109	Regenerative load ratio/ Optional data monitor output 1	Always "0" during amplifier-less operation mode.	878+100n	2478+100n
Md.110	Effective load torque/ Optional data monitor output 2	Always "0" during amplifier-less operation mode.	879+100n	2479+100n
Md.111	Peak torque ratio/ Optional data monitor output 3	Always "0" during amplifier-less operation mode.	880+100n	2480+100n
Md.112	Optional data monitor output 4	Always "0" during amplifier-less operation mode.	881+100n	2481+100n

n: Axis No.-1

(2) The operation of following function differs from the normal operation mode during amplifier-less operation mode.

Function	Operation
External signal selection function	When "1: External input signal of servo amplifier" is set in "Pr.80 External input signal selection", the status of external signal at the amplifier-less operation mode start is shown below. • Upper/lower limit signal (FLS, RLS): ON • Near-point dog signal (DOG): OFF Change "Md.30 External input signal" to change the signal status. (Refer to "Restrictions (3)" for details.) When "2: Buffer memory of QD77MS" is set in "Pr.80 External input signal selection", the upper/lower limit signal (FLS, RLS) and near-point dog signal (DOG) follow the buffer memory status of Simple Motion module during amplifier-less operation mode.
Torque limit function	Turns ON/OFF torque limit ("Md.108 Servo status" high-order buffer memory address: b13) depending on "Md.104 Motor current value". (Refer to "Restrictions (3)" for details.)

(3) The operation of following monitor data differs from the normal operation mode during amplifier-less operation mode.

Storage item		Storage details	Buffer memory address	
			QD77MS2 QD77MS4	QD77MS16
Md.30	External input signal	When "1: External input signal of servo amplifier" is set in "Pr.80 External input signal selection", the external input signal status can be operated by turning ON/OFF the "b0: Lower limit signal", "b1: Upper limit signal" or "b6: Near-point dog signal" during amplifier-less operation mode.	816+100n	2416+100n
Md.104	Motor current value	"0" is set at the amplifier-less operation mode start. The motor current value can be emulated by changing this monitor data in user side during amplifier-less operation mode.	856+100n	2456+100n

n: Axis No.-1

(4) When the power supply is turned OFF → ON or PLC CPU is reset during amplifier-less operation mode, the mode is switched to the normal operation mode.

(5) The operation of servo motor or the timing of operation cycle, etc. at the amplifier-less operation is different from the case where the servo amplifiers are connected at the normal operation mode. Confirm the operation finally with a real machine.

(6) The amplifier-less operation cannot be used in the test mode. Do not request to switch to the amplifier-less operation mode during test mode.

(7) The amplifier-less operation cannot be used in the fully closed loop system, linear servo or direct drive motor.

(8) Even if the PLC READY signal [Y0| is turned ON by changing "Pr.100 Servo series" from "0: Servo series is not set" to other than "0", the setting does not become valid. (The axis connecting status remains disconnection.)

(9) When "Md.52 Communication between amplifiers axes searching flag" is in searching the driver communication axes, the switch to the amplifier-less operation mode cannot be executed. Switch to the amplifier-less operation mode after searching.

(10) The synchronous encoder via servo amplifier cannot be used during amplifier-less operation mode.

[3] Buffer memory list

The buffer memory used in the amplifier-less operation function is shown below.

(1) System control data

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Cd.137	Amplifier-less operation mode switching request	→	Switch operation mode. ABCDh: Switch from the normal operation mode to the amplifier-less operation mode. 0000h : Switch from the amplifier-less operation mode to the normal operation mode	1926	5926

(2) System monitor data

Monitor item		Monitor value	Storage details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Md.51	Amplifier-less operation mode status	→	Indicate the current operation mode. 0: Normal operation mode 1: Amplifier-less operation mode	1432	4232

[4] Operation mode switching procedure

(1) Switch from the normal operation mode to the amplifier-less operation mode

1) Stop all operating axes, and then confirm that the BUSY signal for all axes turned OFF.
2) Turn OFF the PLC READY signal [Y0].
3) Confirm that the READY signal [X0] turned OFF.
4) Set "ABCDh" in "Cd.137 Amplifier-less operation mode switching request".
5) Confirm that "1: Amplifier-less operation mode" was set in "Md.51 Amplifier-less operation mode status".

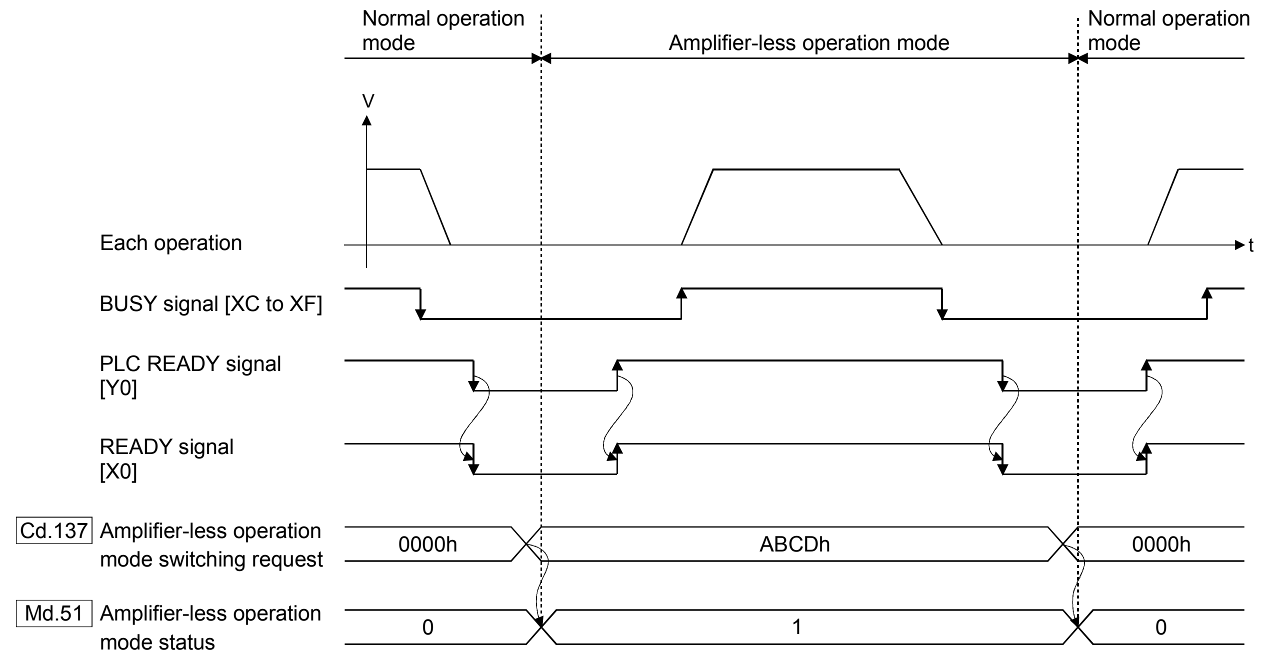
(2) Switch from the amplifier-less operation mode to the normal operation mode

1) Stop all operating axes, and then confirm that the BUSY signal for all axes turned OFF.
2) Turn OFF the PLC READY signal [Y0].
3) Confirm that the READY signal [X0] turned OFF.
4) Set "0000h" in "Cd.137 Amplifier-less operation mode switching request".
5) Confirm that "0: Normal operation mode" was set in "Md.51 Amplifier-less operation mode status".

(3) Operation chart

The following drawing shows the operation for the switching of the normal operation mode and amplifier-less operation mode

[QD77MS4 operation example]



(Note): Refer to Section 3.3 for input/output signal of QD77MS16.

POINT

(1) Switch the "normal operation mode" and "amplifier-less operation mode" after confirming the all input signals except synchronization flag [X1] OFF. When switching the normal operation mode and amplifier-less operation mode in the status that any one of input signals except the synchronization flag [X1] is ON, an "error when switching from normal operation mode to amplifier-less operation mode (error code: 808)" or "error when switching from amplifier-less operation mode to normal operation mode (error code: 809)" will occur, and the switching of operation mode will not execute.

(2) When the operation mode is switched with the servo amplifiers connected, the communication to the servo amplifiers is shown below.
- At switching from normal operation mode to amplifier-less operation mode: The communication for all axes during connection is disconnected. (The servo amplifier LED indicates "AA".)
- At switching from amplifier-less operation mode to normal operation mode: The communication to the servo amplifiers during connection is started.

(3) Even if the servo amplifiers are not connected, the switching of operation mode is possible.

(4) The forced stop is invalid regardless of the setting in "Pr.82 Forced stop valid/invalid selection" during the amplifier-less operation mode.

(5) Only "0000h" and "ABCDh" are valid for the "Cd.137 Amplifier-less operation mode switching request". The switching to amplifier-less operation mode can be accepted only when "Cd.137 Amplifier-less operation mode switching request" is switched from "0000h" to "ABCDh". The switching to normal operation mode can be accepted only when "Cd.137 Amplifier-less operation mode switching request" is switched from "ABCDh" to "0000h".

14.8 Virtual servo amplifier function

This function is used to operate as virtual servo amplifier axis that generates only command virtually by setting "4097, 4128" in servo parameter "Pr.100 Servo series". The synchronous control with virtually input command is possible by using the virtual servo amplifier axis as servo input axis of synchronous control.
Also, it can be used as simulation operation for axes without servo amplifiers.

Setting value of "Pr.97 SSCNET setting"	Setting value of "Pr.100 Servo series"
0: SSCNETⅢ	4097: Virtual servo amplifier (MR-J3)
1: SSCNETⅢ/H	4128: Virtual servo amplifier (MR-J4)

The details shown below explain about the "Virtual servo amplifier function".
[1] Control details
[2] Restrictions

[1] Control details

(1) When "4097, 4128" is set in "Pr.100 Servo series" of flash ROM, it operates as virtual servo amplifier immediately after power supply ON.

(2) When "0" is set in "Pr.100 Servo series" of flash ROM, it operates as virtual servo amplifier by setting "4097, 4128" in "Pr.100 Servo series" of buffer memory and by turning the PLC READY signal [Y0] OFF to ON after power supply ON.

(3) Do not connect the actual servo amplifier to axis set as virtual servo amplifier. If the servo amplifier is connected, the LED display status remains "Ab." and the servo amplifier is not recognized. The following servo amplifiers cannot be connected until the end station.

(4) The current feed value and machine feed value of virtual servo amplifier are as follows.
   (a) "0: Disabled (used in incremental system)" is set in "Absolute position detection system (PA03)".
   The both of current feed value and machine feed value are set to "0".

   (b) "1: Enabled (used in absolute position detection system)" is set in "Absolute position detection system (PA03)".
   OP is established: Address at latest power supply OFF
   OP is not established: "0" (Feed current value and machine feed value)

(5) When the virtual servo amplifier is set in the system setting of GX Works2, "0: Disabled (used in incremental system)" is set in "Absolute position detection system (PA03)".
Set "1: Enabled (used in absolute position detection system)" to the buffer memory to use as absolute position detection system.

POINT

Do not make to operate by switching between the actual servo amplifier and virtual servo amplifier. When a value except "0" is set in "Pr.100 Servo series" of flash ROM, the operation is not changed even if the "Pr.100 Servo series" of buffer memory is changed after power supply ON and then the PLC READY signal [Y0] is turned OFF to ON.

[2] Restrictions

(1) The following monitor data of virtual servo amplifier differ from the actual servo amplifier.

Storage item		Storage details	Buffer memory address	
			QD77MS2 QD77MS4	QD77MS16
Md.102	Deviation counter value	Always "0".	852+100n 853+100n	2452+100n 2453+100n
Md.106	Servo amplifier software No.	Always "0".	864+100n to 869+100n	2464+100n to 2469+100n
Md.107	Parameter error No.	Always "0".	870+100n	2470+100n
Md.108	Servo status	• Zero point pass (b0) : Always ON • Zero speed (b3) : Changed depending on the command speed • Speed limit (b4) : Always ON when other than "0" is set to the command torque at torque control mode. Otherwise, always OFF. • PID control (b8) : Always OFF	876+100n	2476+100n
		• READY ON (b0), Servo ON (b1) : Changed depending on the all axis servo ON signal [Y1] and "Cd.100 Servo OFF command" • Control mode (b2, b3) : Indicates control mode. • Servo alarm (b7) : Always OFF • In-position (b12) : Always ON • Torque limit (b13) : Changed depending on "Md.104 Motor current value". (Refer to "Restrictions (2) and (3)" for details.) • Absolute position lost (b14): Always OFF • Servo warning (b15) : Always OFF	877+100n	2477+100n
Md.109	Regenerative load ratio/Optional data monitor output 1	Always "0".	878+100n	2478+100n
Md.110	Effective load torque/Optional data monitor output 2	Always "0".	879+100n	2479+100n
Md.111	Peak torque ratio/Optional data monitor output 3	Always "0".	880+100n	2480+100n
Md.112	Optional data monitor output 4	Always "0".	881+100n	2481+100n

n: Axis No.-1

(2) The operation for external signal selection function of virtual servo amplifier differs from the actual servo amplifier.

Function	Operation
External signal selection function	When "1: External input signal of servo amplifier" is set in "Pr.80 External input signal selection", the external signal status immediately after power supply ON is shown below. • Upper/lower limit signal (FLS, RLS): ON • Near-point dog signal (DOG): OFF Change the signal status in "Md.30 External input signal". (Refer to "Restrictions (3)" for details.)
Torque limit function	Turns ON/OFF torque limit ("Md.108 Servo status" high-order buffer memory address: b13) depending on "Md.104 Motor current value". (Refer to "Restrictions (3)" for details.)

(3) The following monitor data of virtual servo amplifier differ from the actual servo amplifiers. The writing operation is possible in the virtual servo amplifier.

Storage item		Storage details	Buffer memory address	
			QD77MS2 QD77MS4	QD77MS16
Md.30	External input signal	When "1: External input signal of servo amplifier" is set in "Pr.80 External input signal selection", the external input signal status can be operated by turning ON/OFF the following signals. • b0: Lower limit signal • b1: Upper limit signal • b6: Near-point dog signal	816+100n	2416+100n
Md.104	Motor current value	"0" is set after immediately power supply ON. The motor current value can be emulated by changing this monitor data in user side.	856+100n	2456+100n

n: Axis No.-1

14.9 Driver communication function

This function uses the "Master-slave operation function" of servo amplifier. The Simple Motion module controls master axis and the slave axis is controlled by data communication between servo amplifiers (driver communication) without Simple Motion module.

There are restrictions in the function that can be used by the version of servo amplifier. Refer to each servo amplifier instruction manual for details.

The following shows the number of settable axes for the master axis and slave axis.

Network	Servo amplifier	Module	Combination of number of settable axes (Note-1)		Remark
			Master axis	Slave axis	
SSCNETⅢ	MR-J3-☐B MR-J3-☐BS MR-J3-☐B-RJ006 (Note-2)	QD77MS2	1 axis	1 axis	The axes other than the master axis and slave axis can be used as normal axis.
		QD77MS4	1 axis to 2 axes	1 axis or more/ 1 master axis	
		QD77MS16	1 axis to 4 axes	—	
SSCNETⅢ/H	MR-J4-☐B (Note-3)	QD77MS2	1 axis	1 axis	
		QD77MS4	1 axis to 2 axes	1 axis or more/ 1 master axis	
		QD77MS16	1 axis to 8 axes	—	

—: No restriction

(Note-1): When the slave axis is not allocated for the master axis, the operation is normal operation only of master axis.

(Note-2): The fully closed loop control servo amplifier can be set for the master axis only. It cannot be set for the slave axis.

(Note-3): In the fully closed loop system, the servo amplifier can be set for the master axis only. It cannot be set for the slave axis. Also, it cannot be used with the linear servo motors or direct drive motors. Refer to the "Servo Amplifier Instruction Manual" for details.

The details shown below explain about the "Driver communication function".

[1] Control details

[2] Precautions during control

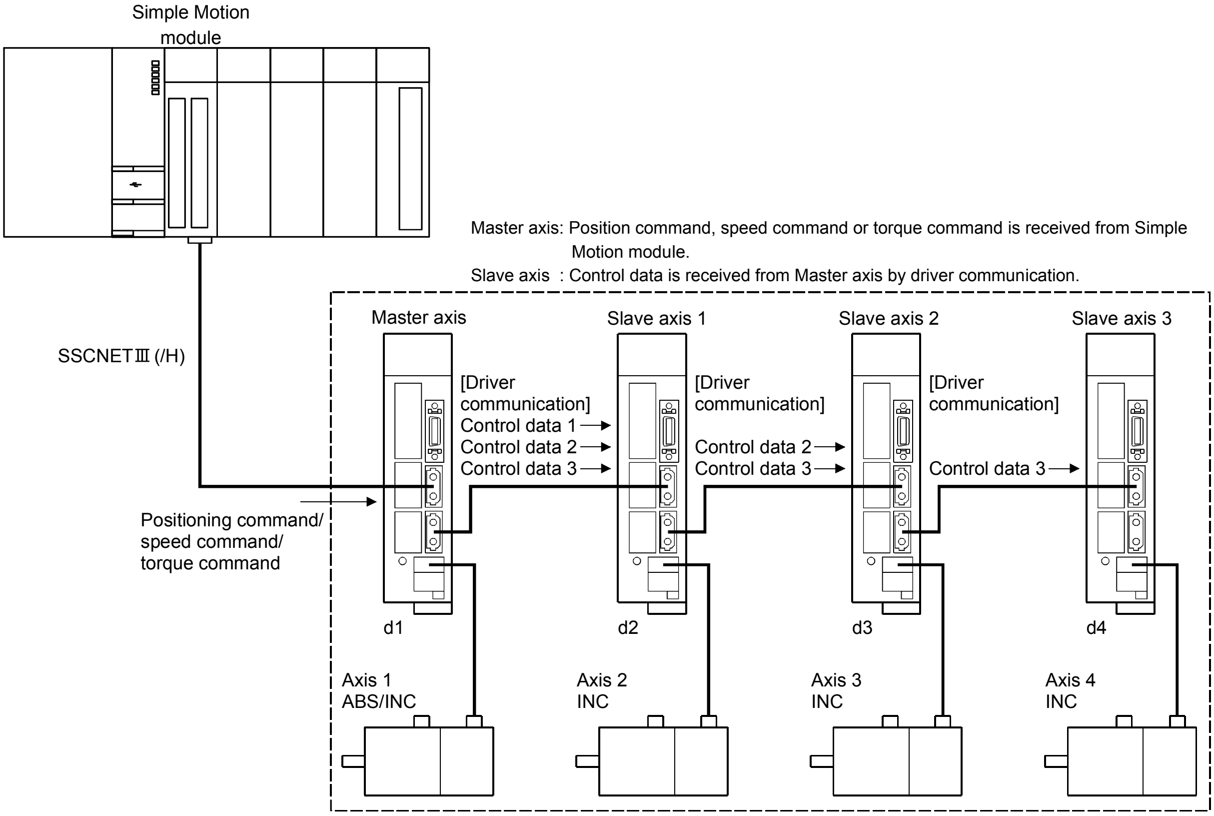
[3] Servo parameter

[1] Control details

Set the master axis and slave axis in the servo parameter.

Execute each control of Simple Motion module for the master axis. (However, be sure to execute the servo ON/OFF of slave axis and error reset at servo error occurrence in the slave axis.) The servo amplifier set as master axis receives command (positioning command, speed command, torque command) from the Simple Motion module, and send the control data to the servo amplifier set as slave axis by driver communication between servo amplifiers.

The servo amplifier set as the slave axis is controlled with the control data transmitted from master axis by driver communication between servo amplifiers.



POINT

(1) When the communication is disconnected due to a fault in the servo amplifier, it is not possible to communicate with the axis after the faulty axis. Therefore, when connecting the SSCNETⅢ cable, connect the master axis in the closest position to the Simple Motion module.

(2) This function is used for the case to operate by multiple motors in one system. Connect the master axis and slave axis without slip.

[2] Precautions during control

⚠CAUTION

- In the operation by driver communication, the positioning control or JOG operation of the master axis is not interrupted even if the servo error occurs in the slave axis. Be sure to stop by user program.

(1) Servo amplifier

(a) Use the servo amplifiers compatible with the driver communication for the axis to execute the driver communication.

(b) The combination of the master axis and slave axis is set in the servo parameters. The setting is valid by turning ON or resetting the system's power supply after writing the servo parameters to the Simple Motion module.

(c) Check the operation enabled status of driver communication in "Md.52 Communication between amplifiers axes searching flag". Switch of the amplifier-less operation mode cannot be executed during searching the driver communication axes. Switch to the amplifier-less operation mode after the searching is completed.

(d) When connecting/disconnecting at driver communication function use, it can be executed only for the head axis (servo amplifier connected directly to the Simple Motion module). The servo amplifier other than the head axis can be disconnected, however it cannot be connected again.

(e) Differences between SSCNETⅢ connection and SSCNETⅢ/H connection in driver communication function are shown below.

	SSCNETⅢ	SSCNETⅢ/H
Communication with the servo amplifiers after controller's power supply ON	The servo amplifiers cannot be operated until the connection with all system setting axes is confirmed.	The servo amplifiers cannot be operated until the connection with all driver communication setting axes is confirmed. The normal operation axis (driver communication unset up axis) can be connected after the network is established.
Connection with the disconnected servo amplifiers	It cannot be connected.	When only the normal operation axis (driver communication unset up axis) is disconnected, it can be connected again. However, when the driver communication setting axis is disconnected, it cannot be communicated with the servo amplifiers connected after disconnecting. (The servo amplifier's LED display remains "AA".)

Monitor item		Monitor value	Storage details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Md.52	Communication between amplifiers axes searching flag	→	The detection status of axis that set communication between amplifiers is stored. 0: Search end 1: Searching	1434	4234

(2) OPR control, positioning control, manual control, expansion control, and synchronous control

  (a) Do not start the slave axis. The command to servo amplifier is invalid even if the slave axis is started.
  (b) The OPR request flag (Md.31 Status: b3) of slave axis is always ON. There is no influence for control of slave axis.
  (c) There are some restrictions for data used as the positioning control of slave axis. The external input signals such as FLS or RLS, and the parameters such as software stroke limit are invalid. Refer to this section (4) or (5) for details.
  (d) For setting the slave axis as a servo input axis, set "2: Real current value" or "4: Feedback value" in "Pr.300 Servo input axis type". Otherwise, the slave axis does not operate as an input axis.
  (e) At the driver communication operation, only the switching to positioning control mode, speed control mode, and torque control mode are possible. When the mode is switched to continuous operation to torque control mode for the master axis, "Control mode switching not possible" (warning code: 125) will occur, and the control mode is not switched.

(3) Absolute position system

Set "0: Disabled (used in incremental system)" in "Absolute position detection system (PA03)" of servo parameter for slave axis. If "1: Enabled (used in absolute position detection system)" is set, the error "OPR data incorrect" (error code: 1201) will occur and the OPR of slave axis cannot be executed.

(4) I/O signals of slave axis

  (a) Input signal

  [QD77MS2]

  Only the error detection signal [X8, X9] is valid. And only the servo error detection is valid. (The control of slave axis is not influenced even if the error other than servo error has been occurred.)

  [QD77MS4]

  Only the error detection signal [X8 to XB] is valid. And only the servo error detection is valid. (The control of slave axis is not influenced even if the error other than servo error has been occurred.)

  [QD77MS16]

  All signals cannot be used. The error detection signal turns ON "Error detection" (Md.31 Status: b13).

  (b) Output signal

  All output signals of slave axis cannot be used.

(5) Data used for positioning control of slave axis

(a) Only the following axis monitor data are valid in slave axis.

Item		Remark
Md.23	Axis error No.	Valid for only servo error detection.
Md.35	Torque limit stored value/forward torque limit stored value	—
Md.102	Deviation counter value	—
Md.103	Motor rotation speed	—
Md.104	Motor current value	—
Md.107	Parameter error No.	—
Md.108	Servo status	The following bit is valid. • b0: Zero point pass (Execute OPR to the master axis.)
		The following bits are valid. • b0: READY ON • b1: Servo ON • b7: Servo alarm (Note): The slave axis is always controlled in torque control mode, "control mode (high-order buffer memory address: b2, b3)" is set to torque control mode (0, 1).
Md.109	Regenerative load ratio/Optional data monitor output 1	—
Md.110	Effective load torque/Optional data monitor output 2	—
Md.111	Peak torque ratio/Optional data monitor output 3	—
Md.112	Optional data monitor output 4	—
Md.114	Servo alarm	—
Md.120	Reverse torque limit stored value	—

(b) Only the following axis control data are valid in slave axis.

Item		Remark
Cd.5	Axis error reset	Only servo error detection
Cd.22	New torque value/forward new torque value	—
Cd.100	Servo OFF command	—
Cd.101	Torque output setting value	—
Cd.112	Torque change function switching request	—
Cd.113	Reverse new torque value	—

[3] Servo parameter

Set the following parameters for the axis to execute the driver communication. (Refer to the "Servo Amplifier Instruction Manual" for details.)

[MR-J3-□B/MR-J3-□BS/MR-J3-□B-RJ006 use]

Setting item			Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Input/output setting	PA04	Forced stop deceleration function selection	Disable deceleration stop function at the master axis and slave axis.(Note-3)	30104+200n	28404+100n
	PD15	Driver communication setting	Set the master axis and slave axis.	30210+200n	Set with GX Works2
	PD16	Driver communication setting Master transmit data selection 1	Set the transmitted data at master axis setting.	30211+200n	
	PD17	Driver communication setting Master transmit data selection 2		30212+200n	
	PD20	Driver communication setting Master axis No. selection 1 for slave	Set the axis No. of master axis at slave axis setting.	30215+200n	
	PD30	Master-slave operation - Torque command coefficient on slave	Set the parameter at slave axis setting.	30225+200n	
	PD31	Master-slave operation - Speed limit coefficient on slave		30226+200n	
	PD32	Master-slave operation - Speed limit adjusted value on slave		30227+200n	

n: Axis No.-1

(Note-1): When the slave axis is not allocated for the master axis, the operation is normal operation only of master axis.

(Note-2): For QD77MS16, the above servo parameters are not allocated to the buffer memory. Write them to Simple Motion module with GX Works2.

(Note-3): At MR-J3-□B/MR-J3-□B-RJ006 use, it is not necessary to change the setting since the initial value is disabled. However, it is required to set disabled since the initial value is enabled at MR-J3-□BS use.

POINT

(1) The servo parameters are transmitted from Simple Motion module to servo amplifier after power supply ON or reset of PLC CPU. Execute flash ROM writing of Simple Motion module after writing the servo parameter to buffer memory, and then turn the power supply ON or reset the PLC CPU.

(2) The servo parameters for driver communication setting (PD15 to PD17, PD20) become valid by turning the servo amplifier's power supply OFF to ON. Turn the servo amplifier's power supply OFF to ON after executing the above (1). Then, turn the system's power supply ON or reset the PLC CPU.

(3) In the driver communication function, the torque generation direction for slave axis can be set in "Rotation direction selection/travel direction selection (PA14)".

[MR-J4-□B use]

Setting item			Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Input/output setting	PA04	Forced stop deceleration function selection	Disable deceleration stop function at the master axis and slave axis.	30104+200n	28404+100n
	PD15	Driver communication setting	Set the master axis and slave axis.	30210+200n	Set with GX Works2
	PD16	Driver communication setting Master transmit data selection 1	Set the transmitted data at master axis setting.	30211+200n	
	PD17	Driver communication setting Master transmit data selection 2		30212+200n	
	PD20	Driver communication setting Master axis No. selection 1 for slave	Set the axis No. of master axis at slave axis setting.	30215+200n	
	PD30	Master-slave operation - Torque command coefficient on slave	Set the parameter at slave axis setting.	30225+200n	
	PD31	Master-slave operation - Speed limit coefficient on slave		30226+200n	
	PD32	Master-slave operation - Speed limit adjusted value on slave		30227+200n	

n: Axis No.-1

(Note-1): When the slave axis is not allocated for the master axis, the operation is normal operation only of master axis.
(Note-2): For QD77MS16, the above servo parameters of PD□ are not allocated to the buffer memory. Write them to Simple Motion module with GX Works2.
(Note-3): At slave setting, set only "Driver communication setting Master axis No. selection 1 for slave (PD20)" in the master axis No. selection normally.

POINT

(1) The servo parameters are transmitted from Simple Motion module to servo amplifier after power supply ON or reset of PLC CPU. Execute flash ROM writing of Simple Motion module after writing the servo parameter to buffer memory, and then turn the power supply ON or reset the PLC CPU.
(2) The servo parameters for driver communication setting (PA04, PD15 to PD17, PD20) become valid by turning the servo amplifier's power supply OFF to ON. Turn the servo amplifier's power supply OFF to ON after executing the above (1). Then, turn the system's power supply ON or reset the PLC CPU.
(3) In the driver communication function, the torque generation direction for slave axis can be set in "Rotation direction selection/travel direction selection (PA14)".

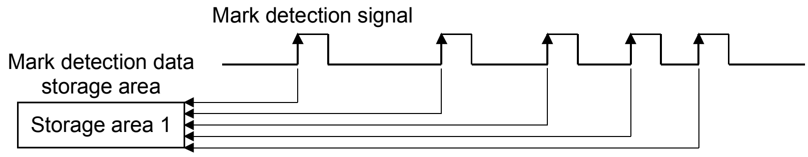
14.10 Mark detection function

Any data can be latched at the input timing of the mark detection signal (DI1 to DI4). Also, only data within a specific range can be latched by specifying the data detection range.

The following three modes are available for execution of mark detection.

1) Continuous detection mode

The latched data is always stored to the first of mark detection data storage area at mark detection.

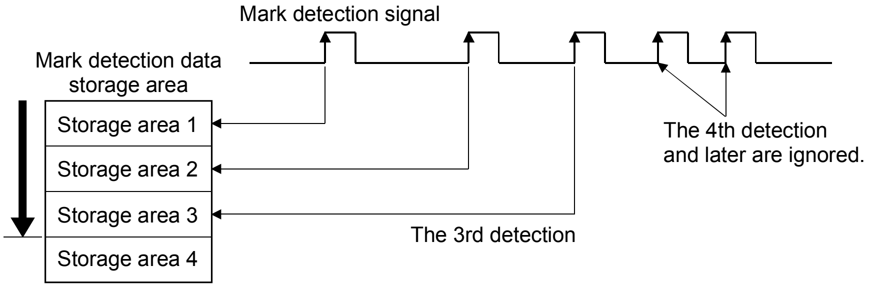


2) Specified number of detections mode

The latched data from a specified number of detections is stored.

The detected position for a specified number of detections can be collected when the mark detection signal is continuously input at high speed.

Example) Number of detections: 3

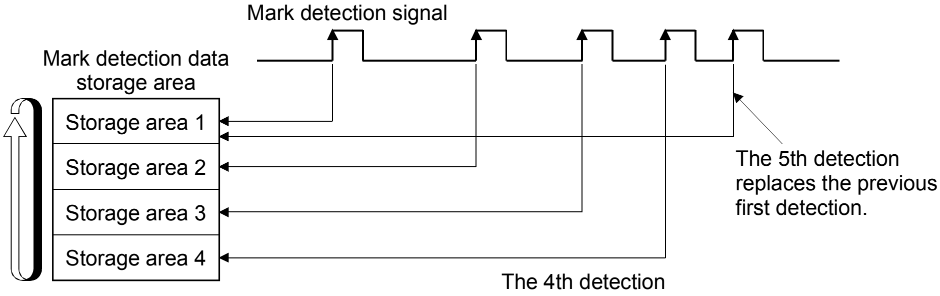


3) Ring buffer mode

The latched data is stored in a ring buffer for a specified number of detections.

The latched data is always stored at mark detection.

Example) Number of detections: 4



Item	Performance specifications		
	QD77MS2	QD77MS4	QD77MS16
Number of mark detection settings	Up to 4		Up to 16
Input signal	Axis 1 to Axis 2 External input signal (DI1 to DI2)	Axis 1 to Axis 4 External input signal (DI1 to DI4)	Axis 1 to Axis 16 External input signal (DI1 to DI4)
Input signal detection direction	Selectable for leading edge or trailing edge in logic setting of external input signal		
Input signal compensation time	Correctable within the range of -32768 to 32767μs		
Detection accuracy	10μs		
Latch data	11 types + Optional buffer memory data (2 word) (Current feed value, Machine feed value, Real current value, Servo input axis current value, Synchronous encoder axis current value, Synchronous encoder axis current value per cycle, Current value after composite main shaft gear, Current value per cycle after main shaft gear, Current value per cycle after auxiliary shaft gear, Cam axis current value per cycle, Cam axis current value per cycle (real position))		
Number of continuous latch data storage	Up to 32		
Latched data range	Settable in the range of -2147483648 to 2147483647		

The details shown below explain about the "Mark detection function".

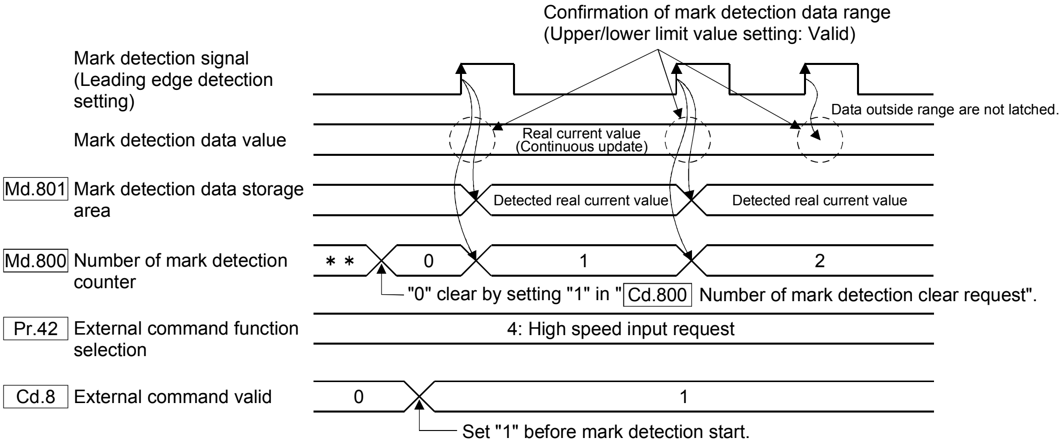
[1] Operation for mark detection function
[2] How to use mark detection function
[3] List of buffer memory
[4] Precautions

[1] Operation for mark detection function

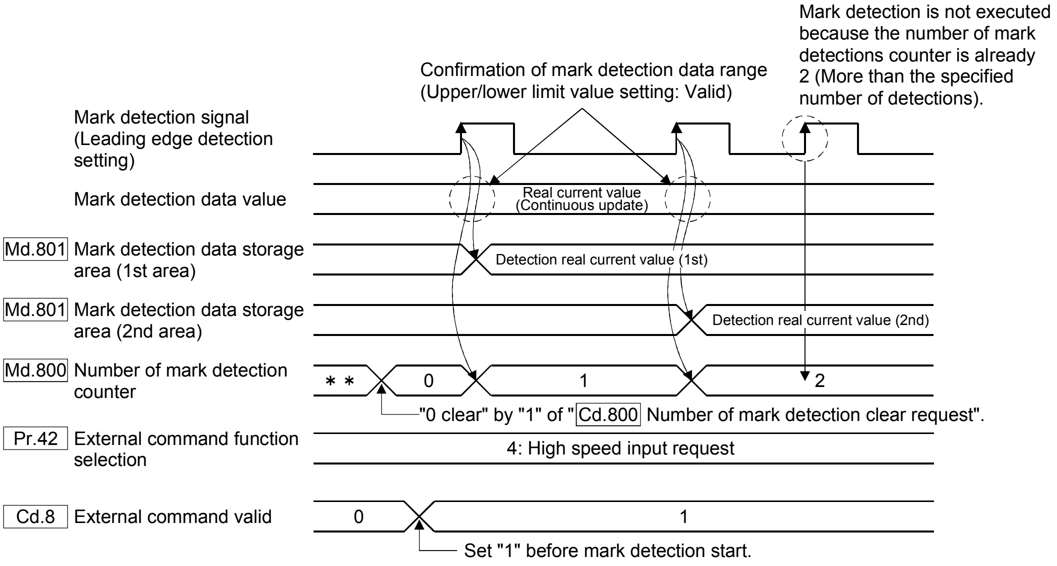
Operations done at mark detection are shown below.

- Calculations for the mark detection data are estimated at leading edge/trailing edge of the mark detection signal.
  However, when the specified number of detections mode is set, the current number of mark detection counter is checked, and then it is judged whether to execute the mark detection.
- When a mark detection data range is set, it is first confirmed whether the mark detection data is within the range or not. Data outside the range are not detected.
- The mark detection data is stored in the mark detection data storage area according to the mark detection mode, and then the number of mark detection counter is updated.

(1) Continuous detection mode



(2) Specified number of detection mode (Number of detections: 2)



[2] How to use mark detection function

The following shows an example for mark detection by the external command signal (DI2) of axis 2.
The mark detection target is axis 1 real current value, and the all range is detected in continuous detection mode.

(1) Allocate the input signal (DI2) to the external command signal of axis 2, and set the "high speed input request" for mark detection.

Storage item		Setting value	Storage details/storage value	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Pr.95	External command signal selection	2	Set "2: DI2" to the external command signal of axis 2.	—	219 (69+150n)
Pr.42	External command function selection	4	Set "4: High speed input request" as the function used in the external command signal of axis 2.	212 (62+150n)	

n: Axis No.-1

(2) Set the following mark detection setting parameters. The optional mark detection setting No. can be set.

Storage item		Setting value	Storage details/storage value	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Pr.800	Mark detection signal setting	2	Set "2: Axis 2" to the external input signal for mark detection.	54000+20k	
Pr.801	Mark detection signal compensation time	0	Set "0: (No compensation)" to the compensation time such as delay of sensor.	54001+20k	
Pr.802	Mark detection data type	2	Set "2: Real current value" to the target data for mark detection.	54002+20k	
Pr.803	Mark detection data axis No.	1	Set "1: Axis 1" to the axis No. of target data for mark detection.	54003+20k	
Pr.805	Latch data range upper limit value	0	Set "0" to the valid upper limit value for latch data at mark detection. (Mark detection for all range is executed by setting the same value as lower limit value.)	54006+20k 54007+20k	
Pr.806	Latch data range lower limit value	0	Set "0" to the valid lower limit value for latch data at mark detection. (Mark detection for all range is executed by setting the same value as upper limit value.)	54008+20k 54009+20k	
Pr.807	Mark detection mode setting	0	Set "0: Continuous detection mode" to the mark detection mode.	54010+20k	

k: Mark detection setting No.-1

(3) Turn the power supply OFF or reset of PLC CPU to validate the setting parameters.

(4) The mark detection starts by setting "1: Validates an external command." in "Cd.8 External command valid" of axis 2 with the sequence program.
Refer to "Md.800 Number of mark detection counter" or "Md.801 Mark detection data storage area" of mark detection setting No. set in this section (2) for the number of mark detections and mark detection data.

[3] List of buffer memory

The following shows the configuration of buffer memory for mark detection function.

Buffer memory address	Number of word	Item	Mark detection setting No.
54000 to 54019	20	Mark detection setting parameter Pr.800 to Pr.807	Mark detection setting 1
54020 to 54039	20		Mark detection setting 2
54040 to 54059	20		Mark detection setting 3
to	to		to
54300 to 54319	20		Mark detection setting 16
54640 to 54649	10	Mark detection control data Cd.800 , Cd.801 , Cd.802	Mark detection setting 1
54650 to 54659	10		Mark detection setting 2
54660 to 54669	10		Mark detection setting 3
to	to		to
54790 to 54799	10		Mark detection setting 16
54960 to 55039	80	Mark detection monitor data Md.800 , Md.801	Mark detection setting 1
55040 to 55119	80		Mark detection setting 2
55120 to 55199	80		Mark detection setting 3
to	to		to
56160 to 56239	80		Mark detection setting 16

- Guide to buffer memory address
  In the buffer memory address, "k" in "54002+20k", etc. indicates a value corresponding to mark detection setting No. such as the following table.

Mark detection setting No.	k	Mark detection setting No.	k	Mark detection setting No.	k	Mark detection setting No.	k
1	0	5	4	9	8	13	12
2	1	6	5	10	9	14	13
3	2	7	6	11	10	15	14
4	3	8	7	12	11	16	15

(Note): Calculate as follows for the buffer memory address corresponding to each mark detection setting No.
(Example) For mark detection setting 16
54002+20k (Pr.802 Mark detection data type)=54002+20×15=54302

(Note): The range from mark detection setting No.1 to 4 (k=0 to 3) is valid in the QD77MS2/QD77MS4.

The following shows the buffer memory used in the mark detection function.

(1) Mark detection setting parameters

Setting item		Setting details/setting value	Default value	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Pr.800	Mark detection signal setting	Set the external input signal (high speed input request) for mark detection. 0 : Invalid 1 to 2 : External command signal of axis 1 to axis 2 (QD77MS2) 1 to 4 : External command signal of axis 1 to axis 4 (QD77MS4) 1 to 16 : External command signal of axis 1 to axis 16 (QD77MS16) Fetch cycle: Power supply ON	0	54000+20k	
Pr.801	Mark detection signal compensation time	Set the compensation time such as delay of sensor. Set a positive value to compensate for a delay. -32768 to 32767[µs] Fetch cycle: Power supply ON or PLC READY signal [Y0] OFF to ON	0	54001+20k	
Pr.802	Mark detection data type	Set the target data for mark detection. 0 to 12 : Data type -1 : Optional 2 word buffer memory Fetch cycle: Power supply ON	0	54002+20k	
Pr.803	Mark detection data axis No.	Set the axis No. of target data for mark detection. 1 to 2 : Axis 1 to Axis 2 (QD77MS2) 1 to 4 : Axis 1 to Axis 4 (QD77MS4) 1 to 16 : Axis 1 to Axis 16 (QD77MS16) 801 to 804 : Synchronous encoder Axis 1 to 4 Fetch cycle: Power supply ON	0	54003+20k	
Pr.804	Mark detection data buffer memory No.	Set the optional buffer memory No. Set this parameter as an even number. 0 to 65534: Optional buffer memory Fetch cycle: Power supply ON	0	54004+20k 54005+20k	
Pr.805	Latch data range upper limit value	Set the valid upper limit value for latch data at mark detection. -2147483648 to 2147483647 Fetch cycle: Power supply ON, PLC READY signal [Y0] OFF to ON, or latch data range change request	0	54006+20k 54007+20k	
Pr.806	Latch data range lower limit value	Set the valid lower limit value for latch data at mark detection -2147483648 to 2147483647 Fetch cycle: Power supply ON, PLC READY signal [Y0] OFF to ON, or latch data range change request	0	54008+20k 54009+20k	
Pr.807	Mark detection mode setting	Set the continuous detection mode or specified number of detection mode. 0 : Continuous detection mode 1 to 32 : Specified number of detection mode (Set the number of detections.) -1 to -32 : Ring buffer mode (Set the value that made the number of buffers into negative value.) Fetch cycle: Power supply ON or PLC READY signal [Y0] OFF to ON	0	54010+20k	

k: Mark detection setting No.-1

Pr.800 Mark detection signal setting

Set the input signal for mark detection.

0 : Invalid
1 to 2 : External command signal (DI) of axis 1 to axis 2 (QD77MS2)
1 to 4 : External command signal (DI) of axis 1 to axis 4 (QD77MS4)
1 to 16 : External command signal (DI) of axis 1 to axis 16 (QD77MS16)

Set "4: High speed input request" in "Pr.42 External command function selection" and set "1: Validates an external command." in "Cd.8 External command valid".

Pr.801 Mark detection signal compensation time

Compensate the input timing of the mark detection signal.
Set this parameter to compensate such as delay of sensor input. (Set a positive value to compensate for a delay.)

Pr.802 Mark detection data type

Set the data that latched at mark detection.
The target data is latched by setting "0 to 12". Set the axis No. in "Pr.803 Mark detection data axis No.".
Optional 2 word buffer memory is latched by setting "-1". Set the buffer memory No. in "Pr.804 Mark detection data buffer memory No.".

0 : Current feed value
1 : Machine feed value
2 : Real current value
3 : Servo input axis current value
6 : Synchronous encoder axis current value
7 : Synchronous encoder axis current value per cycle
8 : Current value after composite main shaft gear
9 : Current Value per cycle after main shaft gear
10 : Current value per cycle after auxiliary shaft gear
11 : Cam axis current value per cycle
12 : Cam axis current value per cycle (Real position)
-1 : Optional 2 words buffer memory

Pr.803 Mark detection data axis No.

Set the axis No. of data that latched at mark detection.

Pr.802 Mark detection data type			Pr.803 Mark detection data axis No.		
Setting value	Data name	Unit	QD77MS2	QD77MS4	QD77MS16
0	Current feed value	10^{-1}[μm], 10^{-5}[inch], 10^{-5} [degree], [PLS]	1 to 2	1 to 4	1 to 16
1	Machine feed value				
2	Real current value				
3	Servo input axis current value				
6	Synchronous encoder axis current value	Synchronous encoder axis position unit	801 to 804		
7	Synchronous encoder axis current value per cycle				
8	Current value after composite main shaft gear	Main input axis position unit	1 to 2	1 to 4	1 to 16
9	Current value per cycle after main shaft gear	Cam axis cycle unit			
10	Current value per cycle after auxiliary shaft gear				
11	Cam axis current value per cycle				
12	Cam axis current value per cycle (Real position) (Note)				

(Note): Cam axis current value per cycle that considered delay of the servo system.

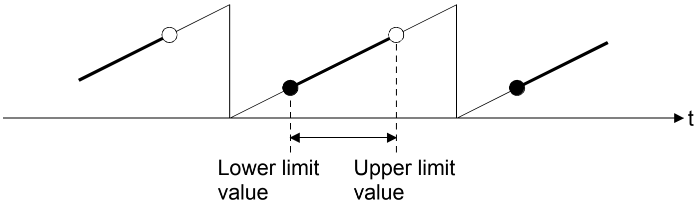
Pr.804 Mark detection data buffer memory No.

Set the No. of optional 2 words buffer memory that latched at mark detection.
Set this No. as an even No.

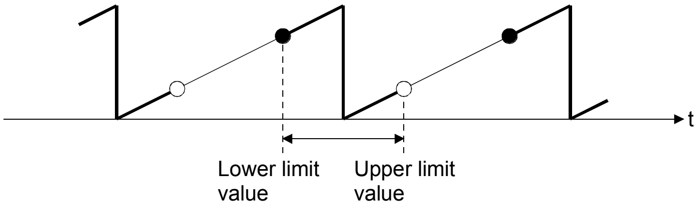
Pr.805 Latch data range upper limit value, Pr.806 Latch data range lower limit value

Set the upper limit value and lower limit value of the latch data at mark detection. When the data at mark detection is within the range, they are stored in "Md.801 Mark detection data storage area" (1 to 32) and the "Md.800 Number of mark detection counter" is incremented by 1. The mark detection processing is not executed.

- Upper limit value > Lower limit value
  The mark detection is executed when the mark detection data is "greater or equal to the lower limit value and less than the upper limit value".



- Upper limit value < Lower limit value
  The mark detection is executed when the mark detection data is "greater or equal to the lower limit value or less than the upper limit value".



- Upper limit value = Lower limit value
  The mark detection range is not checked. The mark detection is executed for all range.

Pr.807 Mark detection mode setting

Set the data storage method of mark detection.

Mode	Setting value	Operation for mark detection	Mark detection data storage method
Continuous detection mode	0	Always	The data is updated in the mark detection data storage area 1.
Specified number of detection mode	1 to 32	Number of detections (If the number of mark detection counter is the number of detections or more, the mark detection is not executed.)	The data is stored to the mark detection data storage area "n". n = (1+ Number of mark detection counter)
Ring buffer mode	-1 to -32	Always (The mark detection data storage area 1 to 32 is used as a ring buffer for the number of detections.)	

(2) Mark detection control data

Setting item		Setting details/setting value	Default value	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Cd.800	Number of mark detection clear request	Set "1" to execute "0" clear of number of mark detections. "0" is automatically set after completion by "0" clear of number of mark detections. 1: 0 clear of number of mark detections Fetch cycle: Operation cycle	0	54640+10k	
Cd.801	Mark detection invalid flag	Set this flag to invalidate mark detection temporarily. 1 : Mark detection: Invalid Others : Mark detection: Valid Fetch cycle: Operation cycle	0	54641+10k	
Cd.802	Latch data range change request	Request the processing of latch data range change. Set the following value depending on the timing of updating the change value. 1: Change in the next Operation cycle of the requested 2: Change in the next DI input of the requested "0" is automatically set after the change is completed. Fetch cycle: Operation cycle or DI input	0	54642+10k	

k: Mark detection setting No.-1

Cd.800 Number of mark detection clear request

Set "1" to execute "0" clear of "Md.800 Number of mark detection counter". "0" is automatically set after completion by "0" clear of "Md.800 Number of mark detection counter".

Cd.801 Mark detection invalid flag

Set "1" to invalidate mark detection temporarily. The mark detection signal during invalidity is ignored.

Cd.802 Latch data range change request

Request the processing of latch data range change. Set the following value depending on the timing of updating the change value.

1 : Change in the next Operation cycle of the requested
2 : Change in the next DI input of the requested

- "0" is automatically set after receiving the latch data range change request. (It indicates that the latch data range change is completed.)
- "Pr.805 Latch data range upper limit value" and "Pr.806 Latch data range lower limit value" at latch data range change request are used as the change value.
- Restrictions according to the type of latch data range change request are shown below.

Types of change request	Cd.801 Mark detection invalid flag	Changing possibility
1: Change in the next Operation cycle of the requested	1 : Mark detection: Invalid	○
	Other than 1: Mark detection: Valid	
2: Change in the next DI input of the requested	1 : Mark detection: Invalid	×
	Other than 1: Mark detection: Valid	○

○: Possible, ×: Not possible

(3) Mark detection monitor data

Storage item		Storage details/storage value	Buffer memory address	
			QD77MS2 QD77MS4	QD77MS16
Md.800	Number of mark detection counter	The number of mark detections is stored. "0" clear is executed at power supply ON. Continuous detection mode: 0 to 65535 (Ring counter) Specified number of detection mode: 0 to 32 Ring buffer mode: 0 to (number of buffers - 1) Refresh cycle: At mark detection	54960+80k	
Md.801	Mark detection data storage area 1 to Mark detection data storage area 32	The latch data at mark detection is stored. Data for up to 32 times are stored in the specified number of detection mode. Data are stored as a ring buffer for number of detections in the ring buffer mode. -2147483648 to 2147483647 Refresh cycle: At mark detection	54962+80k, 54963+80k to 55024+80k, 55025+80k	

k: Mark detection setting No.-1

Md.800 Number of mark detection counter

The counter value is incremented by 1 at mark detection. Preset "0" clear in "Cd.800 Number of mark detection clear request" to execute the mark detection in specified number of detections mode or ring buffer mode.

Md.801 Mark detection data storage area 1 to 32

The latch data at mark detection is stored. Data for up to 32 times can be stored in the specified number of detection mode or ring buffer mode.

[4] Precautions

When the data of "Pr.802 Mark detection data type" or "Pr.803 Mark detection data axis No." is selected incorrectly, the incorrect latch data is stored.
For the data of "Pr.802 Mark detection data type", set the item No. instead of specifying the buffer memory No. directly.

14.11 Optional data monitor function

This function is used to store the data (refer to following table) up to four points per axis to the buffer memory and monitor them.

The details shown below explain about the "Optional data monitor function".
[1] Data that can be set
[2] List of buffer memory

[1] Data that can be set

Data type		Unit	Used point	Monitoring possibility	
				MR-J3(W)-B	MR-J4(W)-B
1	Effective load ratio	[%]	1 word	○	○
2	Regenerative load ratio	[%]		○	○
3	Peak load ratio	[%]		○	○
4	Load inertia moment ratio	[×0.1]		○	○
5	Position loop gain 1	[rad/s]		○	○
6	Bus voltage	[V]		○	○
7	Servo motor speed	[r/min]		○	○
8	Absolute position encoder multiple revolution counter	[rev]		○	○
9	Unit power consumption	[W]		—	○
10	Instantaneous torque	[×0.1%]		—	○
12	Motor thermistor temperature	[°C]		○	○
13	Equivalent disturbance torque	[×0.1%]		—	○
14	Overload alarm margin	[×0.1%]		—	○
15	Error excessive alarm margin	[×16PLS]		—	○
16	Settling time	[ms]		—	○
17	Overshoot amount	[PLS]		—	○
20	Position feedback	[PLS]	2 words	○	○
21	Absolute position encoder single revolution position	[PLS]		○	○
22	Select droop pulses	[PLS]		○	○
23	Unit integral power consumption	[Wh]		—	○
24	Load side encoder information 1	[PLS]		○ (Note-4)	○ (Note-4), (Note-5)
25	Load side encoder information 2	—		○ (Note-4)	○ (Note-4), (Note-5)
26	Z-phase counter	[PLS]		○ (Note-3)	○ (Note-3)
27	Motor-side/load-side position deviation	[PLS]		—	○ (Note-4)
28	Motor-side/load-side speed deviation	[×0.01r/min]		—	○ (Note-4)

○: Possible, — : Not possible ("0" is stored.)

(Note-1): The motor speed that took the average every 227[ms].
Use the servo amplifiers of version compatible with the monitor of motor speed.
Always "0" if the monitor is executed for the servo amplifier which does not support this function.

(Note-2): The data set to "Droop pulse monitor setting for controller display" of "Fully closed loop function selection 3 (PE10)" is monitored.

(Note-3): It can be monitored when using the linear servo motors.

(Note-4): It can be monitored when using the fully closed control.

(Note-5): It can be monitored when using the synchronous encoder via servo amplifier.

Refer to the "Servo Amplifier Instruction Manual" for details of the data monitored.

[2] List of buffer memory

The buffer memory used in the optional data monitor function is shown below.

(1) Expansion parameter

Setting item		Setting details/setting value	Buffer memory address	
			QD77MS2 QD77MS4	QD77MS16
Pr.91	Optional data monitor: Data type setting 1	• Set the data type monitored in optional data monitor function every data type setting. (Refer to this section [1]) • When "0: No setting" is set, the stored value of "Md.109 Regenerative load ratio/Optional data monitor output 1" to "Md.112 Optional data monitor output 4" is different every data type setting 1 to 4. (Refer to (2))	100+150n	
Pr.92	Optional data monitor: Data type setting 2		101+150n	
Pr.93	Optional data monitor: Data type setting 3		102+150n	
Pr.94	Optional data monitor: Data type setting 4		103+150n	

n: Axis No.-1

POINT

(1) The monitor address of optional data monitor is registered to servo amplifier with initialized communication after power supply ON or PLC CPU reset.

(2) Set the data type of "used point: 2 words" in "Pr.91 Optional data monitor: Data type setting 1" or "Pr.93 Optional data monitor: Data type setting 3". If it is set in "Pr.92 Optional data monitor: Data type setting 2" or "Pr.94 Optional data monitor: Data type setting 4", the warning (warning code: 116) will occur with initialized communication to servo amplifier, and "0" is set in Md.109 to Md.112.

(3) Set "0" in "Pr.92 Optional data monitor: Data type setting 2" when the data type of "used point: 2 words" is set in "Pr.91 Optional data monitor: Data type setting 1", and set "0" in "Pr.94 Optional data monitor: Data type setting 4" when the data type of "used point: 2 words" is set in "Pr.93 Optional data monitor: Data type setting 3". When other than "0" is set, the warning (warning code: 116) will occur with initialized communication to servo amplifier, and "0" is set in Md.109 to Md.112.

(4) When the data type of "used point: 2 words" is set, the monitor data of low-order is "Md.109 Regenerative load ratio/Optional data monitor output 1" or "Md.111 Peak torque ratio/Optional data monitor output 3".

(5) Refer to this Section "[1] Data that can be set" for the data type that can be monitored on each servo amplifier. When the data type that cannot be monitored is set, "0" is stored to the monitor output.

(2) Axis monitor data

Storage item		Storage details/storage value	Buffer memory address	
			QD77MS2 QD77MS4	QD77MS16
Md.109	Regenerative load ratio/Optional data monitor output 1	• The content set in "Pr.91 Optional data monitor: Data type setting 1" is stored at optional data monitor data type setting. • The regenerative load ratio is stored when nothing is set.	878+100n	2478+100n
Md.110	Effective load torque/Optional data monitor output 2	• The content set in "Pr.92 Optional data monitor: Data type setting 2" is stored at optional data monitor data type setting. • The effective load ratio is stored when nothing is set.	879+100n	2479+100n
Md.111	Peak torque ratio/Optional data monitor output 3	• The content set in "Pr.93 Optional data monitor: Data type setting 3" is stored at optional data monitor data type setting. • The peak torque ratio is stored when nothing is set.	880+100n	2480+100n
Md.112	Optional data monitor output 4	• The content set in "Pr.94 Optional data monitor: Data type setting 4" is stored at optional data monitor data type setting. • "0" is stored when nothing is set.	881+100n	2481+100n

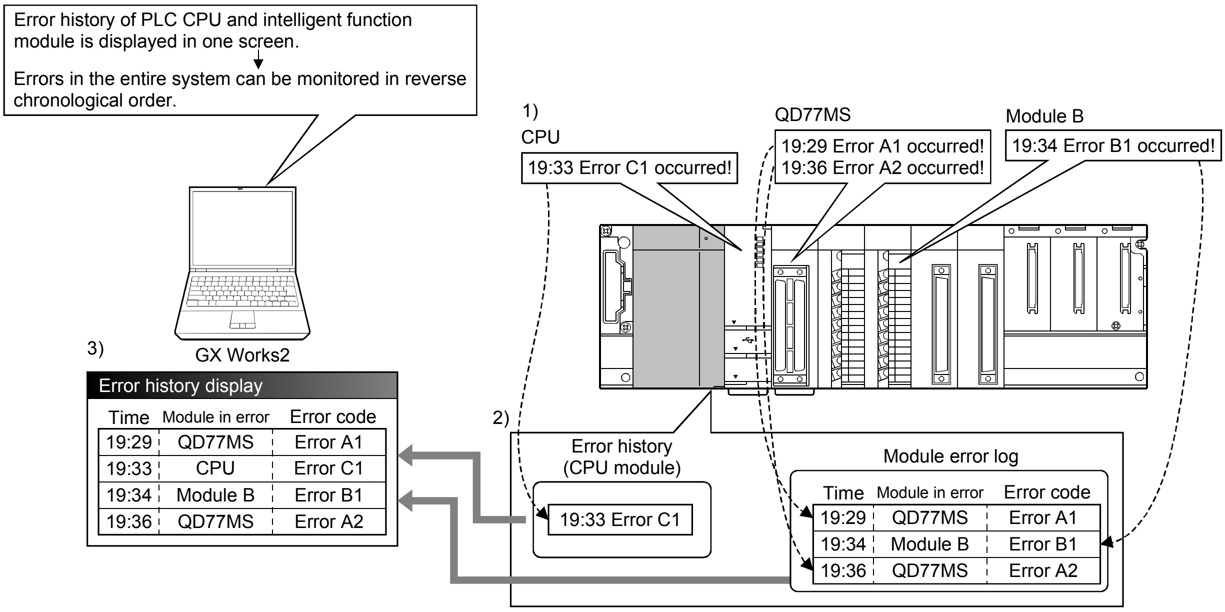
n: Axis No.-1

POINT

When the communication interrupted by the servo amplifier's power supply OFF or disconnection of communication cable with servo amplifiers during optional data monitor, "0" is stored in Md.109 to Md.112 .

14.12 Module error collection function

This function collects errors occurred in the Simple Motion module in the PLC CPU. Those errors are stored in a memory (latch area) of the PLC CPU as module error logs. The stored error logs are retained even when the PLC CPU is powered off or reset.



Error history display

Time	Module in error	Error code
19:29	QD77MS	Error A1
19:33	CPU	Error C1
19:34	Module B	Error B1
19:36	QD77MS	Error A2

Module error log

Time	Module in error	Error code
19:29	QD77MS	Error A1
19:34	Module B	Error B1
19:36	QD77MS	Error A2

<Operation>

1) The error occurs in the PLC CPU or Intelligent function module.
2) The PLC CPU collects and stores the error in each intelligent function module as "Module error history".
3) The list of error in PLC CPU or each intelligent function module error is displayed with GX Works2.

For details on the module error collection function, refer to Section 16.1 "Checking errors using GX Works2".

14.13 Connect/disconnect function of SSCNET communication

Temporarily connect/disconnect of SSCNET communication is executed during system's power supply ON.
This function is used to exchange the servo amplifiers or SSCNETⅢ cables.

The details shown below explain about the "Connect/disconnect function of SSCNET communication".
[1] Control details
[2] Precautions during control
[3] Buffer memory list
[4] Procedure to connect/disconnect
[5] Program

[1] Control details

Set the connect/disconnect request of SSCNET communication in "Cd.102 SSCNET control command", and the status for the command accept waiting or execute waiting is stored in "Md.53 SSCNET control status".
Use this buffer memory to connect the servo amplifiers disconnected by this function.
When the power supply module of head axis of SSCNET system (servo amplifier connected directly to the Simple Motion module) turns OFF/ON, this function is not necessary.

[2] Precautions during control

(1) Confirm the LED display of the servo amplifier for "AA" after completion of SSCNET communication disconnect processing. And then, turn OFF the servo amplifier's power supply.

(2) The "Md.53 SSCNET control status" only changes into the "-1: Execute waiting" even if the "Axis No.: Disconnect command of SSCNET communication" or "-10: Connect command of SSCNET communication" is set in "Cd.102 SSCNET control command". The actual processing is not executed. Set "-2: Execute command" in "Cd.102 SSCNET control command" to execute.

(3) When the "Axis No.: Disconnect command of SSCNET communication" is set to axis not connect or virtual servo amplifier, the status will not change without "Md.53 SSCNET control status" becoming "-1: Execute waiting".

(4) Operation failure may occur in some axes if the servo amplifier's power supply is turned OFF without using the disconnect function. Be sure to turn OFF the servo amplifier's power supply by the disconnect function.

(5) Execute the connect/disconnect command to the A-axis for multiple-axis servo amplifier.

(6) When using the driver communication function, it can be disconnected by executing the connect/disconnect command, however it cannot be connected again.

(7) The connect/disconnect/execute command cannot be accepted during amplifier-less operation mode. "Md.53 SSCNET control status" will be "0: Command accept waiting" (The disconnection is released.).
If being switched to the amplifier-less operation mode when "Md.53 SSCNET control status" is "1: Disconnected axis existing", the disconnected axis is automatically connected when switching to the normal operation mode again.
If being switched to the amplifier-less operation mode when "Md.53 SSCNET control status" is "-1: Execute waiting", the connect/disconnect command becomes invalid.

[3] Buffer memory list

The buffer memory for the connect/disconnect function of SSCNET communication is shown below.

(1) System control data

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Cd.102	SSCNET control command	→	The connect/disconnect command of SSCNET communication is executed. 0 : No command Axis No. (Note-1) : Disconnect command of SSCNET communication (Axis No. to be disconnected) -2 : Execute command -10 : Connect command of SSCNET communication Except above setting: Invalid (Note-1): QD77MS2 : 1 to 2, QD77MS4 : 1 to 4, QD77MS16: 1 to 16	1932	5932

(2) System monitor data

Monitor item		Monitor value	Storage details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Md.53	SSCNET control status	→	The connect/disconnect status of SSCNET communication is stored. 1: Disconnected axis existing 0: Command accept waiting -1: Execute waiting -2: Executing	1433	4233

[4] Procedure to connect/disconnect

Procedure to connect/disconnect at the exchange of servo amplifiers or SSCNETⅢ cables is shown below.

(1) Procedure to disconnect

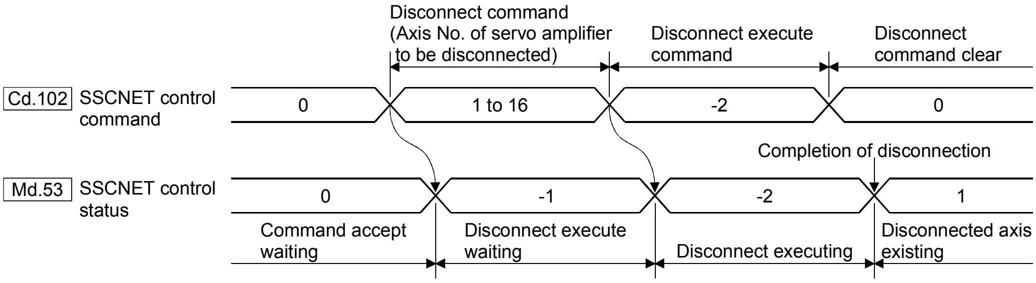
1) Set the axis No. to disconnect in "Cd.102 SSCNET control command".
(Setting value: 1 to 16)

2) Check that "-1: Execute waiting" is stored in "Md.53 SSCNET control status". (Disconnect execute waiting)

3) Set "-2: Execute command" in "Cd.102 SSCNET control command".

4) Check that "1: Disconnected axis existing" is stored in "Md.53 SSCNET control status". (Completion of disconnection. "20: Servo amplifier has not been connected" is stored in "Md.26 Axis operation status".)

5) Turn OFF the servo amplifier's power supply after checking the LED display "AA" of servo amplifier to be disconnected.



(2) Procedure to connect

1) Turn ON the servo amplifier's power supply.

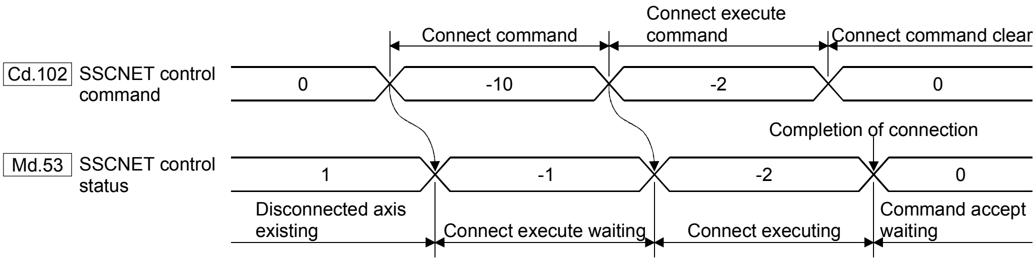
2) Set "-10: Connect command of SSCNET communication" in "Cd.102 SSCNET control command".

3) Check that "-1: Execute waiting" is set in "Md.53 SSCNET control status". (Connect execute waiting)

4) Set "-2: Execute command" in "Cd.102 SSCNET control command".

5) Check that "0: Command accept waiting" is set in "Md.53 SSCNET control status". (Completion of connection)

6) Resume operation of servo amplifier after checking "0: Standby" in "Md.26 Axis operation status" of the connected axis.



POINT

When "-1: Execute waiting" is set in "Md.53 SSCNET control status", the command of execute waiting can be canceled if "0: No command" is set in "Cd.102 SSCNET control command".

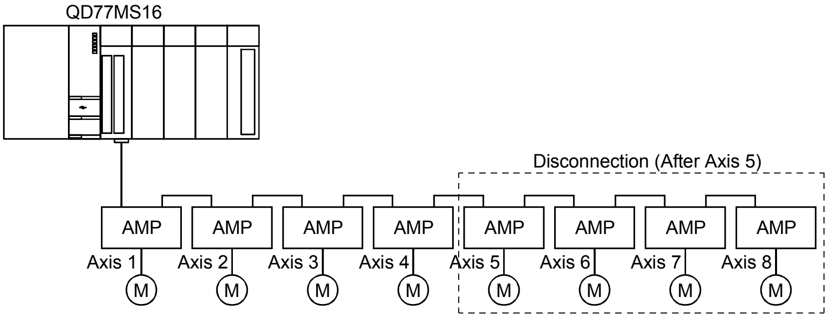
[5] Program

The sequence program example to connect/disconnect the servo amplifiers after Axis 5 connected to the QD77MS16 is shown next page.

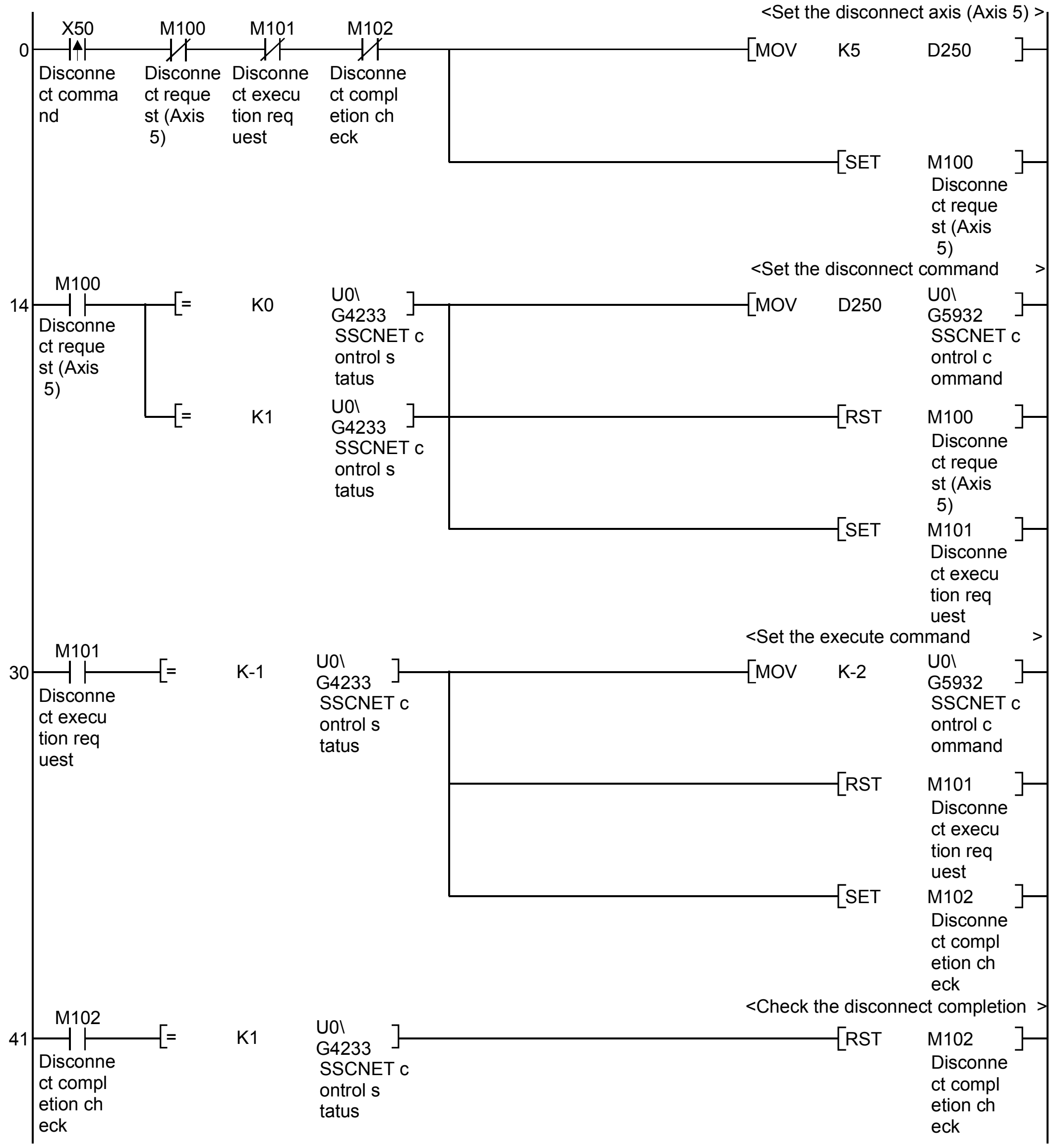
Disconnect procedure : Turn OFF the servo amplifier's power supply after checking the LED display "AA" of servo amplifier by turning X50 from OFF to ON.

Connect procedure : Resume operation of servo amplifier after checking the "Md.26 Axis operation status" of the connected servo amplifier by turning X51 from OFF to ON.

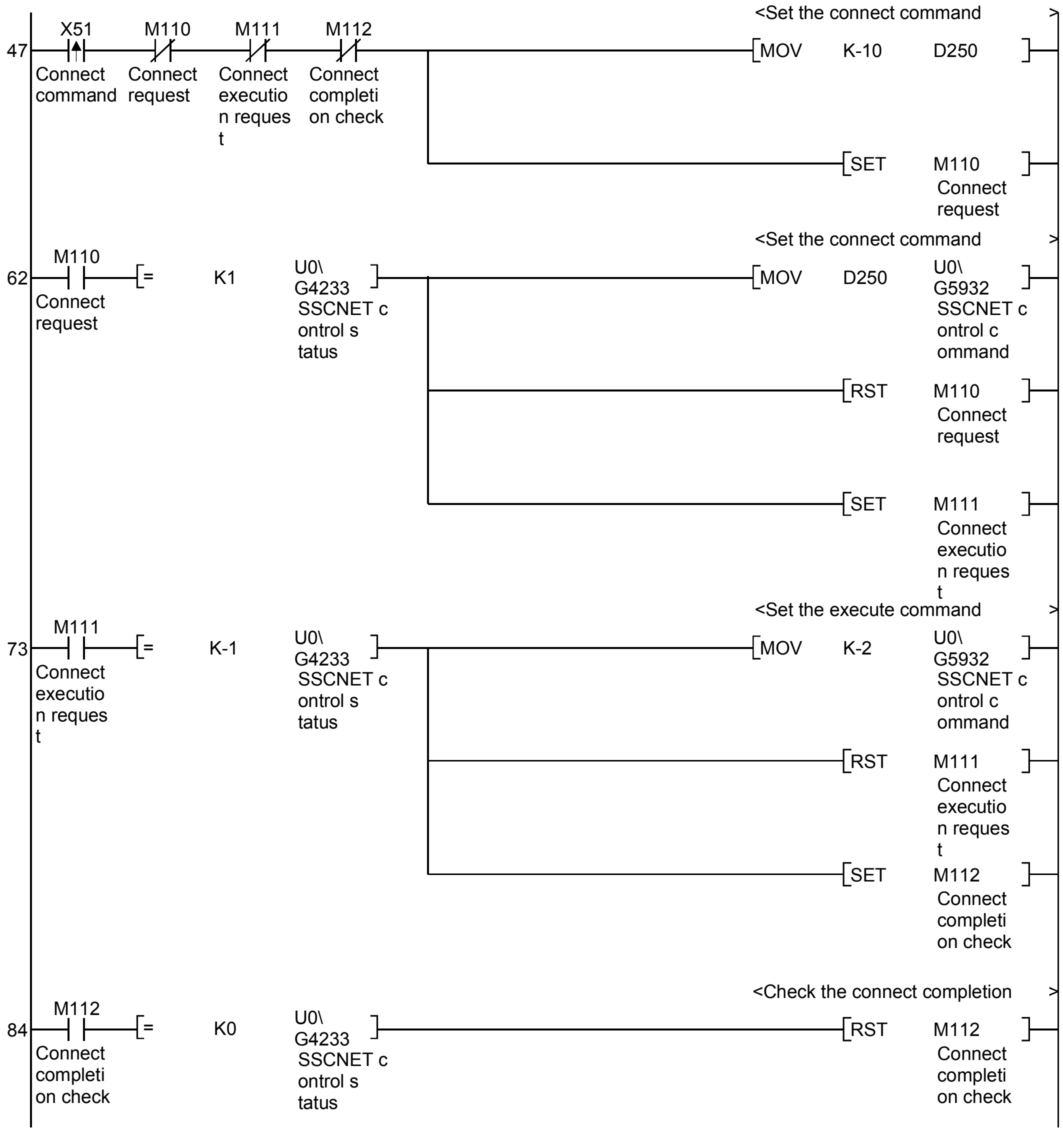
System configuration



(1) Disconnect operation



(2) Connect operation



14.14 QD75MH initial value setting function

The "QD75MH initial value setting function" is used to set the factory-set initial value of QD75MH in the setting data set in the QD77MS buffer memory/internal memory and flash ROM/internal memory (nonvolatile).
Because some initial values of parameter between QD77MS and QD75MH are different, when switching to QD77MS from QD75MH without using Simple Motion Module Setting Tool of GX Works2, set the parameter value to factory-set initial value of QD75MH by this function before using. (This function does not need to be executed in case the parameter setting of QD77MS is executed using the Simple Motion Module Setting Tool of GX Works2.)

The details shown below explain about the "QD75MH initial value setting function".
[1] QD75MH initial value setting means
[2] Control details
[3] Precautions during control
[4] QD75MH initial value setting method

[1] QD75MH initial value setting means

- Initialization is executed with a sequence program.

[2] Control details

The following table shows the data that the initial value is set by the "QD75MH initial value setting function".
(The data set are "buffer memory/internal memory" and "flash ROM/internal memory (nonvolatile)" setting data.)

Setting data
Basic parameters (Pr.1 to Pr.10)
Detailed parameters (Pr.11 to Pr.42, Pr.80 to Pr.90, Pr.95)
OPR basic parameters (Pr.43 to Pr.48)
OPR detailed parameters (Pr.50 to Pr.57)
Expansion parameters (Pr.91 to Pr.94, Pr.96, Pr.97, Pr.114)
Servo parameters (Pr.100, PA, PB, PC, PD, PE, PS, PF, Po, PL)
Positioning data (No.1 to 600)
Block start data (No.7000 to 7004)

Refer to the "Type QD75MH Positioning Module Use’s Manual (Details)" for set initial value. However, "0" is set in the data of QD77MS only.

[3] Precautions during control

(1) Parameter initialization is only executed when the positioning control is not carried out (when the PLC READY signal [Y0] is OFF).
A warning "In PLC READY (warning code: 111)" will occur if executed when the PLC READY signal [Y0] is ON.

(2) Writing to the flash ROM is up to 100,000 times. If writing to the flash ROM exceeds 100,000 times, the writing may become impossible, and "Flash ROM write error (error code: 801)" will occur.

(3) A "PLC CPU reset" or "PLC CPU power restart" must be carried out after the parameters are initialized.

(4) When using the QD77MS16, the setting value is set to "1" even though the initial value setting is executed by this function because the initial value of QD75MH "0" is out of the setting range in "Pr.80 External input signal selection".

Important

Parameter initialization takes about 10 seconds. (Up to 30 seconds are sometimes required.)
Do not turn the power ON/OFF or reset the PLC CPU during parameter initialization. If the power is turned OFF or the PLC CPU module is reset to forcibly end the process, the data backed up in the flash ROM/internal memory (nonvolatile) will be lost.

[4] QD75MH initial value setting method

(1) QD75MH initial value setting is carried out by the writing of the data shown in the table below to the buffer memory using the TO command/intelligent function device.
The initialization of the parameter is executed at the time point the data is written to the buffer memory.

Setting item		Setting value	Setting details	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Cd.47	QD75MH initial value setting request	1	Set "1" (Requests QD75MH initial value setting).	1909	5909

*: Refer to Section 5.7.1 "System control data" for details on the setting details.

When the initialization is complete, "0" will be set in "Cd.47 QD75MH initial value setting request" automatically.

MEMO

Chapter 15 Dedicated Instructions

The dedicated instructions of Simple Motion module are explained in this chapter.

These instructions are used to facilitate the programming for the use of the functions of the intelligent function module.
Using the dedicated instructions, the programming can be carried out without being aware of the buffer memory address of Simple Motion module and interlock signal.

15.1 List of dedicated instructions

The dedicated instructions explained in this Chapter are listed in Table 15.1.

Table 15.1 List of dedicated instructions

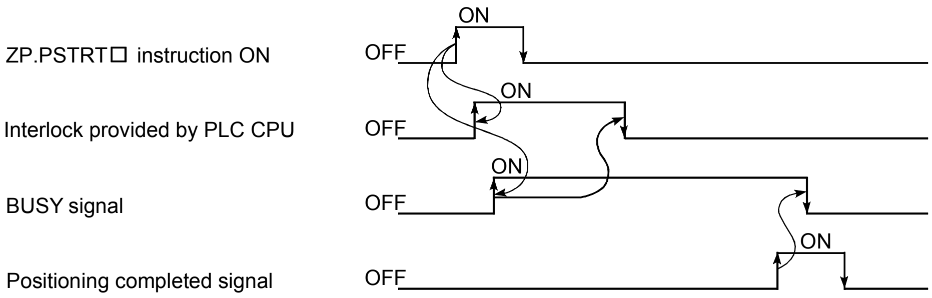
Application	Dedicated instruction	Outline of functions	Reference
Positioning start	ZP.PSTRT1 ZP.PSTRT2 ZP.PSTRT3 ZP.PSTRT4	This function starts the positioning control of the designated axis of the Simple Motion module.	Section 15.3
Teaching	ZP.TEACH1 ZP.TEACH2 ZP.TEACH3 ZP.TEACH4	This function carries out teaching the designated axis of the Simple Motion module.	Section 15.4
Writing to flash ROM	ZP.PFWRT	This function writes the buffer memory parameters, positioning data and block start data to the flash ROM.	Section 15.5
Parameter initialization	ZP.PINIT	This function initializes the buffer memory and flash ROM setting data to the factory-set data (initial values of the Simple Motion module).	Section 15.6

POINT

The dedicated instructions of QD77MS16 can be used for only axis 1 to 4. They cannot be used for axis 5 to 16. If the ZP.PSTRT5 to ZP.PSTRT16 or ZP.TEACH5 to ZP.TEACH16 is executed, "Program code error" (error code: 4002) for PLC CPU and "PLC CPU error" (error code: 803) for QD77MS16 will occur and positioning cannot be started.
Refer to "QCPU User's Manual (Hardware Design, Maintenance and Inspection) for error of PLC CPU".

15.2 Interlock during dedicated instruction is executed

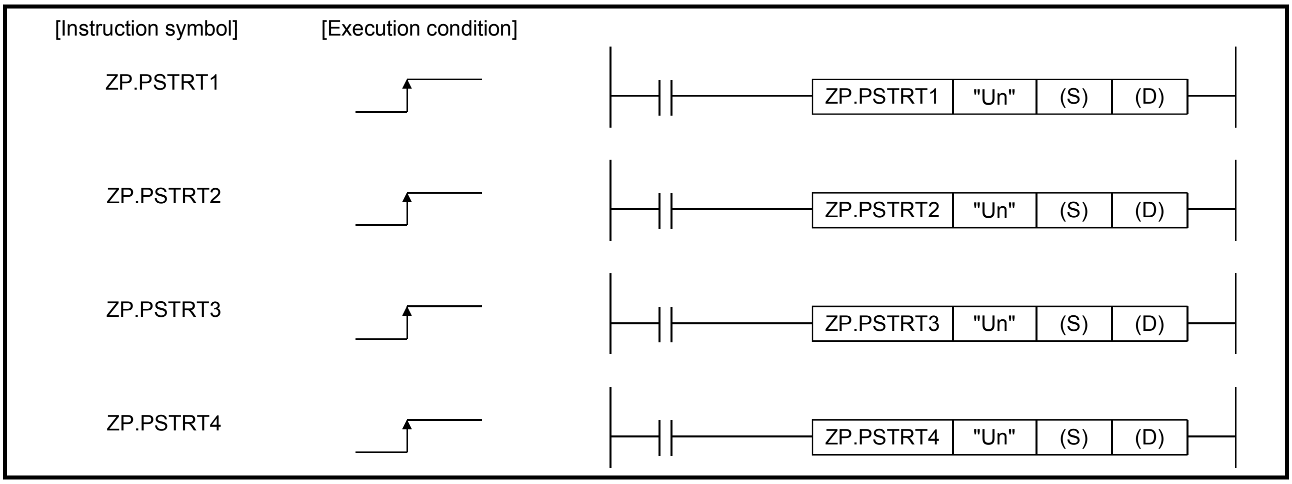
The positioning start instruction (ZP.PSTRT□) and teaching instruction (ZP.TEACH□) cannot be executed simultaneously in each axis. If they are executed at the same time, the second and later instructions are ignored by an internal interlock (no error will occur).
The timing of the positioning start instruction (ZP.PSTRT□) is as shown below.



15.3 ZP.PSTRT1, ZP.PSTRT2, ZP.PSTRT3, ZP.PSTRT4

These dedicated instructions are used to start the positioning of the designated axis.

Setting data	Usable device								
	Internal device		File register	Link direct device J□\□		Intelligent function module U□\G□	Index register Zn	Constant	Others
	Bit	Word		Bit	Word			K, H	
(S)	–	○		–				–	–
(D)	○	○	–	–				–	–



Note) When ZP.PSTRT1, ZP.PSTRT2, ZP.PSTRT3, and ZP.PSTRT4 are common to each other, they are designated as "ZP.PSTRT□".

[Setting data]

Setting data	Setting details	Setting side (Note-1)	Data type
"Un"	Head I/O number of Simple Motion module (00 to FE: High-order two digits of I/O number expressed in three digits)	User	BIN 16 bits
(S)	Head number of a device in which control data is stored	–	Device name
(D)	Head number of a bit device which turns ON the operation by one scan at the time of completion of the instruction. If the instruction is completed abnormally, ((D) + 1) will also be turned ON.	System	Bit

Note) The file register of each of the local device and the program cannot be used as a device for setting data.

(Note-1): The data on the setting side is as follows.

- User : Data before the execution of dedicated instructions is stored by user.
- System: Data after the execution of dedicated instruction is stored by PLC CPU.

[Control data]

Device	Item	Setting data	Setting range	Setting side (Note-1)
(S)+0	System area	–	–	–
(S)+1	Complete status	The state at the time of completion is stored. • 0 : Normal completion • Other than 0: Abnormal completion (error code) (Note-2)	–	System
(S)+2	Start No.	The following data Nos. to be started by the ZP.PSTRT□ instruction are designated. • Positioning data No. : 1 to 600 • Block start : 7000 to 7004 • Machine OPR : 9001 • Fast OPR : 9002 • Current value changing : 9003 • Multiple axes simultaneous start : 9004	1 to 600 7000 to 7004 9001 to 9004	User

(Note-1): The data on the setting side is as follows.
- User : Data before the execution of dedicated instructions is stored by user.
- System: Data after the execution of dedicated instruction is stored by PLC CPU.

(Note-2): Refer to Section 16.5 for error codes at abnormal completion.

[Functions]

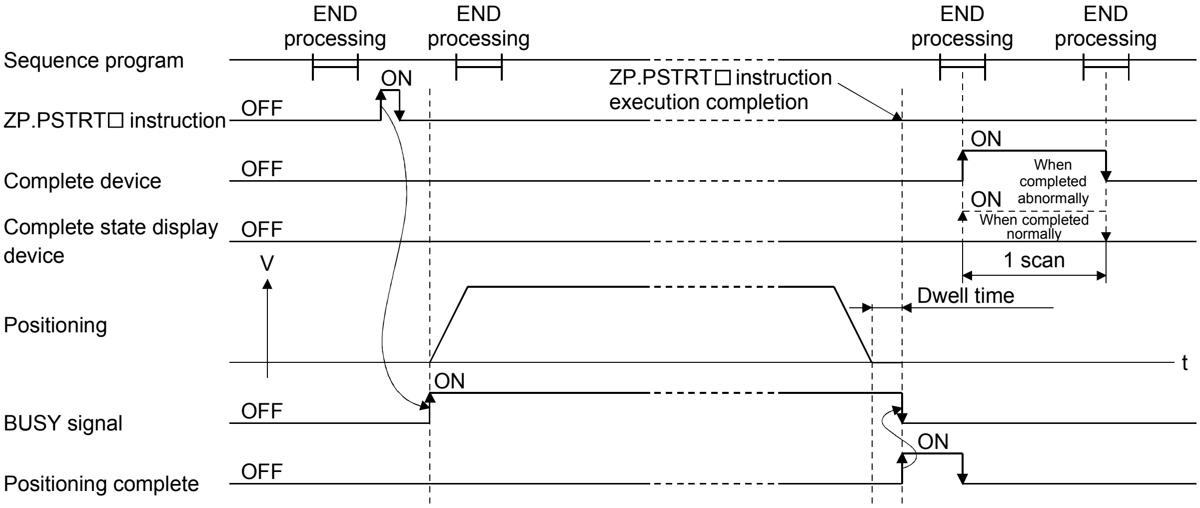
(1) The positioning start of the axes to be processed (See below) is carried out.
- ZP.PSTRT1: Axis 1
- ZP.PSTRT2: Axis 2
- ZP.PSTRT3: Axis 3
- ZP.PSTRT4: Axis 4

(2) The block start, OPR start, current value changing, and multiple axes simultaneous start can be carried out by the setting of "start number" 7000 to 7004/9001 to 9004 in ((S)+2).

(3) The ZP.PSTRT□ instruction completion can be confirmed using the complete devices ((D)+0) and ((D)+1).

(a) Complete device ((D)+0)
This device is turned ON by the END processing of the scan for which ZP.PSTRT□ instruction is completed, and turned OFF by the next END processing.

(b) Complete state display device ((D)+1)
This device is turned ON and OFF according to the state in which ZP.PSTRT□ instruction is completed.
- When completed normally :Kept unchanged at OFF.
- When completed abnormally: This device is turned ON by the END processing of the scan for which ZP.PSTRT□ instruction is completed, and turned OFF by the next END processing. (Same ON/OFF operation as the complete device.)



[Errors]

(1) When a ZP.PSTRT☐ instruction is completed abnormally, the error complete signal ((D)+1) is turned ON, and the error code is stored in the complete status ((S)+1).
Check and take a measure against the error referring to Section 16.5 "List of errors".

[Precautions]

(1) If the positioning is started by the ZP.PSTRT☐ instruction, the start complete signals turn ON. However, since the ON time is short, the ON status may not to be detected in the program.
Confirm the operation during the positioning control using the ZP.PSTRT☐ start instruction and BUSY signals.

(2) If the stop instruction is input before completion of the positioning which has been started by the ZP.PSTRT☐ instruction, the completion device (D) turns the 1-scan ON to complete execution of the ZP.PSTRT☐ instruction.

(3) The following dedicated instructions cannot be executed simultaneously for the same axis.
(The instructions can be executed simultaneously for different axes.)
- Positioning start instructions (ZP.PSTRT1 to ZP.PSTRT4)
- Teaching instructions (ZP.TEACH1 to ZP.TEACH4)

(4) The ZP.PSTRT☐ instruction can only be executed when the READY signal [X0] is turned ON.
Even if the ZP.PSTRT☐ instruction execution request is given when the READY signal [X0] is turned OFF, the ZP.PSTRT☐ instruction will not be executed. (Not processed.)
Before executing the ZP.PSTRT☐ instruction, turn ON the PLC READY signal [Y0], and turn ON the READY signal [X0].

(5) If the ZP.PSTRT☐ instruction is executed in the following cases, an error "Dedicated instruction error" (error code: 804) will occur and positioning cannot be started.

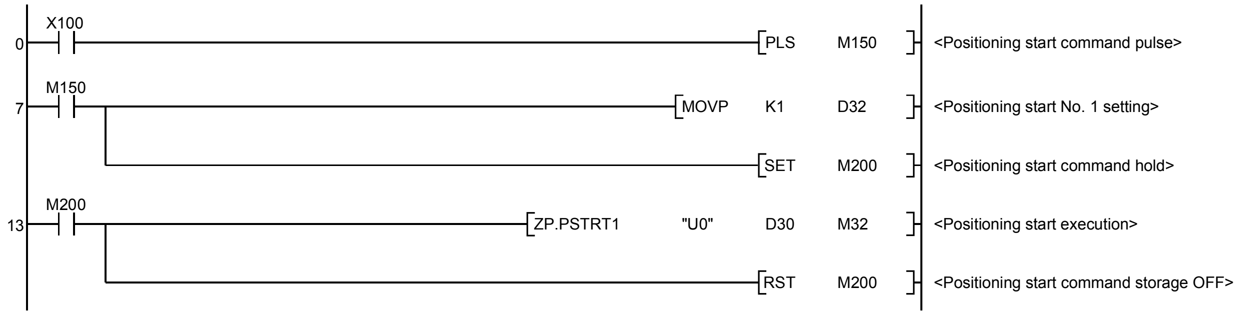
- Any value other than 1 to 600, 7000 to 7004, and 9001 to 9004 is set to "Starting number" (device: (S)+2) of the control data.

(6) When the multiple axes simultaneous start is executed by ZP.PSTRT☐ instruction, the completion device (D) will turn ON when the positioning of the axes executed by ZP.PSTRT☐ instructions (when the instructions is ZP.PSTRT1, the axis will be 1.) is completed.

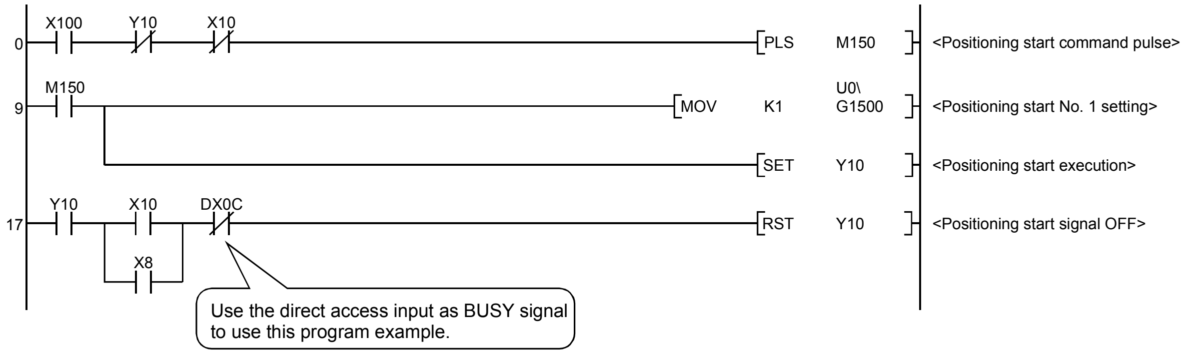
[Program examples]

- The following program executes the positioning start of positioning data No. 1 when X100 turns ON in QD77MS4.
  Use D30 to D32 as the control data devices of positioning data No. 1, and M32 and M33 as the completion devices.

(1) Positioning start program



(2) Positioning start program (when dedicated instruction is not used)

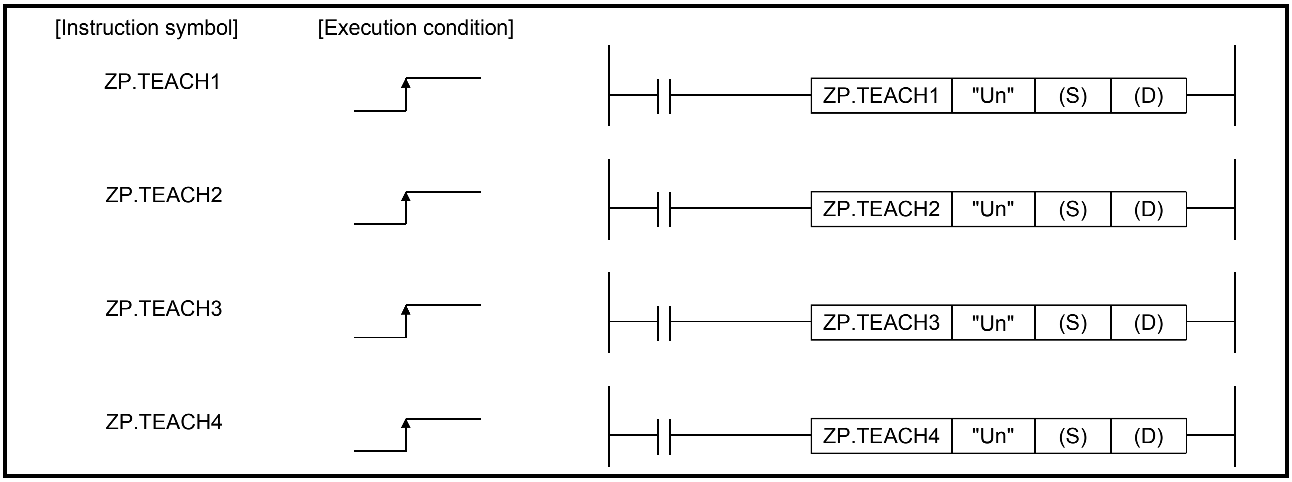


Use the direct access input as BUSY signal to use this program example.

15.4 ZP.TEACH1, ZP.TEACH2, ZP.TEACH3, ZP.TEACH4

These dedicated instructions are used to teach the designated axis.

Setting data	Usable device								
	Internal device		File register	Link direct device J□\□		Intelligent function module U□\G□	Index register Zn	Constant	Others
	Bit	Word		Bit	Word			K, H	
(S)	–	○		–				–	–
(D)	○	○	–	–				–	–



Note) When ZP.TEACH1, ZP.TEACH2, ZP.TEACH3, and ZP.TEACH4 are common to each other, they are designated as "ZP.TEACH□".

[Setting data]

Setting data	Setting details	Setting side (Note-1)	Data type
"Un"	Head I/O number of Simple Motion module (00 to FE: High-order two digits of I/O number expressed in three digits)	User	BIN 16 bits
(S)	Head number of a device in which control data is stored	–	Device name
(D)	Head number of a bit device which turns ON the operation by one scan at the time of completion of the instruction. If the instruction is completed abnormally, ((D) + 1) will also be turned ON.	System	Bit

Note) The file register of each of the local device and the program cannot be used as a device for setting data.

(Note-1): The data on the setting side is as follows.

- User : Data before the execution of dedicated instructions is stored by user.
- System: Data after the execution of dedicated instruction is stored by PLC CPU.

[Control data]

Device	Item	Setting data	Setting range	Setting side (Note-1)
(S)+0	System area	–	–	–
(S)+1	Complete status	The state at the time of completion is stored. 0 : Normal completion Other than 0 : Abnormal completion (error code) (Note-2)	–	System
(S)+2	Teaching data selection	The address (positioning address/arc address) to which the current feed value is written is set. 0: Current feed value is written to positioning address. 1: Current feed value is written to arc address.	0, 1	User
(S)+3	Positioning data No.	The positioning data No. for which teaching is carried out is set.	1 to 600	User

(Note-1): The data on the setting side is as follows.

- User : Data before the execution of dedicated instructions is stored by user.
- System: Data after the execution of dedicated instruction is stored by PLC CPU.

(Note-2): Refer to Section 16.5 for error codes at abnormal completion.

[Functions]

(1) The "current feed value" of the axes to be set (See below) is set in the positioning address or arc address.
The positioning data other than the positioning addresses and arc addresses are set by GX Works2 or using a sequence program.

- ZP.TEACH1: Axis 1
- ZP.TEACH2: Axis 2
- ZP.TEACH3: Axis 3
- ZP.TEACH4: Axis 4

(2) Teaching can be carried out for the positioning data No. 1 to 600.

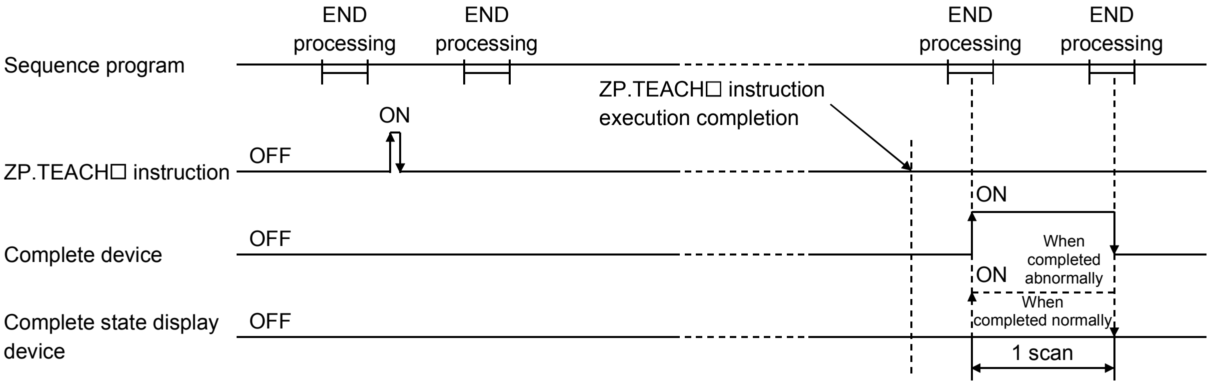
(3) The movement of the machine to the address (position) set in the positioning address/arc address of the positioning data is carried out by the JOG operation, inching operation, or manual pulse generator operation.

(4) The ZP.TEACH□ instruction completion can be confirmed using the complete devices ((D)+0) and ((D)+1).

(a) Complete device ((D)+0)
This device is turned ON by the END processing of the scan for which ZP.TEACH□ instruction is completed, and turned OFF by the next END processing.

(b) Complete state display device ((D)+1)
This device is turned ON and OFF according to the state in which ZP.TEACH□ instruction is completed.

- When completed normally :Kept unchanged at OFF.
- When completed abnormally: This device is turned ON by the END processing of the scan for which ZP.TEACH□ instruction is completed, and turned OFF by the next END processing. (Same ON/OFF operation as the complete device.)



[Errors]

(1) When a ZP.TEACH□ instruction is completed abnormally, the error complete signal ((D)+1) is turned ON, and the error code is stored in the complete status (S)+1.
Check and take a measure against the error referring to Section 16.5 "List of errors".

[Precautions]

(1) The following dedicated instructions cannot be executed simultaneously for the same axis.
(The instructions can be executed simultaneously for different axes.)
- Positioning start instructions (ZP.PSTRT1 to ZP.PSTRT4)
- Teaching instructions (ZP.TEACH1 to ZP.TEACH4)

(2) The ZP.TEACH□ instruction can only be executed when the BUSY signal is turned OFF.
When the BUSY signal is turned ON, the ZP.TEACH□ instruction will not be executed. (Not processed.)
Before executing the ZP.TEACH□ instruction, make sure that the BUSY signal for the axis to be processed is turned OFF.

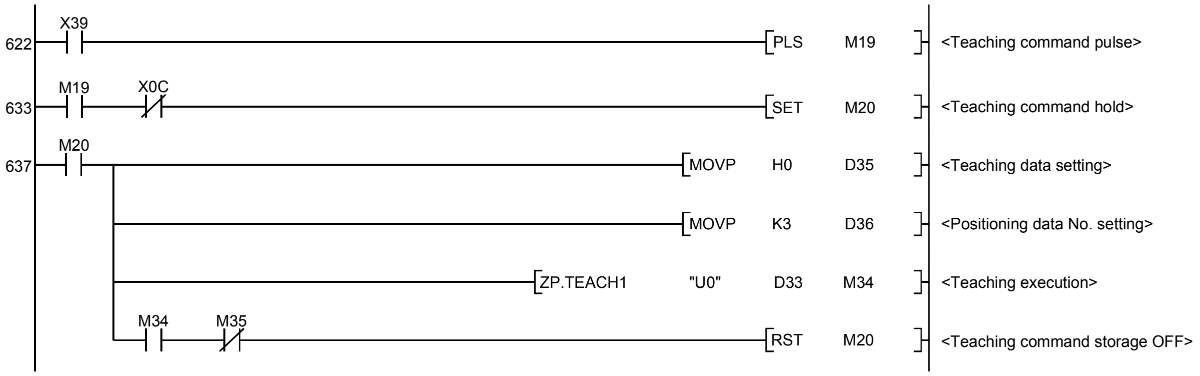
(3) If the ZP.TEACH□ instruction is executed in any of the following cases, an error "Dedicated instruction error" (error code: 804) will occur and teaching cannot be performed.
- Any value other than 0 and 1 is set to "Teaching selection" (device: (S)+2) of the control data.
- Any value other than 1 to 600 is set to "Positioning No." (device: (S)+3) of the control data.

[Program example]

Program to execute the teaching of the positioning data No. 3 of the axis 1 when X39 is turned ON in QD77MS4.

(1) Teaching program

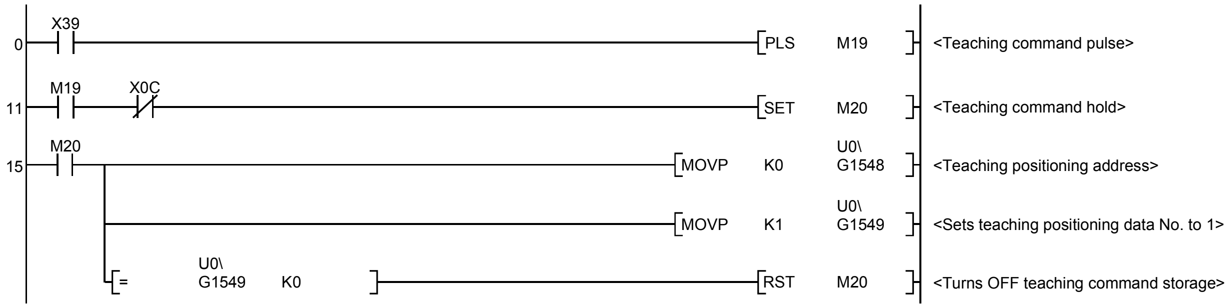
Positioned manually to target position.



```
622  X39                    [PLS  M19]                     <Teaching command pulse>
633  M19  X0C(NC)           [SET  M20]                     <Teaching command hold>
637  M20                    [MOVP  H0  D35]                <Teaching data setting>
                            [MOVP  K3  D36]                <Positioning data No. setting>
                            [ZP.TEACH1  "U0"  D33  M34]    <Teaching execution>
     M34  M35(NC)           [RST  M20]                     <Teaching command storage OFF>
```

(2) Teaching program (when dedicated instruction is not used)

Positioned manually to target position.



```
0    X39                    [PLS  M19]                     <Teaching command pulse>
11   M19  X0C(NC)           [SET  M20]                     <Teaching command hold>
15   M20                    [MOVP  K0  U0\G1548]           <Teaching positioning address>
                            [MOVP  K1  U0\G1549]           <Sets teaching positioning data No. to 1>
     [=  U0\G1549  K0]      [RST  M20]                     <Turns OFF teaching command storage>
```

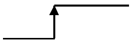
15.5 ZP.PFWRT

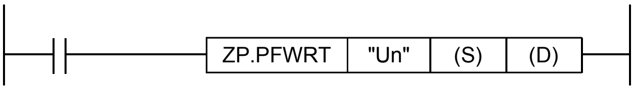
These dedicated instructions are used to write the parameters, positioning data, and block start data of Simple Motion module to the flash ROM.

Setting data	Usable device								
	Internal device		File register	Link direct device J□\□		Intelligent function module U□\G□	Index register Zn	Constant	Others
	Bit	Word		Bit	Word			K, H	
(S)	–	○		–				–	–
(D)	○	○	–	–				–	–

[Instruction symbol] [Execution condition]

ZP.PFWRT





[Setting data]

Setting data	Setting details	Setting side (Note-1)	Data type
"Un"	Head I/O number of Simple Motion module (00 to FE: High-order two digits of I/O number expressed in three digits)	User	BIN 16 bits
(S)	Head number of a device in which control data is stored	–	Device name
(D)	Head number of a bit device which turns ON the operation by one scan at the time of completion of the instruction. If the instruction is completed abnormally, ((D) + 1) will also be turned ON.	System	Bit

Note) The file register of each of the local device and the program cannot be used as a device for setting data.

(Note-1): The data on the setting side is as follows.

- User : Data before the execution of dedicated instructions is stored by user.
- System: Data after the execution of dedicated instruction is stored by PLC CPU.

[Control data]

Device	Item	Setting data	Setting Range	Setting side (Note-1)
(S)+0	System area	–	–	–
(S)+1	Complete status	The state at the time of completion is stored. 0 : Normal completion Other than 0 : Abnormal completion (error code) (Note-2)	–	System

(Note-1): The data on the setting side is as follows.

- User : Data before the execution of dedicated instructions is stored by user.
- System: Data after the execution of dedicated instruction is stored by PLC CPU.

(Note-2): Refer to Section 16.5 for error codes at abnormal completion.

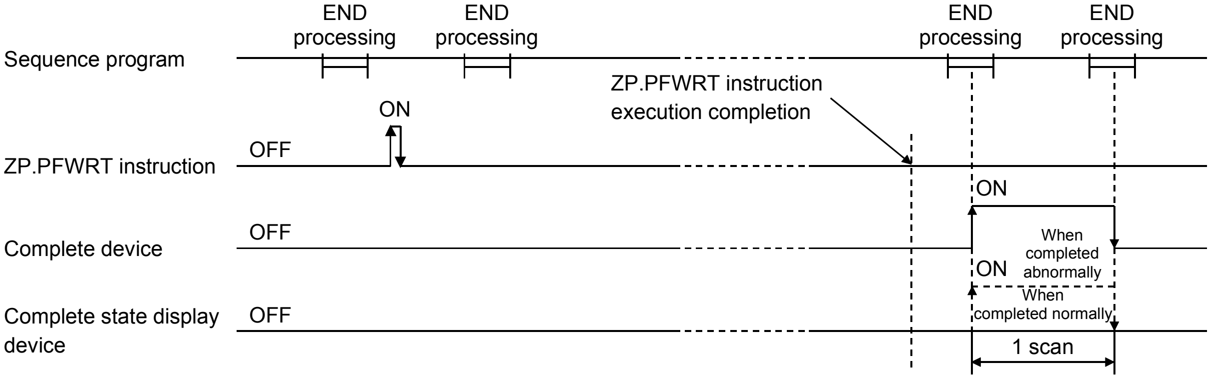
[Functions]

(1) The ZP.PFWRT instruction completion can be confirmed using the complete devices ((D)+0) and ((D)+1).

(a) Complete device ((D)+0)
This device is turned ON by the END processing of the scan for which ZP.PFWRT instruction is completed, and turned OFF by the next END processing.

(b) Complete state display device ((D)+1)
This device is turned ON and OFF according to the state in which ZP.PFWRT instruction is completed.

- When completed normally : Kept unchanged at OFF.
- When completed abnormally : This device is turned ON by the END processing of the scan for which ZP.PFWRT instruction is completed, and turned OFF by the next END processing. (Same ON/OFF operation as the complete device.)



[Errors]

(1) When a dedicated instruction is completed abnormally, the error complete signal ((D)+1) is turned ON, and the error code is stored in the complete status ((S)+1). Check and take measures against the error referring to Section 16.5 "List of errors".

[Precautions]

(1) Do not turn ON the power and reset the PLC CPU while parameters, positioning data and block start data are written to the flash ROM using the ZP.PFWRT instruction.
A parameter error will occur or normal positioning start will become impossible because the parameters, positioning data and block start data are not written normally to the flash ROM.
If this occurs, restart the operation by the method shown below.
- For GX Works2, write the parameters, positioning data and block start data again to the flash ROM.
- For a sequence program, write the parameters, positioning data and block start data to the Simple Motion module after initializing the parameters (ZP.PINIT instruction execution and others).
  Then execute the ZP.PFWRT instruction again.

(2) Writing to the flash ROM is up to 100,000 times.
If writing to the flash ROM exceeds 100,000 times, the writing to the flash ROM will become impossible.

(3) After the power ON and PLC CPU reset operation, writing to the flash ROM using a sequence program is limited to up to 25 times. (Not limited to up to 25 times when writing to the flash ROM is carried out by GX Works2.)
If the 26th or more writing is requested after the power ON/PLC CPU reset operation, a flash ROM exceed writing error (error code: 805) will occur, and the writing will be disabled. If a flash ROM write error occurs by one writing to the flash ROM, check and correct the flash ROM writing program. Then reset the error or turn ON the power and reset the PLC CPU again.

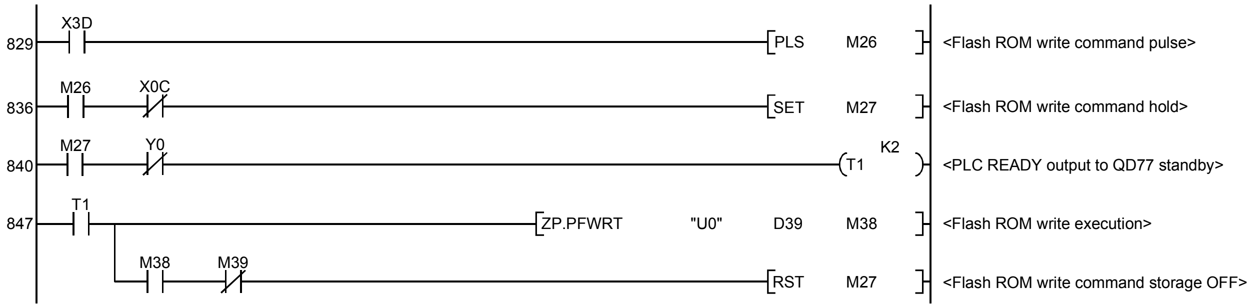
(4) The ZP.PFWRT instruction can only be executed when the READY signal [X0] is turned OFF.
When the READY signal [X0] is turned ON, the ZP.PFWRT instruction cannot be executed.
Before executing the ZP.PFWRT instruction, turn OFF the PLC READY signal [Y0] and then turn OFF the READY signal [X0].

(5) When the PLC READY signal [Y0] is turned ON, an error (error code: 1205) occurs, "Rotation direction selection/travel direction selection (PA14)" is changed by sequence program or the GX Works2 after the servo parameter is transmitted to servo amplifier (LED of the servo amplifier is indicated b☐, C☐, or d☐).
When "Rotation direction selection/travel direction selection (PA14)" is changed, transmit the servo parameter to servo amplifier.

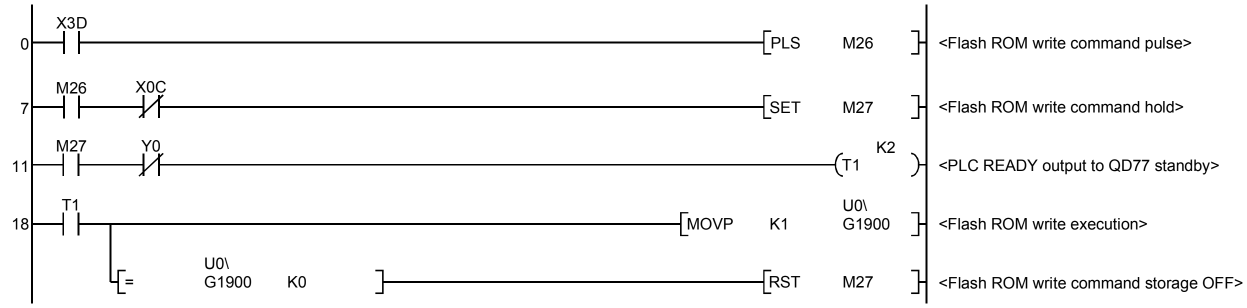
[Program example]

Program used to write the parameters and positioning data stored in the buffer memory to the flash ROM when X3D is turned ON in QD77MS4.

(1) Flash ROM write program



(2) Flash ROM write program (when dedicated instruction is not used)



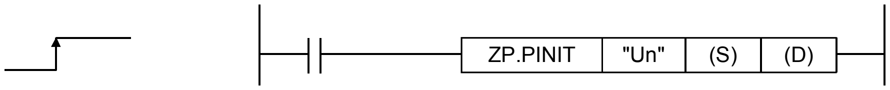
15.6 ZP.PINIT

This dedicated instruction is used to initialize the setting data of the Simple Motion module.

Setting data	Usable device								
	Internal device		File register	Link direct device J□\□		Intelligent function module U□\G□	Index register Zn	Constant	Others
	Bit	Word		Bit	Word			K, H	
(S)	–	○		–				–	–
(D)	○	○	–	–				–	–

[Instruction symbol] [Execution condition]

ZP.PINIT



[Setting data]

Setting data	Setting details	Setting side (Note-1)	Data type
"Un"	Head I/O number of Simple Motion module (00 to FE: High-order two digits of I/O number expressed in three digits)	User	BIN 16 bits
(S)	Head number of a device in which control data is stored	–	Device name
(D)	Head number of a bit device which turns ON the operation by one scan at the time of completion of the instruction. If the instruction is completed abnormally, ((D) + 1) will also be turned ON.	System	Bit

Note) The file register of each of the local device and the program cannot be used as a device for setting data.

(Note-1): The data on the setting side is as follows.

- User : Data before the execution of dedicated instructions is stored by user.
- System: Data after the execution of dedicated instruction is stored by PLC CPU.

[Control data]

Device	Item	Setting data	Setting range	Setting side (Note-1)
(S)+0	System area	–	–	–
(S)+1	Complete status	The state at the time of completion is stored. 0 : Normal completion Other than 0: Abnormal completion (error code) (Note-2)	–	System

(Note-1): The data on the setting side is as follows.

- User : Data before the execution of dedicated instructions is stored by user.
- System: Data after the execution of dedicated instruction is stored by PLC CPU.

(Note-2): Refer to Section 16.5 for error codes at abnormal completion.

[Functions]

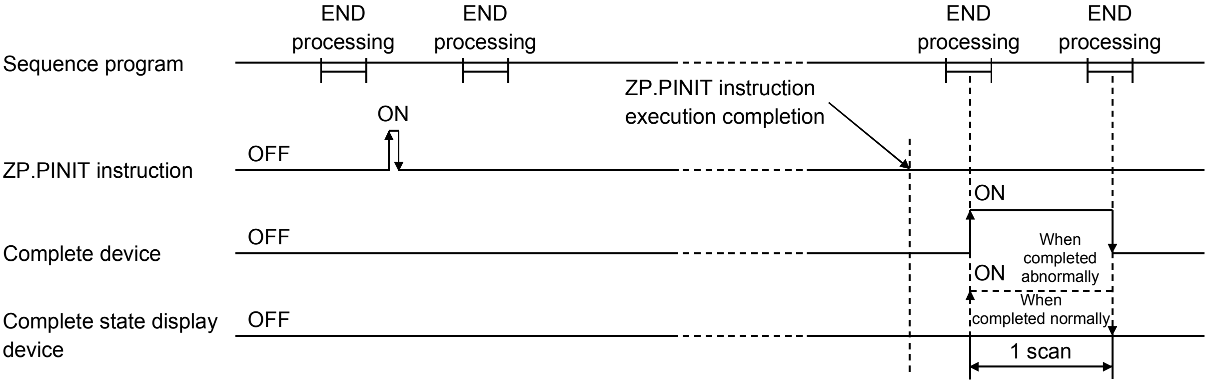
(1) This dedicated instruction is used to return the setting data set in the buffer memory of Simple Motion module and flash ROM to their factory-set data (initial values).
Refer to Section 14.2 for initialized setting data.

(2) The ZP.PINIT instruction completion can be confirmed using the complete devices ((D)+0) and ((D)+1).

(a) Complete device ((D)+0)
This device is turned ON by the END processing of the scan for which ZP.PINIT instruction is completed, and turned OFF by the next END processing.

(b) Complete state display device ((D)+1)
This device is turned ON and OFF according to the state in which ZP.PINIT instruction is completed.

- When completed normally : Kept unchanged at OFF.
- When completed abnormally : This device is turned ON by the END processing of the scan for which ZP.PINIT instruction is completed, and turned OFF by the next END processing. (Same ON/OFF operation as the complete device.)



[Errors]

(1) When a dedicated instruction is completed abnormally, the error complete signal ((D)+1) is turned ON, and the error code is stored in the complete status ((S)+1).
Check and take measures against the error referring to Section 16.5 "List of errors".

[Precautions]

(1) The ZP.PINIT instruction can only be executed when the READY signal [X0] is turned OFF.
When the READY signal [X0] is turned ON, the ZP.PINIT instruction cannot be executed.
Before executing the ZP.PINIT instruction, turn OFF the PLC READY signal [Y0] and then turn OFF the READY signal [X0].

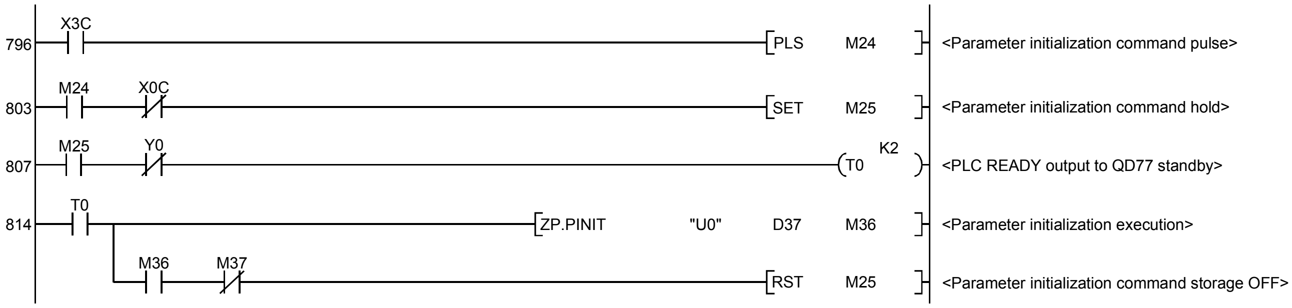
(2) Writing to the flash ROM is up to 100,000 times.
If writing to the flash ROM exceeds 100,000 times, the writing to the flash ROM will become impossible.

(3) After the power ON and PLC CPU reset operation, writing to the flash ROM using a sequence program is limited to up to 25 times. (Not limited to up to 25 times when writing to the flash ROM is carried out by GX Works2.)
If the 26th or more writing is requested after the power ON/PLC CPU reset operation, a flash ROM exceed writing error (error code: 805) will occur, and the writing will be disabled. If a flash ROM write error occurs by one writing to the flash ROM, check and correct the flash ROM writing program. Then reset the error or turn ON the power and reset the PLC CPU again.

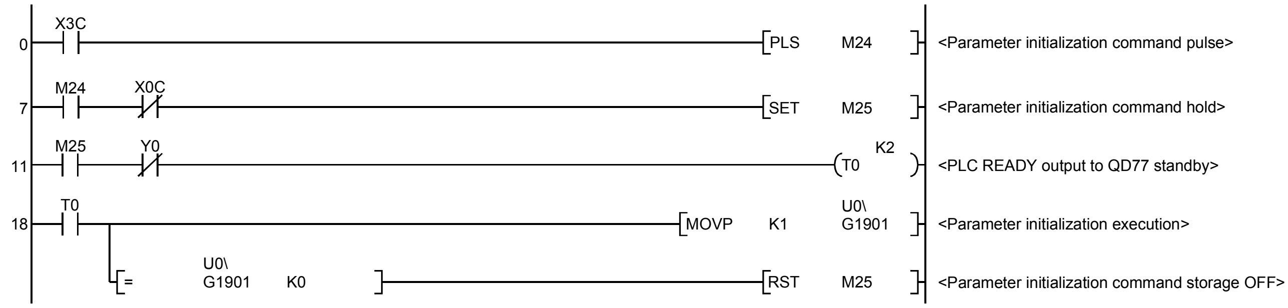
[Program example]

The following program initializes the parameters in buffer memory and flash ROM when X3C turns ON in QD77MS4.

(1) Parameter initialization program



(2) Parameter initialization program (when dedicated instruction is not used)



MEMO

Chapter 16 Troubleshooting

The "errors" and "warnings" detected by the Simple Motion module are explained in this chapter.

Errors can be confirmed with the LED display of Simple Motion module and GX Works2. When an error or warning is detected, confirm the detection details and carry out the required measures.

16.1 Checking errors using GX Works2

Error codes corresponding to the errors occurred in the Simple Motion module can be checked either on the following screen of GX Works2.
Select the screen according to the purpose and usage.
- "Module's Detailed Information" screen
- "Error History" screen

(1) Checking errors on the "Module's Detailed Information" screen

Select [Diagnostics]→ [System Monitor] on GX Works2.
Select "QD77MS" for "Main block" and click the [Detailed information] button.
The "Module's Detailed Information" screen for the QD77MS appears and error code, error details, and corrective actions can be checked.

(2) Checking errors on the "Error History" screen.

POINT

The PLC CPU and GX Works2 that support the module error collection function are required to confirm errors on the "Error History" screen. Refer to each PLC CPU manual for the version of the PLC CPU or GX Works2 that supports the module error collection function.

On the "Error History" screen, the error logs of the QD77MS are displayed in a list together with the error logs of other modules. The logs can be output to a CSV format file. The error codes and the time of error occurrence can be checked even after the PLC CPU is powered off and then on or reset.
Select [Diagnostics] → [System Monitor] → [System Error History] button on GX Works2.

(a) Error History List
Module error logs are displayed in a list.

(b) Error and Solution, Intelligent Module Information

- Error and Solution
  Details of the selected in the "Error History List" and its corrective action are displayed.
- Intelligent Module Information
  The status of Simple Motion module when the error selected in the "Error History List" occurred is displayed.

Item		Description
Start axis		The axis No. requested to start is stored.
Positioning start No.		The start No. at positioning start is stored. (Note-1)
Axis in which the error occurred		The axis No. in which the error occurred is stored.
Axis error occurrence (Data No.)		The positioning data No. currently being executed in which the error occurred is stored. (Note-1), (Note-2)
Current feed value		The current feed value (at error occurrence) of the error axis is stored.
State of the input signal [X0 to XF]		The status of input signals [X0 to XF] (at error occurrence) is stored (in binary).
State of the input signal [X10 to X1F]		The status of input signals [X10 to X1F] (at error occurrence) is stored (in binary).
State of the output signal [Y0 to YF]		The status of output signals [Y0 to YF] (at error occurrence) is stored (in binary).
State of the output signal [Y10 to Y1F]		The status of output signals [Y10 to Y1F] (at error occurrence) is stored (in binary).
QD77MS4 display	• Axis 1 upper limit signal • Axis 1 lower limit signal • Axis 1 stop signal • Axis 1 external command signal/ switching signal • Axis 1 near-point signal	The status of axis 1 external input signals (at error occurrence) is stored.
	• Axis 2 upper limit signal • Axis 2 lower limit signal • Axis 2 stop signal • Axis 2 external command signal/ switching signal • Axis 2 near-point signal	The status of axis 2 external input signals (at error occurrence) is stored.
	• Axis 3 upper limit signal • Axis 3 lower limit signal • Axis 3 stop signal • Axis 3 external command signal/ switching signal • Axis 3 near-point signal	The status of axis 3 external input signals (at error occurrence) is stored.
	• Axis 4 upper limit signal • Axis 4 lower limit signal • Axis 4 stop signal • Axis 4 external command signal/ switching signal • Axis 4 near-point signal	The status of axis 4 external input signals (at error occurrence) is stored.
QD77MS16 display	• Axis in which the error occurred (Upper limit signal) • Axis in which the error occurred (Lower limit signal) • Axis in which the error occurred (Stop signal) • Axis in which the error occurred (External command signal/ switching signal) • Axis in which the error occurred (Near-point signal)	The status of external input signals of the axis in which the error occurred (at error occurrence) is stored.
Servo alarm		The alarm code detected by servo amplifier is stored. (Note-3)

(Note-1): "0" is stored at the servo error occurrence.

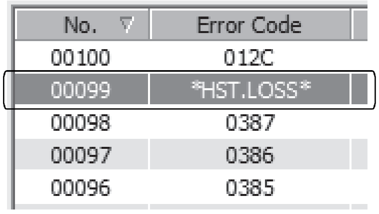
(Note-2): The current cam data No. is displayed for output axis of synchronous control.

(Note-3): "0" is stored unless the servo error occurs.

(c) [Create CSV File] button
The module error logs are output to a CSV format file.

POINT

(1) If errors frequently occur in the Simple Motion module, "*HST.LOSS*" (instead of an actual error code) may be displayed in the Error Code column.
(Display example)



No.	Error Code
00100	012C
00099	*HST.LOSS*
00098	0387
00097	0386
00096	0385

If "*HST.LOSS*" is frequently displayed, set a larger value for the number of errors collected per scan in the PLC RAS tab of the PLC Parameter dialog box.
For the setting, refer to the "User's Manual (Function Explanation, Program Fundamentals)" of the CPU module in use.

(2) If the error occurred at the simultaneous start, the axis No. in which the error is detected is stored in the "Starting axis" in Error History.

16.2 Checking errors using a display unit

The buffer memory monitor/test function of a display unit allows users to check the errors in the Simple Motion module without using the software package.

For the operation methods of a display unit and display contents, refer to the "User's Manual (Function Explanation, Program Fundamentals)" of the CPU module in use.

16.3 Troubleshooting

(1) Troubleshooting using the LEDs

Check items and corrective actions for troubleshooting using the indicator LEDs of the Simple Motion module are described below.

(a) When the RUN LED turns off.

Check item	Action
Is the power supplied?	Check that the voltage supplied to the power supply module is within the rated range.
Is the power supply capacity sufficient?	Calculate the total current consumption of the connected modules (PLC CPU module, I/O modules, and intelligent function modules) and check that the power supply capacity is not insufficient.
Is the module connected correctly?	• Check that the connector on the side of the module is properly inserted. • Check that the module joint levers are locked.

If there is no problem on the above check items, a watchdog timer error may have occurred. Reset the PLC CPU and check that the RUN LED turns on. If not, the possible cause is a hardware failure. Please consult your local Mitsubishi representative, explaining a detailed description of the problem.

(b) When the ERR.LED turns on

Check item	Action
Is there a system error?	An error may have occurred in the PLC CPU. Check the error code and take a corrective action.

(c) When the ERR. LED and axis LED flash

Check item	Action
Is there an axis error?	Check the error code and take the action described in Section 16.5.

(d) When all LEDs turn on

Reset the PLC CPU and check that the module is in the normal status. If all LEDs still turn on, the possible cause is a hardware failure. Please consult your local Mitsubishi representative, explaining a detailed description of the problem.

(2) Troubleshooting when a motor does not rotate

Check items and corrective actions for troubleshooting when a motor does not rotate are described below.

POINT

The following signals must be ON for the Simple Motion module to operate (excluding when the "positioning test function" of GX Works2 is used).

- READY signal [X0]
- Servo READY signal
- Upper limit signal and Lower limit signal

The ON status of signals can be checked by the following monitor data.

- Servo READY signal: "Md.108 Servo status (high-order buffer memory address)" (b0, b1).
- Upper limit signal and Lower limit signal: "Md.30 External input signal" (b0, b1).

	Buffer memory address (high-order)	
	QD77MS2/QD77MS4	QD77MS16
Md.108 Servo status: b0, b1	877+100n	2477+100n

n: Axis No.-1

Check item	Action
Are all the READY signal [X0], servo READY signal, and upper/lower limit signals ON?	Review and correct the sequence program and wiring so that all the READY signal [X0], servo READY signal, and upper/lower limit signals turn ON.
Is there an error in the Simple Motion module? (ERR. LED is on or flashing)	Check the error code and take a corrective action.
Is the servo amplifier powered ON?	Power on the servo amplifier.
Is there an error in the servo amplifier?	Check the error code of the servo amplifier and take a corrective action.
Is the wiring between the Simple Motion module and servo amplifier correct?	Check the wiring between the Simple Motion module and servo amplifier, and correct it.
Is the wiring between the servo amplifier and motor correct?	Check the wiring between the servo amplifier and motor, and correct it.
Is the value in "Md.20 Current feed value" changed after positioning control is performed?	Review the start program.
Is the cumulative command pulse of servo amplifier changed after positioning control is performed?	Refer to the "Servo Amplifier Instruction Manual" and check that the function to suppress the motor rotation is not working.
Isn't the value in "Md.26 Axis operation status" "1: stopped"?	Review the stop program.

If a motor does not rotate even after the above items are checked, the possible cause is a hardware failure.
Please consult your local Mitsubishi representative, explaining a detailed description of the problem.

(3) Troubleshooting when a motor does not rotate as intended.

Check items and corrective actions for troubleshooting when a motor does not rotate as intended are described below.

(a) When a motor rotates only in the opposite direction

Check item	Action
Is the value in "Rotation direction selection/ travel direction selection (PA14)" correct?	Check that the value in "Rotation direction selection/ travel direction selection (PA14)" matches the settings of servo amplifier.

(b) When a motor does not rotate at the set speed

<table>
<tr><th>Check item</th><th>Action</th></tr>
<tr><td rowspan="2">Does the value in "Md.28 Axis feedrate" (Note) indicate the set speed?</td><td>[When "Md.28 Axis feedrate" (Note) indicates the set speed]
• Check that the values in "Pr.2 Number of pulses per rotation (AP)", "Pr.3 Movement amount per rotation (AL)", and "Pr.4 Unit magnification (AM)" meet the system.
• When the servo amplifier has the electronic gear function, check that the settings meet the system.</td></tr>
<tr><td>[When "Md.28 Axis feedrate" (Note) does not indicate the set speed]
• Check that the speed is not limited by the value in "Pr.8 Speed limit value".
• In the JOG operation, check that the speed is not limited by the value in "Pr.31 JOG speed limit value".
• In the JOG operation, check that Forward run JOG start signal and Reverse run JOG start signal do not repeatedly turn ON and OFF.
<table>
<tr><th>Signal</th><th>QD77MS2/QD77MS4</th><th>QD77MS16</th></tr>
<tr><td>Forward run JOG start signal</td><td>Y8, YA, YC, YE</td><td>Cd.181 Forward run JOG start</td></tr>
<tr><td>Reverse run JOG start signal</td><td>Y9, YB, YD, YF</td><td>Cd.182 Reverse run JOG start</td></tr>
</table></td></tr>
</table>

(Note): Speed control mode and continuous operation to torque control mode: "Md.122 Speed during command"

(c) When the set position is not reached

<table>
<tr><th>Check item</th><th>Action</th></tr>
<tr><td rowspan="2">Does the value in "Md.20 Current feed value" indicate the intended position when the motor stops?</td><td>[When the position set in "Md.20 Current feed value" is reached]
• Check that the values in "Pr.2 Number of pulses per rotation (AP)", "Pr.3 Movement amount per rotation (AL)", and "Pr.4 Unit magnification (AM)" meet the system.
• When the servo amplifier has the electronic gear function, check that the settings meet the system.</td></tr>
<tr><td>[When the position set in "Md.20 Current feed value" is not reached]
• Check that the motor is not stopped by Axis stop signals. If a motor is stopped by them, the value "1: stopped" is stored in "Md.26 Axis operation status".
<table>
<tr><th>Signal</th><th>QD77MS2/QD77MS4</th><th>QD77MS16</th></tr>
<tr><td>Axis stop signal</td><td>Y4 to Y7</td><td>Cd.180 Axis stop</td></tr>
</table></td></tr>
</table>

16.4 Error and warning details

[1] Errors

■ Types of errors

Errors detected by the Simple Motion module include parameter setting range errors, errors at the operation start or during operation and errors detected by servo amplifier.

(1) Errors detected by the Simple Motion module include parameter setting range errors
The parameters are checked when the power is turned ON and at the rising edge (OFF → ON) of the PLC READY signal [Y0]. An error will occur if there is a mistake in the parameter setting details at that time.
When this kind of error occurs, the READY signal [X0] does not turn ON.
To cancel this kind of error, set the correct value in the parameter for which the error occurred, and then turn ON the PLC READY signal [Y0].

POINT

Re-set the parameters after parameter initialization (refer to Section 14.2) if errors (error code: 900 to 999) frequently occur and the Simple Motion module does not start.

(2) Errors at the operation start or during operation (Simple Motion module detection errors)
These are errors that occur at the operation start or during operation when the positioning control, JOG operation, or inching operation is used. If an axis error occurs during interpolation operation, the error No. will be stored in both the reference axis and the interpolation axis.
Note that, in the following cases (a) and (b), the axis error No. will be stored only in the reference axis during analysis of the positioning data set in each point of the positioning start data table.
(a) When the interpolation axis is BUSY.
(b) When the error occurs in positioning data or parameters unrelated to interpolation control.

If the error occurs at the simultaneous start of a positioning operation, the axis error storage details will differ depending on whether the error occurred before or after the simultaneous start.

- If the error (illegal axis No., other axis BUSY, etc.) occurs before the simultaneous start, an "error before simultaneous start" will occur for the start axis.
- If the error (positioning data error, software stroke limit error, etc.) occurs after the simultaneous start, an error code corresponding to the axis in which the error occurred will be stored. Because a simultaneous start cannot be carried out due to this, an error code "simultaneous start not possible error" will be stored in all axes in which an error has not occurred.

The axis operation status will be displayed as "error occurring" for axes in which an error occurred.
If an error occurs during operation, any moving axes will deceleration stop, and their operation status will be displayed as "error occurring".
All axes will decelerate to a stop during interpolation operations, even if the error occurs in only one axis.

(3) Servo amplifier detection errors
These are errors that occur at the hardware error such as servo amplifier and servomotor or the servo parameter error.
Servo is turned off at the error occurrence, and axis stop. If you remove an error factor, reset the servo amplifier.

(4) Types of error codes

Error code	Classification of errors
001 to 009	Fatal errors
100 to 199	Common errors
200 to 299	OPR or absolute position restoration errors
300 to 399	JOG operation or inching operation errors
500 to 599	Positioning operation errors
600 to 699	Synchronous control input axis errors
700 to 799	Synchronous control output axis errors
800 to 899	I/F (Interface) errors
900 to 1199	Parameter setting range errors
1201 to 1209	Encoder errors
2000 to 2999	Servo amplifier errors
61440 to 61695	Errors for amplifier manufactured by Nikki Denso Co., Ltd.
61696 to 61951	Errors for inverter FR-A700 series

■ Error storage

When an error occurs, the error detection signal turns ON, and the error code corresponding to the error details is stored in the following buffer memory address (Md.23 Axis error No.) for axis error No. storage. Note that there is a delay of up to operation cycle after the error detection signal turns ON until the error code is stored.

Axis No.	QD77MS2		QD77MS4		QD77MS16	
	Error detection signal	Buffer memory address	Error detection signal	Buffer memory address	Error detection signal	Buffer memory address
1	X8	806	X8	806	Md.31 Status: b13	2406
2	X9	906	X9	906		2506
3			XA	1006		2606
4			XB	1106		2706
5						2806
to						to
16						3906

A new error code is stored in the buffer memory address (Md.23 Axis error No.) for axis error storage every time an error occurs.

POINT

When any of the following errors is detected, it is stored in the axis error No. of axis 1. (These errors are stored in the axis error No. of axis 1 for the system which not use the axis 1.)
Error code: 001, 002, 107, 190, 800, 802, 805, 999

When an alarm occurs on servo amplifier, the alarm No. displayed in LED of servo amplifier is stored in the following buffer memory address (Md.114 Servo alarm). Check the error details and remedies by this servo alarm details.

Axis No.	Buffer memory address		
	QD77MS2	QD77MS4	QD77MS16
1	888	888	2488
2	988	988	2588
3		1088	2688
4		1188	2788
5			2888
to			to
16			3988

[2] Warnings

■ Types of warnings

Warnings detected by the Simple Motion module include system warnings, axis warnings and warnings detected by servo amplifier.

(1) Warnings include system warnings.
The types of system warnings are shown below.

- System control data setting warnings
  An axis warning for axis 1 will occur.
- Positioning data setting warnings
  An axis warning for each axis will occur.
  Note that a warning will occur for the reference axis when an interpolation designation or axis setting warning occurs.

(2) Warnings include axis warnings.

- Axis warnings occur due to setting warnings from operations such as positioning operations, JOG operations or manual pulse generator operations.
- Axis warnings occur due to system warnings.
  The axis operation status does not change even if an axis warning occurs.

(3) Servo amplifier detection warnings
These are warning that occur at the hardware error such as servo amplifier and servomotor or the inapplicable servo parameters.
Error or normality operation can't be executed by waning when warning is left as it is though servo off isn't executed.
When the warning cause is removed, warning is automatically released in servo amplifier. However, the state of generating warning is continued in Simple Motion module.
Reset it if necessary.

(4) Types of warning codes

Warning code	Classification of warnings
100 to 199	Common warnings
300 to 399	JOG operation warnings
400 to 499	Manual pulse generator operation warnings
500 to 599	Positioning operation warnings
600 to 699	Synchronous control input axis warnings
700 to 799	Synchronous control output axis warnings
800 to 899	Cam data operation warnings
900 to 999	System control data setting range check warnings
2000 to 2999	Servo amplifier warnings (The contents of warnings vary in the model of servo amplifier.)
61440 to 61695	Warnings for amplifier manufactured by Nikki Denso Co., Ltd.
61696 to 61951	Warnings for inverter FR-A700 series

■ Warning storage

(1) When an axis warning occurs, the warning code corresponding to the warning details is stored in the following buffer memory (Md.24 Axis warning No.) for axis warning No. storage.

	Buffer memory address		
Axis No.	QD77MS2	QD77MS4	QD77MS16
1	807	807	2407
2	907	907	2507
3		1007	2607
4		1107	2707
5			2807
to			to
16			3907

(2) When an axis warning occurs in a positioning operation, etc "axis warning detection (Md.31 Status: b9)" turns ON of the following buffer memory for axis status storage turns ON.

	Buffer memory address		
Axis No.	QD77MS2	QD77MS4	QD77MS16
1	817	817	2417
2	917	917	2517
3		1017	2617
4		1117	2717
5			2817
to			to
16			3917

When a warning occurs on servo amplifier, the warning No. displayed in LED of servo amplifier is stored in the following buffer memory address (Md.114 Servo alarm). Check the warning details and remedies by this servo alarm details.

Axis No.	Buffer memory address		
	QD77MS2	QD77MS4	QD77MS16
1	888	888	2488
2	988	988	2588
3		1088	2688
4		1188	2788
5			2888
to			to
16			3988

[3] Resetting errors and warnings

Remove the cause of error or warning following the actions described in Section 16.5 and 16.6, before cancel an error or warning state by resetting the error.

■ How to clear errors or warnings

An error or warning state is canceled after the following processing is carried out by setting "1" in the address of the buffer memory for axis error resetting (Cd.5 Axis error reset).

- Axis error detection signal is turned OFF.
- "Md.23 Axis error No." is cleared.
- "Md.24 Axis warning No." is cleared.
- "Md.26 Axis operation status" is changed from "Error" to "Standby".
- "Axis warning detection (Md.31 Status: b9)" is turned OFF.

POINT

When servo amplifier errors cannot be reset even if error reset is requested, "0" is not stored in "Cd.5 Axis error reset" by Simple Motion module. It remains "1". Set "0" in "Cd.5 Axis error reset" and then set "1" to execute the error reset again by user side.

[4] Confirming the error and warning definitions

The error and warning definitions can be confirmed with the error codes and warning codes. Confirming them requires GX Works2.

■ Confirming the error definitions

- System monitor of GX Works2 (Refer to Section 16.1.)
- Error history screen of GX Works2 (Simple Motion Module Setting Tool)
  (Refer to the Simple Motion Module Setting Tool Help.)

■ Confirming the warning definitions

- Warning history screen of GX Works2 (Simple Motion Module Setting Tool)
  (Refer to the Simple Motion Module Setting Tool Help.)

16.5 List of errors

The following table shows the error details and remedies to be taken when an error occurs.

16.5.1 QD77MS detection error

Classification of errors	Error code	Error name	Error	Operation status at error occurrence	
—	000	(Normal status)	—	—	
Fatal errors	001	Faults	Hardware is faulty.	The system stops.	
	002	Internal circuit fault			
Common errors	101	PLC READY OFF during operation	The PLC READY signal [Y0] is turned OFF during operation.	The system stops with the setting (deceleration stop/sudden stop) of the detailed parameter 2 Sudden stop selection (stop group 2). (Note that the deceleration stop only occurs during the manual pulse generator operation.)	
	102	Servo READY signal OFF during operation	The servo READY signal is turned OFF during operation.	The system stops immediately.	
	103	Test mode faults during operation	The personal computer cannot communicate with the CPU module.	The system stops with the setting (deceleration stop/sudden stop) of the detailed parameter 2 Sudden stop selection (stop group 2). (Note that the deceleration stop only occurs during the manual pulse generator operation.)	
	104	Hardware stroke limit (+)	The hardware stroke limit (upper limit signal FLS) is turned OFF during operation.	The system stops with the setting (deceleration stop/sudden stop) of the detailed parameter 2 Sudden stop selection (stop group 1). (Note that the deceleration stop only occurs during the manual pulse generator operation.)	
			Start is requested when the hardware stroke limit (upper limit signal FLS) is turned OFF.	The system does not start.	
	105	Hardware stroke limit (–)	The hardware stroke limit (lower limit signal RLS) is turned OFF during operation.	The system stops with the setting (deceleration stop/sudden stop) of the detailed parameter 2 Sudden stop selection (stop group 1). (Note that the deceleration stop only occurs during the manual pulse generator operation.)	
			Start is requested when the hardware stroke limit (lower limit signal RLS) is turned OFF.	The system does not start.	
	106	Stop signal ON at start	Start is requested when a stop signal is turned ON.	The system does not start.	

Related buffer memory address		Set range (Setting with sequence program)	Remedy
QD77MS2 QD77MS4	QD77MS16		
—	—	—	—
—	—	—	Check that there is no influence from noise.
—	—	—	Review the program which turns ON/OFF PLC READY signal [Y0].
—	—	—	Check the servo amplifier power, wiring with the servo amplifier, and connection of connectors.
—	—	—	Check that there is no error on the personal computer side I/F to which a cable is connected.
—	—	—	After making an axis error reset (refer to [3] in Section 16.4), perform manual control operation (refer to Chapter 11) to move the axis to the other position in order that the upper limit signal (FLS) will not turn OFF.
—	—	—	• Check the wiring of upper limit signal FLS. • Check if the specification of the limit switch and the setting of the "Pr.22 Input signal logic selection" match. • If hardware stroke limit (limit switch) is unnecessary system for installation, wire to always turn ON the upper limit signal (FLS) input of the Simple Motion module.
—	—	—	After making an axis error reset (refer to [3] in Section 16.4), perform manual control operation (refer to Chapter 11) to move the axis to the other position in order that the lower limit signal (RLS) will not turn OFF.
—	—	—	• Check the wiring of lower limit signal RLS. • Check if the specification of the limit switch and the setting of the "Pr.22 Input signal logic selection" match. • If hardware stroke limit (limit switch) is unnecessary system for installation, wire to always turn ON the lower limit signal (RLS) input of the Simple Motion module.
—	—	—	After confirming the stop command status, then review the timing of start.

Classification of errors	Error code	Error name	Error	Operation status at error occurrence
Common errors	107	READY OFF → ON during BUSY	The PLC READY signal is turned from OFF to ON when BUSY signal is turned ON.	The READY signal [X0] is not turned ON.
	108	Start not possible	Start is requested when start is not possible in the axis operation state.	The system does not start positioning.
	109	Servo amplifier series error	The set series of the servo parameter "Pr.100 Servo series" and the series of connected servo amplifier are mismatch.	The communication between servo amplifiers or later of target axis is not executed. (The servo amplifier's LED display remains "Ab".)
	190	Operation cycle time over error	The calculation process time of the positioning etc. exceeds the operation cycle.	The operation continues.
Home position return (OPR)	201	Start at OP	• When the OPR retry invalid is set, the near-point dog method machine OPR is started with the OPR complete flag turned ON. • Scale origin signal detection method machine OPR is started with the OPR complete flag turned ON and the near-point dog signal turned ON.	The machine OPR does not start.
	203	Dog detection timing fault	The near-point dog signal is turned OFF during the deceleration from an OPR speed to a creep speed by the near-point dog method machine OPR.	The system stops with the setting (deceleration stop/sudden stop) of the detailed parameter 2 Sudden stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.)
	206	Count method movement amount fault	In the count method 1) and 2) machine OPR, a parameter "Setting for the movement amount after near-point dog ON" is smaller than a distance necessary for deceleration stop from an OPR speed.	At start : The system does not operate. During operation: The system stops with the setting (deceleration stop/sudden stop) of the detailed parameter 2 Sudden stop selection (stop group 3).
	207	OPR request ON	The OPR request flag is turned ON when a fast -OPR is started (positioning start No. 9002).	The fast -OPR does not start.
	209	OPR restart not possible	The restart command is turned ON after the machine OPR is stopped using a stop signal.	The restart is not carried out.
	210	OPR zero point not passed	The zero point is not passed when the dog method, count method or scale origin signal detection method OPR is re-started, or data set method OPR is executed.	The OPR does not complete.
	211	ZCT read error	The data is not loaded from the servo amplifier properly upon the OPR.	
	212	ABS reference point read error	The data is not loaded from the servo amplifier properly upon the OPR.	

Related buffer memory address		Set range (Setting with sequence program)	Remedy
QD77MS2 QD77MS4	QD77MS16		
—	—	—	Turn ON the PLC READY signal [Y0] with the BUSY signals of all axes OFF.
—	—	—	Do not request the start when the axis operation state is other than "standby", "stop", and "step standby".
30100+200n	28400+100n	<Servo series> 0, 1, 3, 4, 6, 7, 32, 64, 96	Match the set series of the servo parameter "Pr.100 Servo series" to the series of connected servo amplifier.
147	105	—	Review the content of the positioning or "Pr.96 Operation cycle setting" longer than the current setting.
78+150n		<OPR retry> 0, 1	• Validate the OPR retry function (set value: 1). (Refer to Section 13.2.1). • Move the work piece from the current position (on OP) using the manual control operation (refer to Chapter 11), then carry out a machine OPR again.
74+150n 75+150n		<OPR speed> 1 to 1000000000 [PLS/s] 1 to 2000000000 [$\times 10^{-2}$mm/min or others]	• Lower the OPR speed. • Increase the dog signal input time. (Refer to Section 8.2.3)
80+150n 81+150n		<Movement amount setting after near-point dog ON> 0 to 2147483647	• Calculate the movement distance using a speed limit, OPR speed, and deceleration time, and set the movement amount after near-point dog ON so that the distance becomes a deceleration distance or longer. • Lower the OPR speed. • Adjust the near-point dog position so that the movement amount after near-point dog ON becomes longer. (Refer to Section 8.2.4, 8.2.5)
74+150n 75+150n		<OPR speed> 1 to 1000000000 [PLS/s] 1 to 2000000000 [$\times 10^{-2}$mm/min]	
1500+100n	4300+100n	<Positioning start No.> 1 to 600, 7000 to 7004, 9001 to 9004	Execute the machine OPR (positioning start No. 9001). (Refer to Section 8.2)
1500+100n	4300+100n	<Positioning start No.> 1 to 600, 7000 to 7004, 9001 to 9004	Start the machine OPR (positioning start No. 9001) again. (Refer to Section 8.2)
—	—	—	Turn the motor more than one revolution using JOG or positioning operation.
—	—	—	• Execute OPR again. • When the servo parameter "Function selection C-4 (PC17)" is changed to "1: Not need to pass servo motor Z-phase after power on", transfer the parameter from the Simple Motion module to the servo amplifier and turn the power supply of the servo amplifier OFF. Then, turn it ON and execute OPR again.
—	—	—	Execute OPR again.

<table>
<tr><th>Classification of errors</th><th>Error code</th><th>Error name</th><th>Error</th><th>Operation status at error occurrence</th></tr>
<tr><td rowspan="2">Home position return (OPR)</td><td>230</td><td>Encoder ABS data not established</td><td>OPR is started on the direct drive motor when the absolute position data of the encoder has not been established.</td><td>The OPR does not start.</td></tr>
<tr><td>231</td><td>Z-phase passing parameter invalid</td><td>Servo amplifier parameter "Function selection C-4 (PC17)" is not set to "0: Need to pass servo motor Z-phase after power on" in the machine OPR of scale origin signal detection method.</td><td>The OPR does not start.</td></tr>
<tr><td rowspan="2">JOG operation or inching operation errors</td><td>300</td><td>Outside JOG speed range</td><td>At the time of JOG starting, the JOG speed comes out of a specified range.</td><td>The JOG operation is not carried out when the JOG speed is outside the setting range at the time of JOG start.</td></tr>
<tr><td>301</td><td>Inching movement amount error</td><td>The inching movement amount dose not satisfy the setting conditions. (The setting value is large.)
Setting condition:
"Inching movement amount × (A) ≤ JOG speed limit value"
Use the following values for (A).
<table>
<tr><th rowspan="2"></th><th colspan="2">Operation cycle</th></tr>
<tr><th>0.88</th><th>1.77</th></tr>
<tr><td>When unit is set to PLS</td><td>1125</td><td>562.5</td></tr>
<tr><td>When unit is set to degree and "Pr.83 Speed control 10 x multiplier setting for degree axis" is valid</td><td>67.5</td><td>33.75</td></tr>
<tr><td>When unit setting is other than the above</td><td>675</td><td>337.5</td></tr>
</table></td><td>The inching operation is not carried out when the inching movement amount exceeds a JOG speed limit at the time of inching start.</td></tr>
<tr><td>Positioning operation errors</td><td>500</td><td>Illegal condition data No.</td><td>The condition data No. is outside the setting range when a block using the condition data is started by a special starting (conditional start, wait start, simultaneous start, FOR (condition)).
(1 ≤ Condition data No. ≤ 10)</td><td>The operation is terminated.</td></tr>
</table>

Related buffer memory address		Set range (Setting with sequence program)	Remedy
QD77MS2 QD77MS4	QD77MS16		
—	—	—	Turn the power supplies of the system or servo amplifier from OFF to ON after passing the zero point of the motor by the JOG operation, etc.
30180+200n	28480+100n	—	Set "0: Need to pass servo motor Z-phase after power on" in the servo parameter "Function selection C-4 (PC17)".
1518+100n 1519+100n	4318+100n 4319+100n	<JOG speed> 1 to 1000000000 [PLS/s] 1 to 2000000000 [$\times 10^{-2}$mm/min or others]	Bring the JOG speed into the setting range. (Refer to Section 11.2)
1517+100n	4317+100n	<Inching movement amount> 0 to 65535	Set a smaller inching movement amount so that the setting condition is satisfied. (Refer to Section 11.3)
Refer to Section 5.4 "List of block start data"		<Condition data No.> 1 to 10	Review the condition data No. (Refer to Section 5.4 Da.14)

Classification of errors	Error code	Error name	Error	Operation status at error occurrence	
Positioning operation errors	501	Error before simultaneous start QD77MS2 QD77MS4	<When blocks are started simultaneously> • The partner axis for simultaneous start is BUSY.	At start : The system does not operate. During operation: The system stops immediately.	
			<When multiple axes are started and controlled simultaneously> • The partner axis for simultaneous start is BUSY. • The "Simultaneous starting axis start data No." of the start axis is 0 or is outside the setting range. • The "Simultaneous starting axis start data No." of those axes other than the start axis is outside the setting range.		
		Error before simultaneous start QD77MS16	<When blocks are started simultaneously> • The partner axis for simultaneous start is BUSY.		
			<When multiple axes are started and controlled simultaneously> • The same axis number is set to multiple simultaneous start axes. • The own axis number is set to a simultaneous start axis. • The number of simultaneous start axes is outside the setting range of 2 to 4. • The partner axis for simultaneous start is BUSY. • The "Simultaneous starting axis start data No." of the start axis and the partner axis for simultaneous start is 0 or is outside the setting range.		
	502	Illegal data No.	• The positioning data No. tried to be executed is outside the ranges of 1 to 600, 7000 to 7004, and 9001 to 9004. • The designation of a JUMP destination is executed currently. • The designation of a JUMP destination is outside the ranges of 1 to 600.	The positioning data is not executed.	
	503	No command speed	• At the start of positioning, a current speed (–1) is set for the command speed of the positioning data to be initially executed. • The current speed is set by speed control. • The current speed is set for speed-position or position-speed switching control.	The operation does not start at positioning start.	

	Related buffer memory address		Set range (Setting with sequence program)		Remedy
	QD77MS2 QD77MS4	QD77MS16			
	Refer to Section 5.5 "List of condition data"		<Condition operators> Axis designation: 10H, 20H, 30H, 40H, 50H, 60H, 70H, 80H, 90H, A0H, B0H, C0H, D0H, E0H		Normalize the condition operators. (Refer to Section 5.5 Da.16)
	1540+100n		Axis 1 start data No.	Simultaneous starting axis start data No. 0 to 600	Normalize the simultaneous starting axis start data No. (Refer to Section 10.5)
	1541+100n		Axis 2 start data No.		
	1542+100n		Axis 3 start data No.		
	1543+100n		Axis 4 start data No.		
		4339+100n	<Simultaneous starting axis> b12 to b15 : 2 to 4 b8 to b11 : 0h to Fh b4 to b7 : 0h to Fh b0 to b3 : 0h to Fh		Normalize the simultaneous start axis.
		4339+100n	<Simultaneous starting axis> b12 to b15 : 2 to 4 b8 to b11 : 0h to Fh b4 to b7 : 0h to Fh b0 to b3 : 0h to Fh		Normalize the simultaneous starting own axis start data No. and the simultaneous starting axis start data No.(1 to 3). (Refer to Section 10.5)
		4340+100n	<Simultaneous starting own axis start data No.> 1 to 600		
		4341+100n	Simultaneous starting axis start data No.1	<Simultaneous starting axis start data No. (1 to 3)> 1 to 600	
		4342+100n	Simultaneous starting axis start data No.2		
		4343+100n	Simultaneous starting axis start data No.3		
	1500+100n	4300+100n	<Positioning start No.> 1 to 600, 7000 to 7004, 9001 to 9004		Normalize the positioning start No., positioning start data (in block start), and positioning data (in JUMP instruction).
	Refer to Section 5.3 "List of positioning data"		<JUMP destination> 1 to 600		
			<Command speed> 1 to 1000000000 [PLS/s] 1 to 2000000000 [$\times 10^{-2}$mm/min or others]		Normalize the positioning data.

Classification of errors	Error code	Error name	Error	Operation status at error occurrence
Positioning operation errors	504	Outside linear movement amount range	• When the parameter "interpolation speed designation method" performs a linear interpolation in setting a "composite speed", the axis movement amount for each positioning data exceeds 1073741824(2^{30}). • The positioning address is –360.00000 or less or 360.00000 or more using INC instruction, where the control unit is set to "degree" and software stroke limit upper limit is not equal to the software stroke limit lower limit.	At start : The system does not operate. During operation: The system stops immediately.
	506	Large arc error deviation	When an arc is interpolated by the designation of the center point, a difference between a radius of start point-center point and a radius of end point-center point exceeds the parameter "Circular interpolation error allowable limit".	At start : The circular interpolation control by center point designation is not executed. During operation: The system stops immediately.
	507	Software stroke limit+	• The positioning is executed at a position exceeding the upper limit of the software stroke limit. • The positioning address and the new current value exceed the upper limit of the software stroke limit. • In the circular interpolation with sub points designated, the sub point exceeds the upper limit of the software stroke limit. • During the speed control mode/the torque control mode/the continuous operation to torque control mode, the current feed value exceeded the upper limit of the software stroke limit.	At operation start: The system does not operate. In the analysis of new current value: Current value is not changed. During operation: • The system stops immediately when the positioning address during position control (including position control in speed-position switching control or position-speed switching control) is switched to the data outside the software stroke limit range. • The system makes a stop at the setting (normal deceleration stop only) of sudden stop selection (stop group 3) in the detailed parameter 2 when the current feed value or machine feed value during speed control (including speed control in speed-position switching control or position-speed switching control) or during manual control falls outside the software stroke limit range. At speed control mode/torque control mode/ continuous operation to torque control mode: The mode is switched to the position control mode and the system stops immediately when the current feed value falls outside the software stroke limit range.
	508	Software stroke limit–	• The positioning is executed at a position exceeding the lower limit of the software stroke limit. • The positioning address and the new current value exceed the lower limit of the software stroke limit. • In the circular interpolation with sub points designated, the sub point exceeds the lower limit of the software stroke limit. • During the speed control mode/the torque control mode/the continuous operation to torque control mode, the current feed value exceeded the lower limit of the software stroke limit.	

Related buffer memory address QD77MS2 QD77MS4	Related buffer memory address QD77MS16	Set range (Setting with sequence program)	Remedy
Refer to Section 5.3 "List of positioning data"		<Positioning address/movement amount> • ABS unit [mm] [inch] [PLS] –2147483648 to 2147483647 Unit [degree] 0 to 35999999 • INC (When software stroke limits are valid) Unit [mm], [inch] [PLS]: –2147483648 to 2147483647 Unit [degree]: –35999999 to 35999999 (When software stroke limits are invalid) –2147483648 to 2147483647 • Speed-position switching INC mode: 0 to 2147483647 ABS mode: 0 to 35999999 ([degree] only) • Position-speed switching 0 to 2147483647 <Arc address> –2147483648 to 2147483647	Review the positioning address.
			• Correct the center point address (arc address) • Correct the end address (positioning address)
60+150n 61+150n		<Circular interpolation error allowable limit> 0 to 1000000	Correct the circular interpolation error allowable limit value.
New current value		<New current value> <Software stroke upper and lower limits> • [mm] [inch] [PLS] –2147483648 to 2147483647 • [degree] 0 to 35999999	At operation start : • Set the current feed value within the software stroke limit by the manual control operation. (Refer to Chapter 11) • Correct the positioning address. (At circular interpolation with sub points designated, also check the arc address.) New current value : Set the new current value within the software stroke limit. (Refer to Section 9.2.19) During operation : Correct the positioning address. (For the positioning and arc addresses, refer to Da.6 and Da.7 in Section 5.3) At speed control mode/torque control mode/continuous operation to torque control mode: Review the operation so that the current feed value does not exceed the software stroke limit.
1506+100n 1507+100n	4306+100n 4307+100n		
Software stroke limit upper limit			
18+150n 19+150n			
Software stroke limit lower limit			
20+150n 21+150n			

Classification of errors	Error code	Error name	Error	Operation status at error occurrence
Positioning operation errors	514	Outside new current value range	The new current address is outside the ranges of 0 to 359.99999, where the control unit is set to "degree".	Current value is not changed.
	515	New current value not possible	• The control system sets an operation pattern (continuous path control) using new current positioning data. • The operation pattern sets a "new current value" in the control system using the data following the "continuous path control" positioning data.	
	516	Continuous path control not possible	• The continuous path control is designated using a control system which is not allowed to use for continuous path control such as speed control, speed-position switching control, position-speed switching control, fixed-feed, and current value changing. • The previous data such as those on speed control, speed-position switching control, position-speed switching control, fixed-feed, and current value changing shows a continuous path control. • The continuous positioning control is designated for speed control or position-speed switching control.	The system does not operate at start.
	518	Outside operation pattern range	The operation pattern set value is 2.	At start : The system does not operate. During operation: The system stops with the setting (deceleration stop/sudden stop) of the detailed parameter 2 Sudden stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.)
	519	Interpolation while interpolation axis BUSY	Interpolation is started during the operation of the interpolation axis.	
	520	Unit group unmatched	The reference and interpolation axis units are different at the parameter "interpolation speed designation method" setting of "composite speed".	
	521	Illegal interpolation description command	In 2-axis interpolation, the axis to be interpolated is the self axis or an axis not present.	
	522	Command speed setting error	The command speed is outside the setting range. Linear interpolation, circular interpolation: Reference axis is outside the setting range. Speed control interpolation: Either of reference axis and interpolation axis is outside the speed range.	

Related buffer memory address		Set range (Setting with sequence program)	Remedy
QD77MS2 QD77MS4	QD77MS16		
1506+100n 1507+100n	4306+100n 4307+100n	<New current value> [degree] 0 to 35999999	Bring the new current value into the setting range. (Refer to Section 9.2.19)
Refer to Section 5.3 "List of positioning data"		<Control system> 01H to 1EH, 80H to 84H • 03H, 0CH, 17H, 1CH: 1 to 4 axis fixed-feed control • 04H, 05H, 13H, 14H, 18H, 19H, 1DH, 1EH: 1 to 4 axis speed control • 81H: current value changing • Speed-position switching control: 06H, 07H • Position-speed switching control: 08H, 09H <Operation pattern> 00, 01, 11 • 01: Continuous positioning control • 11: Continuous path control	• Do not designate a current value changing using the positioning data following the continuous path control. • Do not designate positioning data following continuous path control using a "current value changing". (Refer to Section 9.2.19)
			• Do not designate a speed control, fixed-feed, speed-position switching control, position-speed switching control, and current value changing using the positioning data following the continuous path control data. • Do not carry out the fixed-feed, speed control, speed-position switching control, position-speed switching control, and current value changing using the continuous path control operation pattern. • Do not carry out the speed control and position-speed switching control using the continuous path control operation pattern. (Refer to Chapter 9)
Same as error codes 515 to 516			Correct the operation pattern. (Refer to Section 5.3 Da.1)
			Correct the control system. (Refer to Section 5.3 Da.2)
0+150n		<Unit setting> 0, 1, 2, 3	Correct the positioning data or change the parameter "Unit setting" of the axis to be interpolated. (Refer to Section 9.1.6)
Same as error codes 515 to 516			• Correct the control system. (Refer to Section 5.3 Da.2) • Correct the axis to be interpolated. (Refer to Section 5.3 Da.5, Da.20 to Da.22)
Command speed storage addresses of positioning data No. 1 to 600		<Command speed> 1 to 1000000000 [PLS/s] 1 to 2000000000 [$\times 10^{-2}$mm/min or others]	Correct the command speed. (Refer to Section 5.3 Da.8)

Classification of errors	Error code	Error name	Error	Operation status at error occurrence
Positioning operation errors	523	Interpolation mode error	• For starting, a composite speed is designated in the reference axis parameter "Interpolation speed designation method" using the speed interpolation control or 4-axis linear interpolation control. • For starting, a reference axis speed is designated in the reference axis parameter "Interpolation speed designation method" using the circular interpolation control.	At start : The system does not operate. During operation: The system stops with the setting (deceleration stop/sudden stop) of the detailed parameter 2 Sudden stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.)
	524	Control system setting error	• The control system setting value is outside the setting range. • The number of control axes or the axis to be interpolated differs from the previous data when continuous positioning control or continuous path control is to be exercised for continuously. • The NOP instruction was set to the control system of positioning data No. 600.	
	525	Sub point setting error	Either of the following applies in the circular interpolation with sub points designated. • Start point = sub point • End point = sub point • Start point, end point, and sub point are in line with each other. • Sub point address and center point address are outside the range of –2147483648 to 2147483647.	At start : The system does not operate. During operation: The system stops immediately.
	526	End point setting error	• Start point is equal to end point in the circular interpolation with sub points designated. • End point address is outside the range of –2147483648 to 2147483647 in the circular interpolation with auxiliary point designation and center point designation.	
	527	Center point setting error	Circular interpolation with center point designation applicable to one of the followings. • Start point = Center point • End point = Center point • Center point address is outside the range of –2147483648 to 2147483647.	

Related buffer memory address		Set range (Setting with sequence program)	Remedy
QD77MS2 QD77MS4	QD77MS16		
29+150n		<Interpolation speed designation method> 0: Composite speed 1: Reference axis speed	Set the "Interpolation speed designation method" correctly. (Refer to Section 9.1.6)
Same as error codes 515 to 516			Correct the control system, axis to be interpolated or parameter. (Refer to Section 9.1.6, 9.2.20)
Refer to Section 5.3 "List of positioning data"		<Positioning address/movement amount> • Unit [mm] [PLS] [inch] –2147483648 to 2147483647 (Unit [degree]) cannot be set. <Arc address> –2147483648 to 2147483647	Correct the sub address (arc address). (Refer to Section 9.2.10)
			Correct the end address (positioning address). (Refer to Section 9.2.10)
Same as in error codes 525 to 526.			Correct the center point address (arc address). (Refer to Section 9.2.11)

Classification of errors	Error code	Error name	Error	Operation status at error occurrence
Positioning operation errors	530	Outside address range	• In the speed-position switching control and the position-speed switching control, the setting value of a positioning address is negative. • In ABS1, ABS2, ABS3 and ABS4, the setting value of a positioning address is outside the range of 0 to 359.99999 degrees.	At start : The system does not operate. During operation: The system stops immediately with the setting (deceleration stop/sudden stop) of the detailed parameter 2 sudden stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.)
	532	Simultaneous start not possible	Among the axes to be started simultaneously, there is an axis on which an error other than this error occurs.	
	533	Condition data error	• The condition setting values are not set or outside the setting range. • The condition operator setting values are not set or outside the setting range. • The condition operator is a bit operator, and the parameter 1 is 32 or more. • An unusable condition operator is set for the set condition. • The conditional operator has been [parameter 1 is greater than to parameter 2] with 05H (P1 ≤ ** ≤ P2). • The setting value of "address" is outside the setting range when the condition target is set to "Buffer memory (1-word/2-word)". (1-word: 0 to 32767, 2-word: 0 to 32766) • The setting value of "simultaneous starting axis" is outside the setting range when the condition target is set to "positioning data No.". QD77MS16	The operation is terminated.
	534	Special start instruction error	No applicable special start instruction is present.	
	535	Circular interpolation not possible	Circular interpolation is carried out on an axis in the unit of degree.	
	536	M code ON signal start	The positioning start is carried out when an M code ON signal is turned ON.	The system does not operate at start.
	537	PLC READY OFF start	The positioning start is carried out when the PLC READY signal [Y0] is turned OFF.	
	538	READY OFF start	The positioning start is carried out when the READY signal [X0] is turned OFF.	
	543	Outside start No. range	• At the start of positioning, the setting value of the "positioning start No." of the axis control data is outside the ranges of 1 to 600, 7000 to 7004, and 9001 to 9004. • At a Pre-reading start, the "positioning start No." setting of the axis control data is other than 1 to 600.	

Related buffer memory address		Set range (Setting with sequence program)	Remedy
QD77MS2 QD77MS4	QD77MS16		
Same as in error codes 504, 506.	Same as in error codes 504, 506.	Same as in error codes 504, 506.	Correct the positioning address. (Refer to Section 9.2.16, 9.2.17, or 9.2.18)
Refer to Section 5.3 "List of positioning data" and Section 5.4 "List of block start data"	Refer to Section 5.3 "List of positioning data" and Section 5.4 "List of block start data"	—	In the error history, check the axis where the error other than this error occurred, and remove the error factor. Correct the block start data and positioning data.
Refer to Section 5.4 "List of block start data"	Refer to Section 5.4 "List of block start data"	—	Normalize the block start data.
		<Special start instruction> 00H to 06H	Correct the instruction code of the special start. (Refer to Section 5.4 Da.13)
Refer to Section 5.3 "List of positioning data"	Refer to Section 5.3 "List of positioning data"	—	Correct the control system. (Refer to Section 5.3 Da.2)
1504+100n	4304+100n	<M code OFF request> 1: M code ON signal is turned OFF	After turning OFF the M code ON signal, start the system. (Refer to Section 13.7.3)
—	—	—	Check the program which turns ON/OFF the PLC READY signal [Y0], and turn ON the PLC READY signal. Then start the system.
—	—	—	Check the READY ON signal, and then start the system. (Refer to Section 3.3.2)
1500+100n	4300+100n	<Positioning start No.> 1 to 600, 7000 to 7004, 9001 to 9004	Normalize the positioning start No. (Refer to Section 13.7.7)

Classification of errors	Error code	Error name	Error	Operation status at error occurrence	
Positioning operation errors	544	Outside radius range	The arc radius exceeds 536870912.	At start : The system does not operate. During operation: The system stops immediately.	
	545	Control system LOOP setting error	A "0" is set in the repeating times of the control system "LOOP".	The operation is terminated.	
	546	Illegal setting of ABS direction in unit of degree	The setting value of ABS direction in the unit of degree is as follows. • Set outside the setting range. • A figure other than "0" is set when the software stroke limit is valid.	At start : The system does not operate. During operation: The system decelerates to a stop. (Note that, in the continuous positioning control and continuous path control, the system continues operating with the setting set at the time of start even if the setting is changed during the operation.)	
	547	Start at OPR incomplete	• When executing operation setting at OPR incomplete, positioning was started at OPR request ON. • When executing operation setting at OPR incomplete, control mode switching was executed at OPR request ON.	At start : The system does not operate. At control mode switching: The mode does not change.	
	550	Continuous operation to torque control not supported	Switching to the continuous operation to torque control mode is requested to a servo amplifier which does not support the continuous operation to torque control.	During positioning control: The system stops with the setting of the detailed parameter 2 sudden stop selection (stop group 3). During speed control mode: The mode is switched to position control mode, and the system stops immediately.	
	551	Outside control mode auto-shift switching parameter range	When setting the control mode auto-shift switching selection, the control mode auto-shift switching parameter is outside the range.		
I/F errors	800	Hold error	In the CPU module parameter "Output at error stop", the setting for the Simple Motion module is "Hold".	At start : The system does not operate. During operation: The system stops with the setting (deceleration stop/sudden stop) of the detailed parameter 2 sudden stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.)	
	801	Flash ROM write error	Data is not written to the flash ROM.	At start: The system does not operate.	
	802	Flash ROM sum check error	While data is written to the flash ROM, the power is turned OFF.		

Related buffer memory address		Set range (Setting with sequence program)	Remedy
QD77MS2 QD77MS4	QD77MS16		
Refer to Section 5.3 "List of positioning data"		<Maximum radius> 536870912	Correct the positioning data. (Refer to Section 9.2.10, or 9.2.11)
		<LOOP to LEND> 1 to 65535	Set 1 to 65535 in the repeating time of LOOP. (Refer to Section 9.2.22)
ABS setting direction in the unit of degree		0: Shortcut 1: Clockwise 2: Counterclockwise	• Set the ABS setting direction in the unit of degree within the setting range. • Set "0" when the software stroke limits are valid. (Refer to Section 9.1.5)
1550+100n	4350+100n		
Software stroke limit upper limit		• [mm] [inch] [PLS] –2147483648 to 2147483647 • [degree] 0 to 35999999	Invalidate the software stroke limit. (To invalidate, set the software stroke limit upper limit value to the software stroke limit lower limit value.) (Refer to Section 9.1.5)
18+150n 19+150n			
Software stroke limit lower limit			
20+150n 21+150n			
Operation setting for incompletion of OPR		<Operation setting for incompletion of OPR> 0, 1	• Start after the OPR is executed. • Switch the control mode after the OPR is executed. • For systems which can operate the positioning control and speed-torque control though the OPR request is ON, set "1" to the setting value of the operation setting at OPR incomplete.
87+150n			
—	—	—	Use a servo amplifier which supports the continuous operation to torque control.
1594+100n 1595+100n	4394+100n 4395+100n	< Outside control mode auto-shift switching parameter range > When "1" or "2" is set in "Cd.153 Control mode auto-shift selection". • [mm] [inch] [PLS] –2147483648 to 2147483647 • [degree] 0 to 35999999	Set the control mode auto-shift switching parameter within the range and switch to the continuous operation to torque control mode.
—	—	—	Clear the setting of the CPU module parameter "Output at error stop".
—	—	—	The flash ROM is expected to be at the end of its writable life.
1901	5901	<Parameter initialization request> 1: Parameter initialization is requested	Return the parameter to that set at the time of delivery from the plant. (Refer to Section 14.2)

Classification of errors	Error code	Error name	Error	Operation status at error occurrence
I/F errors	803	PLC CPU error	The CPU module resulted in an error.	At start : The system does not operate. During operation: The system stops with the setting (deceleration stop/sudden stop) of the detailed parameter 2 sudden stop selection (stop group 2). (Note that the deceleration stop only occurs during the manual pulse generator operation.)
	804	Dedicated instruction error	• The ZP.PSTRT□ instruction is executed with the start No. set to other than 1 to 600, 7000 to 7004 and 9001 to 9004. • The ZP.TEACH□ instruction is executed with the teaching data selection set to other than 0 and 1. • The ZP.TEACH□ instruction is executed with the positioning data No. set to other than 1 to 600. • The instruction of a non-existent axis is specified by the ZP.PSTRT□ or ZP.TEACH□ instruction.	The function for each instruction is not executed.
	805	Flash ROM write number error	Data is written to the flash ROM continuously 25 times or more from the program.	At start: The system does not operate.
	806	Dedicated instruction I/F error	Mismatching occurs between the CPU module and the Simple Motion module.	
	808	Error when switching from normal operation mode to amplifier-less operation mode	Input signals other than synchronization flag [X1] are ON when switching from the normal operation mode to the amplifier-less operation mode.	The operation mode is not changed.
	809	Error when switching from amplifier-less operation mode to normal operation mode	Input signals other than synchronization flag [X1] are ON when switching from the amplifier-less operation mode to the normal operation mode.	
Parameter setting range errors	900	Outside unit setting range	The set value of the basic parameter 1 "Unit setting" is outside the setting range.	The READY signal [X0] is not turned ON.
	901	Outside pulse number per rotation range	The set value of the basic parameter 1 "Number of pulses per rotation" is outside the setting range.	
	902	Outside movement amount per rotation range	The set value of the basic parameter 1 "Movement amount per rotation" is outside the setting range.	
	903	Outside unit magnification range	• The set value of the basic parameter 1 "Unit magnification" is outside the setting range. • "Movement amount per rotation (AL)" × "Unit magnification (AM)" exceeds 2147483648.	

Related buffer memory address		Set range (Setting with sequence program)	Remedy
QD77MS2 QD77MS4	QD77MS16		
—	—	—	Check the error code in CPU module. (Refer to the "QCPU User's Manual (Hardware Design, Maintenance and Inspection)".)
—	—	< ZP.PSTRT☐ start No.> 1 to 600, 7000 to 7004, 9001 to 9004 < ZP.TEACH☐ teaching data selection> 0: The current feed value is written to the positioning address. 1: The current feed value is written to the arc address. < ZP.TEACH☐ positioning data No.> 1 to 600	• When executing the ZP.PSTRT☐ instruction, set the start No. within the setting range. (Refer to Section 15.3) • When executing the ZP.TEACH☐ instruction, set the teaching data selection and positioning data No. within the setting range. (Refer to Section 15.4) • Do not specify the instruction of a non-existent axis by the ZP.PSTRT☐ and ZP.TEACH☐ instructions. (Refer to Section 15.3 to Section 15. 4)
—	—	—	Review the program so that data is not written continuously to the flash ROM. (Using "Md.19" in Section 5.6.1, the number of flash ROM write times can be monitored.) (If this error has occurred in a proper using method, writing is enabled by resetting the error, switching power OFF, then ON, or resetting the CPU module.)
—	—	—	A trouble occurs. Repair.
—	—	—	Switch the operation mode after confirming that all input signals other than synchronization flag [X1] are OFF.
—	—	—	
0+150n		0, 1, 2, 3	With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON.
2+150n 3+150n		1 to 200000000	
4+150n 5+150n		1 to 200000000	
1+150n		1,10,100,1000	• Set AL and AM values which make "Movement amount per rotation (AL)" × "Unit magnification (AM)" within 2147483647, and then turn the PLC READY signal [Y0] from OFF to ON. • With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON.

Classification of errors	Error code	Error name	Error	Operation status at error occurrence
Parameter setting range errors	906	Outside bias speed range	• The set value of the basic parameter 1 "Bias speed at start" is outside the setting range. • The bias speed exceeds the speed limit.	The READY signal [X0] is not turned ON.
	907	Outside electronic gear setting range	The set value of the electronic gear is outside the setting range.	
	910	Outside speed limit value range	• The set value of the basic parameter 2 "Speed limit value" is outside the setting range. • The speed limit value is smaller than the OPR speed.	When the PLC READY signal [Y0] is turned from OFF to ON : READY signal [X0] is not turned ON. At start : The system does not operate.
	911	Outside acceleration time 0 range	The set value of the basic parameter 2 "Acceleration time 0" is outside the setting range.	
	912	Outside deceleration time 0 range	The set value of the basic parameter 2 "Deceleration time 0" is outside the setting range.	
	920	Backlash compensation amount error	The calculation result of the following equation is smaller than 0 or larger than 4194304. $0 \leq \frac{\boxed{\text{Pr.11}} \times \boxed{\text{Pr.2}}}{\boxed{\text{Pr.3}} \times \boxed{\text{Pr.4}}} \leq 4194303$	The READY signal [X0] is not turned ON.
	921	Software stroke limit upper limit	• In the unit of "degree", the set value of the detailed parameter 1 "Software stroke limit upper limit value" is outside the setting range. • In a unit other than degree, the software stroke limit upper limit value is smaller than the software stroke limit lower limit value.	
	922	Software stroke limit lower limit	• In the unit of "degree", the set value of the detailed parameter 1 "Software stroke limit lower limit value" is outside the setting range. • In a unit other than degree, the software stroke limit upper limit value is smaller than the software stroke limit lower limit value.	
	923	Software stroke limit selection	• The set value of the detailed parameter 1 "Software stroke limit selection" is outside the setting range. • In the unit of "degree", "1: Apply software stroke limit on machine feed value" is set.	
	924	Software stroke limit valid/invalid setting	The set value of the detailed parameter 1 "Software stroke limit valid/invalid setting" is outside the setting range.	

Related buffer memory address		Set range (Setting with sequence program)	Remedy
QD77MS2 QD77MS4	QD77MS16		
6+150n 7+150n		0 [PLS/s] 0 [$\times 10^{-2}$mm/min or others]	• Set the bias speed to not more than the speed limit value. • With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON.
Unit magnification 1+150n Number of pulses per rotation 2+150n 3+150n Movement amount per rotation 4+150n 5+150n		0.001 ≤ Electronic gear ≤ 320000 Electronic gear = $\frac{\boxed{\text{Pr.2}}}{\boxed{\text{Pr.3}} \times \boxed{\text{Pr.4}}}$	"Pr.2 Number of pulses per rotation (AP)", "Pr.3 Movement amount per rotation (AL)", "Pr.4 Unit magnification (AM)" Review these parameters. (Refer to Section 5.2.1)
10+150n 11+150n		<Speed limit value> 1 to 1000000000 [PLS/s] 1 to 2000000000 [$\times 10^{-2}$mm/min or others]	• Set a value which is not less than the OPR speed. • With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON.
12+150n 13+150n		1 to 8388608	With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON.
14+150n 15+150n		1 to 8388608	
17+150n		$0 \leq \frac{\boxed{\text{Pr.11}} \times \boxed{\text{Pr.2}}}{\boxed{\text{Pr.3}} \times \boxed{\text{Pr.4}}} \leq 4194303$	"Pr.2 Number of pulses per rotation (AP)", "Pr.3 Movement amount per rotation (AL)", "Pr.4 Unit magnification (AM)" "Pr.11 Backlash compensation amount" Review the items above. (Refer to Section 5.2.1 or Section 5.2.3)
18+150n 19+150n		• [mm] [inch] [PLS] –2147483648 to 2147483647 • [degree] 0 to 35999999	• Bring the setting into the setting range. • In a unit other than degree, set so that the lower limit value is smaller than the upper limit value.
20+150n 21+150n		• [mm] [inch] [PLS] –2147483648 to 2147483647 • [degree] 0 to 35999999	
22+150n		0, 1	• Bring the setting into the setting range. • In the unit of "degree", set "0: Apply software stroke limit on current feed value".
23+150n		0, 1	With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON.

Classification of errors	Error code	Error name	Error	Operation status at error occurrence	
Parameter setting range errors	925	Command in-position width	The set value of the detailed parameter 1 "Command in-position width" is outside the setting range.	The READY signal [X0] is not turned ON.	
	926	Illegal torque limit setting value	The set value of the detailed parameter 1 "Torque limit setting value" is outside the setting range.		
	927	M code ON timing error	The set value of the detailed parameter 1 "M code ON signal output timing" is outside the setting range.		
	928	Speed switching mode error	The set value of the detailed parameter 1 "Speed switching mode" is outside the setting range.		
	929	Interpolation speed designation method error	The set value of the detailed parameter 1 "Interpolation speed designation method" is outside the setting range.		
	930	Current value update request error	The set value of the detailed parameter 1 "Current feed value during speed control" is outside the setting range.		
	932	Manual pulse generator input mode error	The set value of the detailed parameter 1 "Manual pulse generator/Incremental synchronous encoder input selection" is outside the setting range.		
	935	Speed-position function selection error	The detailed parameter 1 "Speed-position function selection" is preset to 2 and the following three conditions are not satisfied: 1) Unit is "degree". 2) Software stroke limits are invalid. 3) Update current feed value.		
	936	External input signal selection error	The set value of the detailed parameter 1 "External input signal selection" is outside the setting range.		
	937	Forced stop valid/invalid setting error	The set value of the detailed parameter 1 "Forced stop valid/invalid setting" is outside the setting range.		
	938	Input signal logic selection setting error	The set values of the detailed parameter 1 "Input signal logic selection" are different in the axis that uses the same input signal.		

Related buffer memory address		Set range (Setting with sequence program)	Remedy
QD77MS2 QD77MS4	QD77MS16		
24+150n 25+150n		1 to 2147483647	With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON.
26+150n		1 to 1000	
27+150n		0, 1	
28+150n		0, 1	
29+150n		0, 1	
30+150n		0, 1, 2	
33		0, 1, 2, 3	
34+150n		0, 2	• Speed-position switching control (ABS mode) should satisfy the conditions 1) to 3) given on the left. • When speed-position switching control (ABS mode) is not to be exercised, set 0 to speed-position function selection and turn the PLC READY signal [Y0] from OFF to ON.
32+150n		0, 1, 2, 3, 4, 5, 6	With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON.
35		0, 1	
31+150n		0, 1	With the setting of the axis is matched, turn the PLC READY signal [Y0] from OFF to ON.

Classification of errors	Error code	Error name	Error	Operation status at error occurrence
	950	Acceleration time 1 setting error	The set value of the detailed parameter 2 "Acceleration time 1" is outside the setting range.	When the PLC READY signal [Y0] is turned from OFF to ON:The READY signal [X0] is not turned ON. At start : The system does not operate. During operation : The system stops with the setting (deceleration stop/sudden stop) of the detailed parameter 2 sudden stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.)
	951	Acceleration time 2 setting error	The set value of the detailed parameter 2 "Acceleration time 2" is outside the setting range.	
	952	Acceleration time 3 setting error	The set value of the detailed parameter 2 "Acceleration time 3" is outside the setting range.	
	953	Deceleration time 1 setting error	The set value of the detailed parameter 2 "Deceleration time 1" is outside the setting range.	
	954	Deceleration time 2 setting error	The set value of the detailed parameter 2 "Deceleration time 2" is outside the setting range.	
	955	Deceleration time 3 setting error	The set value of the detailed parameter 2 "Deceleration time 3" is outside the setting range.	

Related buffer memory address		Set range (Setting with sequence program)	Remedy
QD77MS2 QD77MS4	QD77MS16		
36+150n 37+150n		1 to 8388608	With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON.
38+150n 39+150n		1 to 8388608	
40+150n 41+150n		1 to 8388608	
42+150n 43+150n		1 to 8388608	
44+150n 45+150n		1 to 8388608	
46+150n 47+150n		1 to 8388608	

Classification of errors	Error code	Error name	Error	Operation status at error occurrence
Parameter setting range errors	956	JOG speed limit value error	• The set value of the detailed parameter 2 "JOG speed limit value" is outside the setting range. • The set value of the detailed parameter 2 "JOG speed limit value" exceeds the speed limit.	When the PLC READY signal [Y0] is turned from OFF to ON:The READY signal [X0] is not turned ON. At start : The system does not operate. During operation : The system stops with the setting (deceleration stop/sudden stop) of the detailed parameter 2 sudden stop selection (stop group 3). (Note that the deceleration stop only occurs during the manual pulse generator operation.)
	957	JOG acceleration time selection setting error	The set value of the detailed parameter 2 "JOG operation acceleration time selection" is outside the setting range.	
	958	JOG deceleration time selection setting error	The set value of the detailed parameter 2 "JOG operation deceleration time selection" is outside the setting range.	
	959	Acceleration/ deceleration process selection setting error	The set value of the detailed parameter 2 "Acceleration/deceleration process selection" is outside the setting range.	
	960	S-curve ratio setting error	The set value of the detailed parameter 2 "S-curve ratio" is outside the setting range.	
	961	Illegal sudden stop deceleration time	The set value of the detailed parameter 2 "Sudden stop deceleration time" is outside the setting range.	
	962	Stop group 1 sudden stop selection error	The set value of the detailed parameter 2 "Stop group 1 sudden stop selection" is outside the setting range.	
	963	Stop group 2 sudden stop selection error	The set value of the detailed parameter 2 "Stop group 2 sudden stop selection" is outside the setting range.	
	964	Stop group 3 sudden stop selection error	The set value of the detailed parameter 2 "Stop group 3 sudden stop selection" is outside the setting range.	
	966	Outside allowance circular interpolation error width	The set value of the detailed parameter 2 "Allowance circular interpolation error width" is outside the setting range.	
	967	External command function selection error	The set value of the detailed parameter 2 "External command function selection" is outside the setting range.	
	970	Restart allowable range error	The set value of the detailed parameter 2 "Restart allowable range when servo OFF to ON" is outside the setting range.	The READY signal [X0] is not turned ON.
	971	Speed control 10 x multiplier setting for degree axis error	The set value of the detailed parameter 2 "Speed control 10 x multiplier setting for degree axis" is outside the setting range.	
	972	Number of master axis error	Number of axes set for the master axis in servo parameter "Driver communication setting (PD15)" exceed the setting range.	
	973	Master axis No. error	Servo parameters "Driver communication setting Master axis No. selection (1 to 4) for slave (PD20 to PD23)" are set the self axis.	
	974	Master axis setting error	Not setting the master axis in Servo parameters " Driver communication setting Master axis No. selection (1 to 4) for slave (PD20 to PD23) ".	

Related buffer memory address		Set range (Setting with sequence program)	Remedy
QD77MS2 QD77MS4	QD77MS16		
48+150n 49+150n		<JOG speed limit value> 1 to 1000000000 [PLS/s] 1 to 2000000000 [$\times 10^{-2}$mm/min or others]	• With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON. • Bring the setting into the speed limit value or below.
50+150n		0, 1, 2, 3	With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON.
51+150n		0, 1, 2, 3	
52+150n		0, 1	
53+150n		1 to 100	
54+150n 55+150n		1 to 8388608	
56+150n		0, 1	
57+150n		0, 1	
58+150n		0, 1	
60+150n 61+150n		0 to 100000	
62+150n		0, 1, 2, 3, 4	
64+150n 65+150n		0 to 327680	
63+150n		0, 1	
30210+200n	Set with GX Works2	—	Set the number of master axis not more than the number can be set in servo parameter "PD15".
30215+200n 30216+200n 30217+200n 30218+200n	Set with GX Works2	—	Review the master axis No. of servo parameters "PD20 to PD23".

Classification of errors	Error code	Error name	Error	Operation status at error occurrence	
Parameter setting range errors	975	Driver communication setting error	• Setting the driver communication to servo amplifier which does not support the driver communication. • The driver communication setting is different in the module and the servo amplifier.	The communication between servo amplifiers of target axis is not executed. (The servo amplifier's LED display remains "Ab".)	
	976	Manual pulse generator/Incremental synchronous encoder input type selection error	The set value of the detailed parameter 2 "Manual pulse generator/Incremental synchronous encoder input type selection" is outside the setting range.	The READY signal [X0] is not turned ON.	
	977	Operation setting for speed-torque control mode error	The set value of the detailed parameter 2 "Operation setting for speed-torque control mode" is outside the setting range.		
	978	External command signal selection error	The set value of the detailed parameter 2 "External command signal selection" is outside the setting range.		
	979	Synchronous encoder via servo amplifier invalid error	• The servo amplifier axis set as synchronous encoder via servo amplifier is not supported with scale measurement mode. • In system construction, the unset up servo amplifier axis is set as the synchronous encoder via servo amplifier. • In system construction, the axis set to "Invalid" at the external synchronization encoder input is set as the synchronous encoder via servo amplifier. • The servo amplifier axis set as synchronous encoder via servo amplifier is connected to the encoder except Q171ENC/Q171ENC-W8 (including the linear scale, etc.).		
	980	OPR method error	The set value of the OPR basic parameter "OPR method" is outside the setting range.		
	981	OPR direction error	The set value of the OPR basic parameter "OPR direction" is outside the setting range.		
	982	OP address setting error	The set value of the OPR basic parameter "OP address" is outside the setting range.		
	983	OPR speed error	• The set value of the OPR basic parameter "OPR speed" is outside the setting range. • The set value of the OPR basic parameter "OPR speed" is smaller than the bias speed at start.		

Related buffer memory address		Set range (Setting with sequence program)	Remedy
QD77MS2 QD77MS4	QD77MS16		
—	—	—	• Confirm the driver communication and the actually connected servo amplifier. • After setting 'The driver communication setting', write to a flash ROM and switch the power on again or reset the PLC. After that turning the power of servo amplifier on again, switch the power on again or reset the PLC.
67		0, 1	With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON.
68+150n		<Torque initial value selection (b4 to b7)> 0, 1	
		<Speed initial value selection (b8 to b11)> 0, 1, 2	
		<Condition selection at mode switching (b12 to b15)> 0, 1	
	69+150n	0, 1, 2, 3, 4	
30100+200n	28400+100n	32	With the setting brought into the setting range, switch the power on again or reset the PLC.
70+150n		0, 4, 5, 6, 7	With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON.
71+150n		0, 1	
72+150n 73+150n		• [mm] [inch] [PLS] –2147483648 to 2147483647 • [degree] 0 to 35999999	
74+150n 75+150n		<OPR speed> 1 to 1000000000 [PLS/s] 1 to 2000000000 [$\times10^{-2}$mm/min or others]	• Bring the setting into the setting range. • Set the speed to the bias speed at start or higher. (Refer to Section 5.2.5)

Classification of errors	Error code	Error name	Error	Operation status at error occurrence
Parameter setting range errors	984	Creep speed error	• The set value of the OPR basic parameter "Creep speed" is outside the setting range. • The set value of the OPR basic parameter "Creep speed" is larger than the OPR speed. • The set value of the OPR basic parameter "Creep speed" is smaller than the bias speed at start.	The READY signal [X0] is not turned ON.
	985	OPR retry error	The set value of the OPR basic parameter "OPR retry" is outside the setting range.	
	991	Setting for the movement amount after near-point dog ON error	The set value of the OPR detailed parameter "Setting for the movement amount after near-point dog ON" is outside the setting range.	
	992	OPR acceleration time selection error	The set value of the OPR detailed parameter "OPR acceleration time selection" is outside the setting range.	
	993	OPR deceleration time selection error	The set value of the OPR detailed parameter "OPR deceleration time selection" is outside the setting range.	
	995	OPR torque limit value error	• The set value of the OPR detailed parameter "OPR torque limit value" is outside the setting range. • The OPR detailed parameter "OPR torque limit value" has exceeded the detailed parameter 1 "Torque limit setting value".	
	997	Speed designation during OP shift error	The set value of the OPR detailed parameter "Speed designation during OP shift" is outside the setting range.	
	998	Operation setting for incompletion of OPR error	The set value of the OPR detailed parameter "Operation setting for incompletion of OPR" is outside the setting range.	
	999	Operation cycle setting error	The set value of the expansion parameter "Operation cycle setting" is outside the setting range.	
	1003	SSCNET setting error	The set values of the expansion parameter "SSCNET setting" and the servo parameter "Servo series" are mismatch.	
Encoder errors	1201	OPR data incorrect	The backup data for absolute position restoration is illegal.	The operation continues.
Absolute position	1205	SSCNET communication error	Data received from servo amplifier is in error.	The operation continues.

Related buffer memory address QD77MS2 QD77MS4	QD77MS16	Set range (Setting with sequence program)	Remedy
76+150n 77+150n		<Creep speed> 1 to 1000000000 [PLS/s] 1 to 2000000000 [$\times 10^{-2}$mm/min or others]	• Bring the setting into the setting range. • Set the speed to that below the OPR speed. • Set the value to the bias speed at start or higher. (Refer to Section 5.2.5)
78+150n		0, 1	With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON.
80+150n 81+150n		0 to 2147483647	With the setting brought into the setting range, turn the PLC READY signal [Y0] from OFF to ON.
82+150n		0, 1, 2, 3	
83+150n		0, 1, 2, 3	
86+150n		1 to 1000	
88+150n		0, 1	
87+150n		0, 1	
147	105	0, 1	With the setting brought into the setting range, write to the flash ROM and switch the power on again or reset the PLC.
106		<SSCNET setting> 0, 1 <Servo series> 0, 1, 3, 4, 6, 7, 32, 96, 4097, 4128	With "SSCNET setting" and "Servo series" set by a correct combination, write to the flash ROM and switch the power on again or reset the PLC.
—	—	—	Execute OPR.
—	—	—	• Check the SSCNETⅢ cable. • Check the servomotor and encoder cable. • Take measures against noise. • Check whether the rotation direction Rotation direction selection/travel direction selection (PA14) is set "0 → 1" or "1 → 0" in the user program or the GX Works2. (Refer to Section 15.5)

16.5.2 Servo amplifier detection error

The detection error list for servo amplifier is shown below.
Refer to each servo amplifier instruction manual for details.

(1) MR-J4(W)-B

Classification of errors	Error code	Servo amplifier LED display	Name	Details name	Remarks
Servo amplifier errors	2010	10.1	Undervoltage	Voltage drop in the control power	
		10.2		Voltage drop in the main circuit power	
	2011	11.1	Switch setting error	Axis number setting error	MR-J4W-☐B use
		11.2		Disabling control axis setting error	
	2012	12.1	Memory error 1 (RAM)	RAM error 1	
		12.2		RAM error 2	
		12.3		RAM error 3	
		12.4		RAM error 4	
		12.5		RAM error 5	
	2013	13.1	Clock error	Clock error 1	
		13.2		Clock error 2	
	2014	14.1	Control process error	Control process error 1	
		14.2		Control process error 2	
		14.3		Control process error 3	
		14.4		Control process error 4	
		14.5		Control process error 5	
		14.6		Control process error 6	
		14.7		Control process error 7	
		14.8		Control process error 8	
		14.9		Control process error 9	
		14.A		Control process error 10	
	2015	15.1	Memory error 2 (EEP-ROM)	EEP-ROM error at power on	
		15.2		EEP-ROM error during operation	

Classification of errors	Error code	Servo amplifier LED display	Name	Details name	Remarks
Servo amplifier errors	2016	16.1	Encoder initial communication error 1	Encoder initial communication - Receive data error 1	
		16.2		Encoder initial communication - Receive data error 2	
		16.3		Encoder initial communication - Receive data error 3	
		16.5		Encoder initial communication - Transmission data error 1	
		16.6		Encoder initial communication - Transmission data error 2	
		16.7		Encoder initial communication - Transmission data error 3	
		16.A		Encoder initial communication - Process error 1	
		16.B		Encoder initial communication - Process error 2	
		16.C		Encoder initial communication - Process error 3	
		16.D		Encoder initial communication - Process error 4	
		16.E		Encoder initial communication - Process error 5	
		16.F		Encoder initial communication - Process error 6	
	2017	17.1	Board error	Board error 1	
		17.3		Board error 2	
		17.4		Board error 3	
		17.5		Board error 4	
		17.6		Board error 5	
	2019	19.1	Memory error 3 (Flash-ROM)	Flash-ROM error 1	
		19.2		Flash-ROM error 2	
	2020	20.1	Encoder normal communication error 1	Encoder normal communication - Receive data error 1	
		20.2		Encoder normal communication - Receive data error 2	
		20.3		Encoder normal communication - Receive data error 3	
		20.5		Encoder normal communication - Transmission data error 1	
		20.6		Encoder normal communication - Transmission data error 2	
		20.7		Encoder normal communication - Transmission data error 3	
		20.9		Encoder normal communication - Receive data error 4	
		20.A		Encoder normal communication - Receive data error 5	

Classification of errors	Error code	Servo amplifier LED display	Name	Details name	Remarks
Servo amplifier errors	2021	21.1	Encoder normal communication error 2	Encoder error 1	
		21.2		Encoder data update error	
		21.3		Encoder data waveform error	
		21.4		Encoder non-signal error	
		21.5		Encoder hardware error 1	
		21.6		Encoder hardware error 2	
		21.9		Encoder error 2	
	2024	24.1	Main circuit error	Ground fault detected at hardware detection circuit	
		24.2		Ground fault detected at software detection function	
	2025	25.1	Absolute position erased	Servo motor encoder - Absolute position erased	
	2027	27.1	Initial magnetic pole detection error	Magnetic pole detection - Abnormal termination	
		27.2		Magnetic pole detection - Time out error	
		27.3		Magnetic pole detection - Limit switch error	
		27.4		Magnetic pole detection - Estimated error	
		27.5		Magnetic pole detection - Position deviation error	
		27.6		Magnetic pole detection - Speed deviation error	
		27.7		Magnetic pole detection - Current error	
	2028	28.1	Linear encoder error 2	Linear encoder - Environment error	
	2030	30.1	Regenerative error	Regeneration heat error	
		30.2		Regeneration signal error	
		30.3		Regeneration feedback signal error	
	2031	31.1	Overspeed	Abnormal motor speed	
	2032	32.1	Overcurrent	Overcurrent detected at hardware detection circuit (during operation)	
		32.2		Overcurrent detected at software detection function (during operation)	
		32.3		Overcurrent detected at hardware detection circuit (during a stop)	
		32.4		Overcurrent detected at software detection function (during a stop)	
	2033	33.1	Overvoltage	Main circuit voltage error	
	2034	34.1	SSCNET receive error 1	SSCNET receive data error	
		34.2		SSCNET connector connection error	
		34.3		SSCNET communication data error	
		34.4		Hardware error signal detection	
	2035	35.1	Command frequency error	Command frequency error	
	2036	36.1	SSCNET receive error 2	Continuous communication data error	
	2037	37.1	Parameter error	Parameter setting range error	
		37.2		Parameter combination error	

Classification of errors	Error code	Servo amplifier LED display	Name	Details name	Remarks
Servo amplifier errors	2042	42.1	Servo control error	Servo control error by position deviation	
		42.2		Servo control error by speed deviation	
		42.3		Servo control error by torque/thrust deviation	
		42.8	Fully closed loop control error	Fully closed loop control error by position deviation	
		42.9		Fully closed loop control error by speed deviation	
		42.A		Fully closed loop control error by position deviation during command stop	
	2045	45.1	Main circuit device overheat	Main circuit device overheat error	
	2046	46.1	Servo motor overheat	Abnormal temperature of servo motor 1	
		46.2		Abnormal temperature of servo motor 2	
		46.3		Thermistor disconnected	
		46.5		Abnormal temperature of servo motor 3	
		46.6		Abnormal temperature of servo motor 4	
	2047	47.1	Cooling fan error	Cooling fan stop error	
		47.2		Cooling fan speed reduction error	
	2050	50.1	Overload 1	Thermal overload error 1 during operation	
		50.2		Thermal overload error 2 during operation	
		50.3		Thermal overload error 4 during operation	
		50.4		Thermal overload error 1 during a stop	
		50.5		Thermal overload error 2 during a stop	
		50.6		Thermal overload error 4 during a stop	
	2051	51.1	Overload 2	Thermal overload error 3 during operation	
		51.2		Thermal overload error 3 during a stop	
	2052	52.1	Error excessive	Excess droop pulse 1	
		52.3		Excess droop pulse 2	
		52.4		Error excessive during 0 torque limit	
		52.5		Excess droop pulse 3	
	2054	54.1	Oscillation detection	Oscillation detection error	
	2056	56.2	Forced stop error	Over speed during forced stop	
		56.3		Estimated distance over during forced stop	
	2060	1A.1	Servo motor combination error	Servo motor combination error	
		1A.2		Servo motor control mode combination error	

Classification of errors	Error code	Servo amplifier LED display	Name	Details name	Remarks
Servo amplifier errors	2061	2A.1	Linear encoder error 1	Linear encoder error 1-1	
		2A.2		Linear encoder error 1-2	
		2A.3		Linear encoder error 1-3	
		2A.4		Linear encoder error 1-4	
		2A.5		Linear encoder error 1-5	
		2A.6		Linear encoder error 1-6	
		2A.7		Linear encoder error 1-7	
		2A.8		Linear encoder error 1-8	
	2063	63.1	STO timing error	STO1 off	
		63.2		STO2 off	
		1E.1	Encoder initial communication error 2	Encoder malfunction	
		1E.2		Load-side encoder malfunction	
	2064	1F.1	Encoder initial communication error 3	Incompatible encoder	
		1F.2		Incompatible load-side encoder	
	2070	70.1	Load-side encoder initial communication error 1	Load-side encoder initial communication - Receive data error 1	
		70.2		Load-side encoder initial communication - Receive data error 2	
		70.3		Load-side encoder initial communication - Receive data error 3	
		70.5		Load-side encoder initial communication - Transmission data error 1	
		70.6		Load-side encoder initial communication - Transmission data error 2	
		70.7		Load-side encoder initial communication - Transmission data error 3	
		70.A		Load-side encoder initial communication - Process error 1	
		70.B		Load-side encoder initial communication - Process error 2	
		70.C		Load-side encoder initial communication - Process error 3	
		70.D		Load-side encoder initial communication - Process error 4	
		70.E		Load-side encoder initial communication - Process error 5	
		70.F		Load-side encoder initial communication - Process error 6	

Classification of errors	Error code	Servo amplifier LED display	Name	Details name	Remarks
Servo amplifier errors	2071	71.1	Load-side encoder normal communication error 1	Load-side encoder communication - Receive data error 1	
		71.2		Load-side encoder communication - Receive data error 2	
		71.3		Load-side encoder communication - Receive data error 3	
		71.5		Load-side encoder communication - Transmission data error 1	
		71.6		Load-side encoder communication - Transmission data error 2	
		71.7		Load-side encoder communication - Transmission data error 3	
		71.9		Load-side encoder communication - Transmission data error 4	
		71.A		Load-side encoder communication - Transmission data error 5	
	2072	72.1	Load-side encoder normal communication error 2	Load-side encoder data error 1	
		72.2		Load-side encoder data update error	
		72.3		Load-side encoder data waveform error	
		72.4		Load-side encoder non-signal error	
		72.5		Load-side encoder hardware error 1	
		72.6		Load-side encoder hardware error 2	
		72.9		Load-side encoder data error 2	
	2088	888	Watchdog	—	
	2913	2B.1	Encoder counter error	Encoder counter error 1	
		2B.2		Encoder counter error 2	
	2918	3A.1	Inrush current suppression circuit error	Inrush current suppression circuit error	
	2922	3E.1	Operation mode error	Operation mode error	
	2948	8A.1	USB communication time-out error	USB communication time-out error	
	2952	8E.1	USB communication error	USB communication receive error	
		8E.2		USB communication checksum error	
		8E.3		USB communication character error	
		8E.4		USB communication command error	
		8E.5		USB communication data number error	

(2) MR-J3-☐B

Classification of errors	Error code	Servo amplifier LED display	Error name	Remarks
Servo amplifier errors	2010	10	Under voltage	
	2012	12	Memory error 1 (RAM)	
	2013	13	Clock error	
	2015	15	Memory error 2 (EEP-ROM)	
	2016	16	Encoder error 1 (At power on)	
	2017	17	Board error	
	2019	19	Memory error 3 (Flash-ROM)	
	2020	20	Encoder error 2 (Run time)	
	2021	21	Encoder error 3 (Run time)	
	2024	24	Main circuit error	
	2025	25	Absolute position erase	
	2030	30	Regenerative error	
	2031	31	Overspeed	
	2032	32	Overcurrent	
	2033	33	Overvoltage	
	2034	34	Receive error 1	
	2035	35	Command frequency error	
	2036	36	Receive error 2	
	2037	37	Parameter error	
	2045	45	Main circuit device overheat	
	2046	46	Servomotor overheat	
	2047	47	Cooling fan alarm	
	2050	50	Overload 1	
	2051	51	Overload 2	
	2052	52	Error excessive	
	2060	1A	Motor combination error	
	2082	82	Master/slave operation error 1	
	2088	888	Watchdog	
	2907	1B	Converter alarm	
	2921	3D	Driver communication parameter setting error	

(Note): The LED display is different when using the servo amplifiers with a large capacity. Refer to the "Servo Amplifier Instruction Manual" for details.

(3) MR-J3W-☐B

Classification of errors	Error code	Servo amplifier LED display	Name	Details name	Remarks
Servo amplifier errors	2010	10.1	Undervoltage	Voltage drop in the control power	
		10.2		Voltage drop in the main circuit power	
	2011	11.1	Switch setting error	Rotary switch setting error	
		11.2		DIP switch setting error	
		11.3		Rotation/linear motor selection switch setting error	
		11.4		Rotation/linear motor selection switch setting error 2	
	2012	12.1	Memory error 1 (RAM)	CPU built-in RAM error	
		12.2		CPU data RAM error	
		12.3		Custom IC RAM error	
	2013	13.1	Clock error	Clock error	
	2015	15.1	Memory error 2 (EEP-ROM)	EEP-ROM error at power on	
		15.2		EEP-ROM error during operation	
	2016	16.1	Encoder initial communication error 1	Encoder receive data error 1	
		16.2		Encoder receive data error 2	
		16.3		Encoder receive data error 3	
		16.5		Encoder transmission data error 1	
		16.6		Encoder transmission data error 2	
		16.7		Encoder transmission data error 3	
	2017	17.1	Board error	AD converter error	
		17.2		Current feedback data error	
		17.3		Custom IC error	
		17.4		Amplifier detection signal error	
		17.5		Rotary switch error	
		17.6		DIPSW error	
	2019	19.1	Memory error 3 (Flash ROM)	Flash-ROM error 1	
		19.2		Flash-ROM error 2	
	2020	20.1	Encoder normal communication error 1	Encoder receive data error 1	
		20.2		Encoder receive data error 2	
		20.3		Encoder receive data error 3	
		20.5		Encoder transmission data error 1	
		20.6		Encoder transmission data error 2	
		20.7		Encoder transmission data error 3	
	2021	21.1	Encoder normal communication error 2	Encoder data error	
		21.2		Encoder data update error	
		21.3		Encoder data waveform error	Direct drive motor use
	2024	24.1	Main circuit error	Ground fault detected at hardware detection circuit	
		24.2		Ground fault detected at software detection function	
	2025	25.1	Absolute position erase	Absolute position data erase	

Classification of errors	Error code	Servo amplifier LED display	Name	Details name	Remarks
Servo amplifier errors	2027	27.1	Initial magnetic pole detection error	Magnetic pole detection abnormal termination	Linear servo motor/Direct drive motor use
		27.2		Magnetic pole detection time out error	
		27.3		Magnetic pole detection limit switch error	
		27.4		Magnetic pole detection estimated error	
		27.5		Magnetic pole detection position deviation error	
		27.6		Magnetic pole detection speed deviation error	
		27.7		Magnetic pole detection current error	
	2028	28.1	Linear encoder error 2	Linear encoder environment error	Linear servo motor use
	2030	30.1	Regenerative error	Regeneration heat error	
		30.2		Regenerative transistor error	
		30.3		Regenerative transistor feedback data error	
	2031	31.1	Overspeed	Abnormal motor rotation number (Note-1), (Note-2)	
	2032	32.1	Overcurrent	Overcurrent detected at hardware detection circuit (during operation).	
		32.2		Overcurrent detected at software detection function (during operation).	
		32.3		Overcurrent detected at hardware detection circuit (during a stop).	
		32.4		Overcurrent detected at software detection function (during a stop).	
	2033	33.1	Overvoltage	Main circuit voltage error	
	2034	34.1	SSCNET receive error 1	SSCNET receive data error	
		34.2		SSCNET communication connector connection error	
		34.3		Communication data error	
		34.4		Hardware error signal detection	
	2035	35.1	Command frequency error	Command frequency error	
	2036	36.1	SSCNET receive error 2	Continuous communication data error	
	2037	37.1	Parameter error	Parameter setting range error	
		37.2		Parameter combination error	
	2042	42.1	Linear servo control error	Linear servo control error on the positioning detection	Linear servo motor use
			Servo control error	Servo control error by position deviation	Direct drive motor use
		42.2	Linear servo control error	Linear servo control error on the speed detection	Linear servo motor use
			Servo control error	Servo control error by speed deviation	Direct drive motor use
		42.3	Linear servo control error	Linear servo control error on the thrust detection	Linear servo motor use
			Servo control error	Servo control error by torque detection	Direct drive motor use

(Note-1): The details name is different when using the linear servo motors. Refer to the "Servo Amplifier Instruction Manual" for details.
(Note-2): The details name is different when using the direct drive motors. Refer to the "Servo Amplifier Instruction Manual" for details.

Classification of errors	Error code	Servo amplifier LED display	Name	Details name	Remarks
Servo amplifier errors	2045	45.1	Main circuit device overheat	Main circuit abnormal temperature	
		45.2		Board temperature error	
	2046	46.1	Servo motor overheat (Note-2)	Encoder thermal sensor error	
		46.2		Linear servo motor thermal sensor error	Linear servo motor use
				Direct drive motor thermal sensor error	Direct drive motor use
		46.3		Thermistor wire disconnected error	Linear servo motor/Direct drive motor use
	2047	47.1	Cooling fan error	Cooling fan stop error	
		47.2		Decreased cooling fan speed error	
	2050	50.1	Overload 1	Thermal overload error 1 during operation	
		50.2		Thermal overload error 2 during operation	
		50.3		Thermal overload error 4 during operation	
		50.4		Thermal overload error 1 during a stop	
		50.5		Thermal overload error 2 during a stop	
		50.6		Thermal overload error 4 during a stop	
	2051	51.1	Overload 2	Thermal overload error 3 during operation	
		51.2		Thermal overload error 3 during a stop	
	2052	52.3	Error excessive	Excess droop pulse existing between the model position and the actual servo motor position	
		52.4		Maximum deviation at 0 torque limit	
	2060	1A.1	Motor combination error	Motor combination error	
	2061	2A.1	Linear encoder error 1	Linear encoder side error 1	Linear servo motor use
		2A.2		Linear encoder side error 2	
		2A.3		Linear encoder side error 3	
		2A.4		Linear encoder side error 4	
		2A.5		Linear encoder side error 5	
		2A.6		Linear encoder side error 6	
		2A.7		Linear encoder side error 7	
		2A.8		Linear encoder side error 8	
	2063	1E.1	Encoder initial communication error 2	Encoder failure	
	2064	1F.1	Encoder initial communication error 3	Incompatible encoder	
	2088	888	Watchdog	—	

(Note-1): The details name is different when using the linear servo motors. Refer to the "Servo Amplifier Instruction Manual" for details.

(Note-2): The details name is different when using the direct drive motors. Refer to the "Servo Amplifier Instruction Manual" for details.

(4) MR-J3-☐B-RJ004 (For linear servo)

Classification of errors	Error code	Servo amplifier LED display	Name	Remarks
Servo amplifier errors	2010	10	Undervoltage	
	2012	12	Memory error 1 (RAM)	
	2013	13	Clock error	
	2015	15	Memory error 2 (EEP-ROM)	
	2016	16	Encoder error 1 (At power on)	
	2017	17	Board error	
	2019	19	Memory error 3 (Flash ROM)	
	2020	20	Encoder error 2	
	2024	24	Main circuit error	
	2027	27	Initial magnetic pole detection error	
	2028	28	Linear encoder error 2	
	2030	30	Regenerative error	
	2031	31	Overspeed	
	2032	32	Overcurrent	
	2033	33	Overvoltage	
	2034	34	Receive error 1	
	2035	35	Command frequency alarm	
	2036	36	Receive error 2	
	2037	37	Parameter error	
	2042	42	Linear servo control error	
	2045	45	Main circuit device overheat	
	2046	46	Linear servo motor overheat	
	2047	47	Cooling fan alarm	
	2050	50	Overload 1	
	2051	51	Overload 2	
	2052	52	Error excessive	
	2061	2A	Linear encoder error 1	
	2088	888	Watchdog	

(5) MR-J3-□B-RJ006 (For fully closed control)

Classification of errors	Error code	Servo amplifier LED display	Name	Remarks
Servo amplifier errors	2010	10	Undervoltage	
	2012	12	Memory error 1 (RAM)	
	2013	13	Clock error	
	2015	15	Memory error 2 (EEP-ROM)	
	2016	16	Encoder error 1 (At power on)	
	2017	17	Board error	
	2019	19	Memory error 3 (Flash ROM)	
	2020	20	Encoder error 2 (During runtime)	
	2021	21	Encoder error 3 (During runtime)	
	2024	24	Main circuit error	
	2028	28	Linear encoder error 2	
	2030	30	Regenerative error	
	2031	31	Overspeed	
	2032	32	Overcurrent	
	2033	33	Overvoltage	
	2034	34	Receive error 1	
	2035	35	Command frequency alarm	
	2036	36	Receive error 2	
	2037	37	Parameter error	
	2042	42	Fully closed control error detection	
	2045	45	Main circuit device overheat	
	2046	46	Servo motor overheat	
	2047	47	Cooling fan alarm	
	2050	50	Overload 1	
	2051	51	Overload 2	
	2052	52	Error excessive	
	2060	1A	Motor combination error	
	2061	2A	Linear encoder error 1	
	2070	70	Load side encoder error 1	
	2071	71	Load side encoder error 2	
	2088	888	Watchdog	

(6) MR-J3-□B-RJ080W (For direct drive motor)

Classification of errors	Error code	Servo amplifier LED display	Name	Remarks
Servo amplifier errors	2010	10	Undervoltage	
	2012	12	Memory error 1 (RAM)	
	2013	13	Clock error	
	2015	15	Memory error 2 (EEP-ROM)	
	2016	16	Encoder error 1	
	2017	17	Board error	
	2019	19	Memory error 3 (Flash ROM)	
	2020	20	Encoder error 2	
	2021	21	Encoder error 3	
	2024	24	Main circuit error	
	2025	25	Absolute position erase	
	2027	27	Initial magnetic pole detection error	
	2030	30	Regenerative error	
	2031	31	Overspeed	
	2032	32	Overcurrent	
	2033	33	Overvoltage	
	2034	34	Receive error 1	
	2035	35	Command frequency alarm	
	2036	36	Receive error 2	
	2037	37	Parameter error	
	2042	42	Servo control error	
	2045	45	Main circuit device overheat	
	2046	46	Direct drive motor overheat	
	2047	47	Cooling fan alarm	
	2050	50	Overload 1	
	2051	51	Overload 2	
	2052	52	Error excessive	
	2060	1A	Motor combination error	
	2064	1F	Encoder combination error	
	2088	888	Watchdog	
	2913	2B	Encoder counter error	

(7) MR-J3-□BS (For safety servo)

Classification of errors	Error code	Servo amplifier LED display	Name	Remarks
Servo amplifier errors	2010	10	Undervoltage	
	2012	12	Memory error 1 (RAM)	
	2013	13	Clock error	
	2015	15	Memory error 2 (EEP-ROM)	
	2016	16	Encoder error 1 (At power on)	
	2017	17	Board error	
	2019	19	Memory error 3 (Flash ROM)	
	2020	20	Encoder error 2 (during runtime)	
	2021	21	Encoder error 3 (during runtime)	
	2024	24	Main circuit error	
	2025	25	Absolute position erase	
	2028	28	Linear encoder error 2	
	2030	30	Regenerative error	
	2031	31	Overspeed	
	2032	32	Overcurrent	
	2033	33	Overvoltage	
	2034	34	Receive error 1	
	2035	35	Command frequency error	
	2036	36	Receive error 2	
	2037	37	Parameter error	
	2042	42	Fully closed control error detection	
	2045	45	Main circuit device overheat	
	2046	46	Servo motor overheat	
	2047	47	Cooling fan error	
	2050	50	Overload 1	
	2051	51	Overload 2	
	2052	52	Error excessive	
	2056	56	Forced stop error	
	2070	70	Load side encoder error 1	
	2071	71	Load side encoder error 2	
	2060	1A	Motor combination error	
	2061	2A	Linear encoder error 1	
	2063	63	STO timing error	
	2088	888	Watchdog	

16.6 List of warnings

The following table shows the warning details and remedies to be taken when a warning occurs.

16.6.1 QD77MS detection warning

Classification of warnings	Warning code	Warning name	Warning	Operation status at warning occurrence	
—	000	(Normal status)	—	—	
Common warnings	100	Start during operation	• The start request is issued while the axis is BUSY. • Positioning was started during speed control mode/torque control mode.	Position control mode: The operation continues. Speed control mode/torque control mode: The operation continues. (Positioning start is not executed.)	
	104	Restart not possible	The restart command is issued when the axis operation status is not "Stopped".	Continue the operation.	
	109	Teaching in BUSY	The teaching request is issued while the axis is BUSY.	The warning is issued for the axis designated at the time of the teaching request.	
	110	Less than minimum speed	The overridden speed becomes “0”.	The system is controlled with the currently executing unit of 1.	
	111	In PLC READY	The request for writing to the flash ROM is issued when the PLC READY is turned ON.	The warning for axis 1 is issued.	
	112	Illegal override value	A value other than 1 to 300 is set for the override value.	• Controlled at a setting value of 0 : 100. • Controlled at a setting value of 301 or over : 300.	
	113	Outside new torque value range/outside forward new torque value range	A new torque value/forward new torque value is exceeded the torque limit setting value. (Note): When the individual setting is used for new torque value and reverse new torque value, it indicates outside forward new torque value.	The torque change is not carried out.	
	114	Below bias speed	The command speed is below the bias speed at start.	Operate by the bias speed at start.	
	115	Outside reverse new torque value range	A reverse new torque value is exceeded the torque limit setting value.	The torque change is not carried out.	

	Related buffer memory address		Set range (Setting with sequence program)	Remedy
	QD77MS2 QD77MS4	QD77MS16		
	—	—	—	—
	—	—	—	• Normalize the start request ON timing. • When in speed control mode/torque control mode, start positioning after switching to the position control mode.
	1503+100n	4303+100n	<Restart command> 1: Restart	Normalize the start request ON timing. (Refer to Section 6.5.5) (Do not issue the restart command when the axis operation is not stopped.)
	1548+100n 1549+100n	4348+100n 4349+100n	<Teaching data selection> 0, 1 <Teaching positioning data No.> 1 to 600	Carry out the teaching request when the axis is not BUSY. (Refer to Section 13.7.4)
	1513+100n	4313+100n	<Positioning operation speed override> 1 to 300	Prevent the overridden speed from being reduced to 0. (Refer to Section 13.5.2)
	Same as warning code 109			Request to write when the PLC READY signal [Y0] is OFF.
	1513+100n	4313+100n	<Positioning operation speed override> 1 to 300	Set a value within the setting range.
	1525+100n	4325+100n	<New torque value/forward new torque value > 0 to [Torque limit setting value]	Set a new torque value or a forward new torque value less than the limit value.
	26+150n		<Torque limit setting value> 1 to 1000	
	Refer to Section 5.3 "List of positioning data" for command speed		<Command speed> 1 to 1000000000 [PLS/s] 1 to 2000000000 [$\times 10^{-2}$mm/min or another]	Re-set the command speed/bias speed at start so that the command speed is equal to or larger than the bias speed at start.
	Bias speed at start 6+150n 7+150n		<Bias speed at start> 0 [PLS/s] 0 [$\times 10^{-2}$mm/min or another]	
	1564+100n	4364+100n	<Reverse new torque value> 0 to [Torque limit setting value]	Set a value which does not exceed the torque limit setting value as the reverse new torque value.
	26+150n		<Torque limit setting value> 1 to 1000	

Classification of warnings	Warning code	Warning name	Warning	Operation status at warning occurrence	
Common warnings	116	Optional data monitor data type setting error	In the optional data monitor, 2-word data is not set correctly.	Monitoring is not carried out. "0" is stored in Md.109 to Md.112 (Optional data monitor output 1 to 4).	
	120	Control mode switching during BUSY	Control mode switching was executed from the position control mode to the speed control mode/torque control mode while BUSY was turned ON.	The control mode is not switched. (Positioning during operation continues.)	
	121	Control mode switching during zero speed OFF	Control mode was changed when "Zero speed" (Md.108 Servo status) was turned OFF.	The control mode is not switched. (Current operation continues.)	
	122	Outside control mode range	Control mode switching request was performed by specifying a value outside the range for "Cd.139 Control mode setting".		
	123	Control mode switching	Control mode switching request was performed during the control mode switching.	Control mode switching request is not accepted.	
	125	Control mode switching not possible	• Control mode switching was performed from the position control mode to the continuous operation to torque control mode and then from the continuous operation to torque control mode to the speed control mode. • Control mode switching was performed from the speed control mode to the continuous operation to torque control mode and then from the continuous operation to torque control mode to the position control mode. • Control mode switching was performed between the torque control mode and continuous operation to torque control mode.	The control mode is not switched. (Current operation continues.)	
	126	VCII series parameter setting error	The servo parameter "Absolute position detection system (PA03)" is different from VCII series.	The operation is executed by the setting of VCII series.	
	130	Outside mark detection signal setting range	The mark detection signal setting is outside the range.	All mark detections are not operated.	
	131	Outside mark detection data type setting range	The mark detection data type setting is outside the range.		

Related buffer memory address		Set range (Setting with sequence program)	Remedy
QD77MS2 QD77MS4	QD77MS16		
Optional data monitor: Data type setting 1		—	Set the 2-word data to "Pr.91 Optional data monitor: Data type setting 1" or "Pr.93 Optional data monitor: Data type setting 3" and 0 to "Pr.92 Optional data monitor: Data type setting 2" or "Pr.94 Optional data monitor: Data type setting 4".
100+150n			
Optional data monitor: Data type setting 2			
101+150n			
Optional data monitor: Data type setting 3			
102+150n			
Optional data monitor: Data type setting 4			
103+150n			
—	—	—	Switch the control mode after turning BUSY OFF.
—	—	—	Switch the control mode after turning "Zero speed" (Md.108 Servo status) ON.
1575+100n	4375+100n	<Control mode setting> 0, 10, 20, 30	Switch the control mode after setting a value within the range for "Cd.139 Control mode setting".
—	—	—	Carry out the control mode switching request after completing the control mode switching.
—	—	—	Review so that control mode switching is performed between the position control mode and continuous operation to torque control mode or between the speed control mode and continuous operation to torque control mode.
30103+200n	28403+100n	<Servo parameter "Absolute position detection system (PA03)"> 0, 1	Match the setting of the servo parameter "Absolute position detection system (PA03)" to the setting of VCII series, and turn the PLC READY signal [Y0] from OFF to ON.
54000+20k		< Mark detection signal setting > 0 to 16	Set a value within the setting range.
54002+20k		< Mark detection data type > -1 to 12	

Classification of warnings	Warning code	Warning name	Warning	Operation status at warning occurrence
Common warnings	132	Outside mark detection data axis No. setting range	When the mark detection data type setting is not "Optional 2 word buffer memory", the mark detection data type setting is outside the range.	All mark detections are not operated.
	133	Outside mark detection data buffer memory No. setting range	When the mark detection data type setting is "Optional 2 word buffer memory", the mark detection data buffer memory No. is outside the range or odd number.	
JOG operation warnings	300	Speed change during deceleration	The speed change request is issued during deceleration stop with JOG start signal OFF.	The speed change is not carried out.
	301	JOG speed limit value	• The JOG speed (Note-1) is exceeded the speed limit value at start. • The new speed value (Note-1) exceeds the JOG speed limit value when the speed is changed during operation. (Note-1): This speed is a value in which override value is considered when override function is used. (" Cd.13 Positioning operation speed override" is set other then 100[%].)	• When the speed exceeds the JOG speed limit, the JOG operation is carried out with the JOG speed limit value. • While the speed is limited by the JOG speed limit value, the " Md.39 In speed limit flag" is turned ON.
Manual pulse generator operation warnings	401	Outside manual pulse generator input magnification range	The manual pulse generator 1 pulse input magnification is set to 0, 10001 or more, or negative value.	• When input magnification is set at 10001 or more, or negative value: Re-set to 10000. • When input magnification is set at 0: Re-set to 1.

Related buffer memory address		Set range (Setting with sequence program)	Remedy
QD77MS2 QD77MS4	QD77MS16		
54003+20k		< Mark detection data axis No.> 1 to 16, 801 to 804	Set a value within the setting range.
54004+20k 54005+20k		<Mark detection data buffer memory No.> 0 to 65534	Set a value with an even number within the setting range.
JOG speed		<JOG speed> 1 to 1000000000 [PLS/s] 1 to 2000000000 [$\times 10^{-2}$mm/min or another]	Do not carry out the JOG speed change during deceleration with the JOG start signal OFF.
1518+100n 1519+100n	4318+100n 4319+100n		
New speed value		<New speed value> 0 to 1000000000 [PLS/s] 0 to 2000000000 [$\times 10^{-2}$mm/min or another]	Set a value within the setting range.
1514+100n 1515+100n	4314+100n 4315+100n		
JOG speed limit value		<JOG speed limit value> 1 to 1000000000 [PLS/s] 1 to 2000000000 [$\times 10^{-2}$mm/min or another]	
48+150n 49+150n			
Positioning operation speed override		< Positioning operation speed override > 1 to 300 [%]	
1513+100n	4313+100n		
1522+100n 1523+100n	4322+100n 4323+100n	<Manual pulse generator 1 pulse input magnification> 1 to 1000	Set the manual pulse generator 1 pulse input magnification to within the setting range.

Classification of warnings	Warning code	Warning name	Warning	Operation status at warning occurrence
Positioning operation warnings	500	Deceleration/stop speed change	The speed change request is issued during deceleration stop.	The speed change is not carried out.
	501	Speed limit value over	• Setting speeds (Note-2) exceed the speed limit value when starting/restarting the positioning or when changing the speed at the positioning (Note-1). (At the interpolation control, either of reference axes or interpolation axes exceeds the speed limit value.) • "Command speed at speed control mode" exceeds "Pr.8 Speed limit value" during the speed control mode. • "Cd.146 Speed limit value at torque control mode" exceeds "Pr.8 Speed limit value" during the torque control mode. • "Cd.147 Speed limit value at continuous operation to torque control mode" exceeds "Pr.8 Speed limit value" during the continuous operation to torque control mode. (Note-1): The speed change by position-speed switching control, target position change function, or override function is contained. (Note-2): This speed is a value in which override value is considered when override function is used. ("Cd.13 Positioning operation speed override" is set other then 100[%].)	[Position control mode] • The speed is controlled with the speed limit value. • The "Md.39 In speed limit flag" is turned ON. [Speed control mode/Torque control mode/Continuous operation to torque control] • The speed is controlled with the speed limit value. (The "Md.39 In speed limit flag" is not turned ON.)
	503	M code ON signal ON start	The M code ON signal is turned ON when the positioning data is executed.	Continue executing the positioning data.
	505	No operation termination setting	In the positioning by block starting, the 50th point of the positioning start data is set to CONTINUE.	The operation is terminated.
	506	FOR to NEXT nest construction	FOR to NEXT is nested.	The operation is continued.
	508	Speed-position switching (during acceleration) signal ON	The switching signal for speed-position switching control (INC mode) is turned ON during acceleration.	

Related buffer memory address		Set range (Setting with sequence program)	Remedy
QD77MS2 QD77MS4	QD77MS16		
1516+100n	4316+100n	<Speed change request> 1: Speed change is requested	Do not carry out the speed change during deceleration with a stop command, during stoppage, or during automatic deceleration with position control.
OPR speed		<OPR speed> 1 to 1000000000 [PLS/s] 1 to 2000000000 [$\times 10^{-2}$mm/min or another]	Review each speed so that setting speeds do not exceed the speed limit value.
74+150n 75+150n			
Command speed		<Command speed> 1 to 1000000000 [PLS/s] 1 to 2000000000 [$\times 10^{-2}$mm/min or another]	
Refer to Section 5.3 "List of positioning data"			
New speed value		<New speed value> 0 to 1000000000 [PLS/s] 0 to 2000000000 [$\times 10^{-2}$mm/min or another]	
1514+100n 1515+100n	4314+100n 4315+100n		
Position-speed switching control speed change register		<Position-speed switching control speed change register> 0 to 1000000000 [PLS/s] 0 to 2000000000 [$\times 10^{-2}$mm/min or another]	
1530+100n 1531+100n	4330+100n 4331+100n		
Target position change value (New speed)		<Target position change value (New speed)> 0 to 1000000000 [PLS/s] 0 to 2000000000 [$\times 10^{-2}$mm/min or another]	
1536+100n 1537+100n	4336+100n 4337+100n		
Speed limit value		<JOG speed limit value> 1 to 1000000000 [PLS/s] 1 to 2000000000 [$\times 10^{-2}$mm/min or another]	
10+150n 11+150n			
Positioning operation speed override		<Positioning operation speed override> 1 to 300[%]	
1513+100n	4313+100n		
Command speed at speed control mode		<Command speed at speed control mode> -1000000000 to 1000000000 [PLS/s] -2000000000 to 2000000000 [$\times 10^{-2}$mm/min or another]	
1576+100n 1577+100n	4376+100n 4377+100n		
Speed limit value at torque control mode		<Speed limit value at torque control mode> 0 to 1000000000 [PLS/s] 0 to 2000000000 [$\times 10^{-2}$mm/min or another]	
1584+100n 1585+100n	4384+100n 4385+100n		
Speed limit value at continuous operation to torque control mode		< Speed limit value at continuous operation to torque control mode > -1000000000 to 1000000000 [PLS/s] -2000000000 to 2000000000 [$\times 10^{-2}$mm/min or another]	
1586+100n 1587+100n	4386+100n 4387+100n		
1504+100n	4304+100n	<M code OFF request> 1: M code ON signal is turned OFF	Normalize the ON and OFF timings of the "M code OFF request". (Refer to Section 13.7.3)
Refer to Section 5.3 "List of positioning data"		<Operation pattern> 00: Positioning end 01: Continuous positioning control 11: Continuous path control	Set the operation termination to the 50th point. (Refer to Chapter 10)
—	—	—	Make 1 nest construction for FOR to NEXT. (Refer to Section 10.3.8)
—	—	—	Do not turn ON the speed-position switching signal during acceleration. (Refer to Section 9.2.16)

Classification of warnings	Warning code	Warning name	Warning	Operation status at warning occurrence	
Positioning operation warnings	509	Insufficient remaining distance	• At a continuous operation interrupt request, the distance required deceleration stop is not long enough. • At a speed change request, the remaining distance is shorter than the distance required for speed change.	• When a command speed is changed: Change to a value as near a new speed value as possible. • When a target position is changed: Adjust the speed to a value as near the command speed as possible, and then change to a target position. (When the operation pattern is a continuous path control, ignore the operations stated above.)	
	511	Step not possible	Code 1 is set for the step start information when the step is outside standby.	The step will not start.	
	512	Illegal external command function	The detailed parameter 2 "External command function selection" setting range is exceeded.	Even if the external command signal is turned ON, the system will not perform anything.	
	513	Insufficient movement amount	The movement amount is not large enough for automatic deceleration.	The system stops immediately after it reaches the positioning address.	
	514	Outside command speed range	• The speed change value is outside the setting range when changing the speed during operation (Note-1) • "Cd.140 Command speed at speed control mode" is outside the setting range during the speed control mode. • "Cd.146 Speed limit value at torque control mode" is outside the setting range during the torque control mode. (Note-1): The speed change by position-speed switching control or target position change function is contained.	• The speed change value is controlled as the "maximum value within the setting range". • The "Md.39 In speed limit flag" is turned ON.	
	516	Illegal teaching data No.	The positioning data No. is set outside the setting range.	Teaching is not carried out when the set value is 0 or 601 or more. (The set value is automatically reset to "0" by the Simple Motion module even when a "0" or "601" or more is set.)	
	517	Illegal teaching data selection	The teaching data selection set value is outside the setting range.	Teaching is not carried out.	

Related buffer memory address		Set range (Setting with sequence program)	Remedy
QD77MS2 QD77MS4	QD77MS16		
—	—	—	Give a request at the position where there is an enough remaining distance.
1546+100n	4346+100n	<Step start information> 1: Step is continued 2: Re-start is carried out	Do not set a "1" to the step start information when the step is not in standby state. (Refer to Section 13.7.1)
62+150n		<External command function selection> 0, 1, 2, 3, 4	Set the detailed parameter 2 "External command function selection" to within the setting range.
Refer to Section 5.3 "List of positioning data"		—	Set a decelerating address or a movement amount to the positioning data.
New speed value		<New speed value> 0 to 1000000000 [PLS/s] 0 to 2000000000 [$\times 10^{-2}$mm/min or another]	• Set the speed change value to within the setting range. • Set "Cd.140 Command speed at speed control mode" to within the setting range during the speed control mode. • Set "Cd.146 Speed limit value at torque control mode" to within the setting range during the torque control mode.
1514+100n 1515+100n	4314+100n 4315+100n		
Position-speed switching control speed change register		<Position-speed switching control speed change register> 0 to 1000000000 [PLS/s] 0 to 2000000000 [$\times 10^{-2}$mm/min or another]	
1530+100n 1531+100n	4330+100n 4331+100n		
Target position change value (New speed)		<Target position change value (New speed)> 0 to 1000000000 [PLS/s] 0 to 2000000000 [$\times 10^{-2}$mm/min or another]	
1536+100n 1537+100n	4336+100n 4337+100n		
Command speed at speed control mode		<Command speed at speed control mode> -1000000000 to 1000000000 [PLS/s] -2000000000 to 2000000000 [$\times 10^{-2}$mm/min or another]	
1576+100n 1577+100n	4376+100n 4377+100n		
Speed limit value at torque control mode		<Speed limit value at torque control mode> 0 to 1000000000 [PLS/s] 0 to 2000000000 [$\times 10^{-2}$mm/min or another]	
1584+100n 1585+100n	4384+100n 4385+100n		
1549+100n	4349+100n	<Teaching positioning data No.> 1 to 600	Set the positioning data No. to within the setting range.
1548+100n	4348+100n	<Teaching data selection> 0, 1	Set the teaching data selection set value to within the setting range.

Classification of warnings	Warning code	Warning name	Warning	Operation status at warning occurrence
Positioning operation warnings	518	Target position change not possible	• A target position change request was given for the control system other than ABS1 and INC1. • A target position change request is turned ON during continuous path control. • A new target position address is outside the software stroke limit range. • A target position change request was given during deceleration to a stop. • A target position change request was issued when speed change 0 flag (Md.31 Status: b10) was ON. • A target position change request was given during speed control mode, torque control mode or continuous operation to torque control mode.	The target position change is not carried out.
	520	Torque limit value over	• A value exceeding "Pr.17 Torque limit setting value" is set to "Cd.143 Command torque at torque control mode" at torque control mode. • A value exceeding "Pr.17 Torque limit setting value" is set to "Cd.150 Target torque at continuous operation to torque control mode" at continuous operation to torque control mode.	The torque is controlled with the torque limit setting value.
	521	Torque initial value selection invalid	• The servo parameter "Function selection C-B POL reflection selection at torque control (PC29)" is "0: Enabled" on the axis that set feedback torque into the torque initial value selection.	The initial value selection is controlled as the command torque.

Related buffer memory address		Set range (Setting with sequence program)	Remedy
QD77MS2 QD77MS4	QD77MS16		
1538+100n	4338+100n	<Target position change request flag> 1: Target position change request	• Do not turn ON the target position change request in the following cases. 1) An operating pattern "continuous path control" is used. 2) A control system other than ABS1, and INC1 is used. 3) During deceleration stop. 4) When speed change 0 flag (Md.31 Status: b10) is ON. 5) During speed control mode 6) During torque control mode 7) During continuous operation to torque control mode • When the target position change address is outside the software stroke limit range, correct the target position change address. (Refer to Section 13.5.5)
Command torque at torque control mode		<Command torque at torque control mode> -10000 to 10000 [$\times 10^{-1}$%]	Review the setting value so that the setting torque is not exceeded the torque limit setting value.
1580+100n	4380+100n		
Target torque at continuous operation to torque control		< Target torque at continuous operation to torque control > -10000 to 10000 [$\times 10^{-1}$%]	
1590+100n	4390+100n		
Torque limit setting value			
26+150n		<Torque limit setting value> 1 to 1000[%]	
Operation setting for speed-torque control mode		<Torque initial value selection (b4 to b7)> 0, 1	• Use a servo amplifier which supports the servo parameter "Function selection C-B POL reflection selection at torque control (PC29)" and set (PC29) to "1: Disabled". • Set the torque initial value selection invalid to command torque.
68+150n			
POL reflection setting at torque control		<POL reflection setting at torque control> 0, 1	
30192+200n	28492+100n		

16.6.2 Servo amplifier detection warning

The detection warning list for Servo amplifier is shown below.
Refer to each servo amplifier instruction manual for details.

(1) MR-J4(W)-B

Classification of warnings	Warning code	Servo amplifier LED display	Name	Details name	Remarks
Servo amplifier warnings	2095	95.1	STO warning	STO1 off detection	
		95.2		STO2 off detection	
	2101	91.1	Servo amplifier overheat warning	Main circuit device overheat warning	
	2102	92.1	Battery cable disconnection warning	Encoder battery cable disconnection warning	
		92.3		Battery degradation	
	2106	96.1	Home position setting warning	In-position warning at home positioning	
		96.2		Command input warning at home positioning	
	2116	9F.1	Battery warning	Low battery	
		9F.2		Battery degradation warning	
	2140	E0.1	Excessive regeneration warning	Excessive regeneration warning	
	2141	E1.1	Overload warning 1	Thermal overload warning 1 during operation	
		E1.2		Thermal overload warning 2 during operation	
		E1.3		Thermal overload warning 3 during operation	
		E1.4		Thermal overload warning 4 during operation	
		E1.5		Thermal overload error 1 during a stop	
		E1.6		Thermal overload error 2 during a stop	
		E1.7		Thermal overload error 3 during a stop	
		E1.8		Thermal overload error 4 during a stop	
	2142	E2.1	Servo motor overheat warning	Servo motor temperature warning	
	2143	E3.2	Absolute position counter warning	Encoder absolute positioning counter warning	
		E3.5		Absolute position counter warning	

Classification of warnings	Warning code	Servo amplifier LED display	Name	Details name	Remarks
Servo amplifier warnings	2144	E4.1	Parameter warning	Parameter setting range error warning	
	2146	E6.1	Servo forced stop warning	Forced stop warning	
	2147	E7.1	Controller forced stop warning	Controller forced stop warning	
	2148	E8.1	Cooling fan speed reduction warning	Decreased cooling fan speed warning	
		E8.2		Cooling fan stop	
	2149	E9.1	Main circuit off warning	Servo-on signal on during main circuit off	
		E9.2		Bus voltage drop during low speed operation	
		E9.3		Ready-on signal on during main circuit off	
	2151	EB.1	The other axis error warning	The other axis error warning	MR-J4W-☐B use
	2152	EC.1	Overload warning 2	Overload warning 2	
	2153	ED.1	Output watt excess warning	Output watt excess warning	
	2160	F0.1	Tough drive warning	Instantaneous power failure tough drive warning	
		F0.3		Vibration tough drive warning	
	2162	F2.1	Drive recorder - Miswriting warning	Drive recorder - Area writing time-out warning	
		F2.2		Drive recorder - Data miswriting warning	
	2163	F3.1	Oscillation detection warning	Oscillation detection warning	

(2) MR-J3-☐B

Classification of warnings	Warning code	Servo amplifier LED display	Warning name	Remarks
Servo amplifier warnings	2102	92	Open battery cable warning	
	2106	96	Home position setting warning	
	2116	9F	Battery warning	
	2140	E0	Excessive regenerative load warning	
	2141	E1	Over load warning1	
	2143	E3	Absolute position counter warning	
	2144	E4	Parameter warning	
	2146	E6	Servo forced stop warning	
	2147	E7	Controller forced stop warning	
	2148	E8	Cooling fan speed reduction warning	
	2149	E9	Main circuit of warning	
	2152	EC	Overload warning 2	
	2153	ED	Output watt excess warning	
	2956	9C	Converter warning	

(3) MR-J3W-□B

Classification of warnings	Warning code	Servo amplifier LED display	Name	Details name	Remarks
Servo amplifier warnings	2101	91.1	Main circuit device overheat warning	Main circuit device overheat warning	
		91.2		Board temperature warning	
	2102	92.1	Battery cable disconnection warning	Encoder battery disconnection warning signal detection	
	2106	96.1	Home position setting warning	INP error at home positioning	
		96.2		Command input error at home positioning	
	2116	9F.1	Battery warning	Low battery	
		9F.2		Battery degradation	Direct drive motor use
	2140	E0.1	Excessive regeneration warning	Excessive regeneration warning	
	2141	E1.1	Overload warning 1	Thermal overload warning 1 during operation	
		E1.2		Thermal overload warning 2 during operation	
		E1.3		Thermal overload warning 3 during operation	
		E1.4		Thermal overload warning 4 during operation	
		E1.5		Thermal overload warning 1 during a stop	
		E1.6		Thermal overload warning 2 during a stop	
		E1.7		Thermal overload warning 3 during a stop	
		E1.8		Thermal overload warning 4 during a stop	
	2142	E2.1	Linear servo motor overheat warning	Linear servo motor overheat warning	Linear servo motor use
			Direct drive motor overheat warning	Direct drive motor overheat warning	Direct drive motor use
	2143	E3.1	Absolute position counter warning	Multi-revolution counter movement amount excess warning	
		E3.2		Absolute position counter warning	
		E3.5		Absolute position counter in encoder warning	
	2144	E4.1	Parameter warning	Parameter setting range error warning	
	2146	E6.1	Servo forced stop warning	Forced stop warning	
	2147	E7.1	Controller forced stop warning	Controller forced stop warning	
	2148	E8.1	Cooling fan speed reduction warning	Decreased cooling fan speed warning	
	2149	E9.1	Main circuit off warning	Servo-on signal on at main circuit off	
		E9.2		Bus voltage drop during low speed operation (Note)	
		E9.3		Ready-on signal on during main circuit off	
	2151	EB.1	The other axis fault warning	The other axis fault warning	
	2152	EC.1	Overload warning 2	Overload warning 2	
	2153	ED.1	Output watt excess warning	Output watt excess	
	2913	2B.1	Encoder counter error	Encoder counter error 1	Direct drive motor use
		2B.2		Encoder counter error 2	

(Note): The details name is different when using the linear servo motors. Refer to the "Servo Amplifier Instruction Manual" for details.

(4) MR-J3-□B-RJ004 (For linear servo)

Classification of warnings	Warning code	Servo amplifier LED display	Name	Remarks
Servo amplifier warnings	2106	96	Home position setting error	
	2140	E0	Excessive regeneration warning	
	2141	E1	Overload warning 1	
	2142	E2	Linear servo motor overheat warning	
	2144	E4	Parameter warning	
	2146	E6	Servo forced stop warning	
	2147	E7	Controller emergency stop warning	
	2148	E8	Cooling fan speed reduction warning	
	2149	E9	Main circuit off warning	
	2152	EC	Overload warning 2	
	2153	ED	Output watt excess warning	

(5) MR-J3-□B-RJ006 (For fully closed control)

Classification of warnings	Warning code	Servo amplifier LED display	Name	Remarks
Servo amplifier warnings	2106	96	Home position setting error	
	2140	E0	Excessive regeneration warning	
	2141	E1	Overload warning 1	
	2144	E4	Parameter warning	
	2146	E6	Servo forced stop warning	
	2147	E7	Controller emergency stop warning	
	2148	E8	Cooling fan speed reduction warning	
	2149	E9	Main circuit off warning	
	2152	EC	Overload warning 2	
	2153	ED	Output watt excess warning	

(6) MR-J3-□B-RJ080W (For direct drive motor)

Classification of warnings	Warning code	Servo amplifier LED display	Name	Remarks
Servo amplifier warnings	2102	92	Battery cable disconnection warning	
	2106	96	Home position setting error	
	2116	9F	Battery warning	
	2140	E0	Excessive regeneration warning	
	2141	E1	Overload warning 1	
	2142	E2	Direct drive motor overheat	
	2143	E3	Absolute position counter warning	
	2144	E4	Parameter warning	
	2146	E6	Servo forced stop warning	
	2147	E7	Controller emergency stop warning	
	2148	E8	Cooling fan speed reduction warning	
	2149	E9	Main circuit off warning	
	2152	EC	Overload warning 2	
	2153	ED	Output watt excess warning	

(7) MR-J3-□BS (For safety servo)

Classification of warnings	Warning code	Servo amplifier LED display	Name	Remarks
Servo amplifier warnings	2095	95	STO warning	
	2102	92	Battery cable disconnection warning	
	2106	96	Home position setting warning	
	2116	9F	Battery warning	
	2140	E0	Excessive regeneration warning	
	2141	E1	Overload warning 1	
	2143	E3	Absolute position counter warning	
	2144	E4	Parameter warning	
	2146	E6	Servo forced stop warning	
	2147	E7	Controller forced stop warning	
	2148	E8	Cooling fan speed reduction warning	
	2149	E9	Main circuit off warning	
	2152	EC	Overload warning 2	
	2153	ED	Output watt excess warning	

Appendices

Appendix 1 List of buffer memory addresses

The following shows the relation between the buffer memory addresses and the various items.

(Note-1): Do not use the buffer memory address that not been described here for a "Maker setting".

(Note-2): For the list of buffer memory addresses for positioning data, refer to the "Simple Motion Module Setting Tool Help" of GX Works2.

(Note-3): For the list of buffer memory addresses used in synchronous control, refer to the "MELSEC-Q/L QD77MS/QD77GF/LD77MS/LD77MH Simple Motion Module User's Manual (Synchronous Control)".

(Note-4): Guide to buffer memory address

- In the buffer memory address, "n" in "1+150n", etc. indicates a value corresponding to axis No.
  Calculate as follows for the buffer memory address corresponding to each axis.
  (Example) For axis No. 16
  1+150n (Pr.4 Unit magnification (AM))=1+150×15=2251
- In the buffer memory address, "p" in "4012+5p", etc. indicates a pointer No.
  Calculate as follows for the buffer memory address corresponding to each pointer No.
  (Example) For pointer No. 15
  4012+5p (Md.3 Start information)=4012+5×15=4087

Buffer memory address		Compatibility of setting value of QD77MS2/ QD77MS4 and QD77MS16	Item	Memory area	
QD77MS2 QD77MS4	QD77MS16				
0+150n		○	Pr.1 Unit setting	Basic parameters 1	Positioning parameters
1+150n		○	Pr.4 Unit magnification (AM)		
2+150n 3+150n		○	Pr.2 Number of pulses per rotation (AP)		
4+150n 5+150n		○	Pr.3 Movement amount per rotation (AL)		
6+150n 7+150n		○	Pr.7 Bias speed at start		
10+150n 11+150n		○	Pr.8 Speed limit value	Basic parameters 2	
12+150n 13+150n		○	Pr.9 Acceleration time 0		
14+150n 15+150n		○	Pr.10 Deceleration time 0		

n: Axis No.-1

○: Compatible △: Partly compatible ×: Not compatible

Buffer memory address		Compatibility of setting value of QD77MS2/ QD77MS4 and QD77MS16	Item	Memory area	
QD77MS2 QD77MS4	QD77MS16				
17+150n		○	Pr.11 Backlash compensation amount	Detailed parameters 1	Positioning parameters
18+150n 19+150n		○	Pr.12 Software stroke limit upper limit value		
20+150n 21+150n		○	Pr.13 Software stroke limit lower limit value		
22+150n		○	Pr.14 Software stroke limit selection		
23+150n		○	Pr.15 Software stroke limit valid/invalid setting		
24+150n 25+150n		○	Pr.16 Command in-position width		
26+150n		○	Pr.17 Torque limit setting value		
27+150n		○	Pr.18 M code ON signal output timing		
28+150n		○	Pr.19 Speed switching mode		
29+150n		○	Pr.20 Interpolation speed designation method		
30+150n		○	Pr.21 Current feed value during speed control		
31+150n		○	Pr.22 Input signal logic selection		
32+150n		△	Pr.80 External input signal selection		
33		○	Pr.24 Manual pulse generator/Incremental synchronous encoder input selection		
34+150n		○	Pr.81 Speed-position function selection		
35		○	Pr.82 Forced stop valid/invalid selection		

n: Axis No.-1

○: Compatible △: Partly compatible ×: Not compatible

Buffer memory address		Compatibility of setting value of QD77MS2/ QD77MS4 and QD77MS16	Item	Memory area	
QD77MS2 QD77MS4	QD77MS16				
36+150n 37+150n		○	Pr.25 Acceleration time 1	Detailed parameters 2	Positioning parameters
38+150n 39+150n		○	Pr.26 Acceleration time 2		
40+150n 41+150n		○	Pr.27 Acceleration time 3		
42+150n 43+150n		○	Pr.28 Deceleration time 1		
44+150n 45+150n		○	Pr.29 Deceleration time 2		
46+150n 47+150n		○	Pr.30 Deceleration time 3		
48+150n 49+150n		○	Pr.31 JOG speed limit value		
50+150n		○	Pr.32 JOG operation acceleration time selection		
51+150n		○	Pr.33 JOG operation deceleration time selection		
52+150n		○	Pr.34 Acceleration/deceleration process selection		
53+150n		○	Pr.35 S-curve ratio		
54+150n 55+150n		○	Pr.36 Sudden stop deceleration time		
56+150n		○	Pr.37 Stop group 1 sudden stop selection		
57+150n		○	Pr.38 Stop group 2 sudden stop selection		
58+150n		○	Pr.39 Stop group 3 sudden stop selection		
59+150n		○	Pr.40 Positioning complete signal output time		
60+150n 61+150n		○	Pr.41 Allowable circular interpolation error width		
62+150n		○	Pr.42 External command function selection		
63+150n		○	Pr.83 Speed control 10 x multiplier setting for degree axis		
64+150n 65+150n		○	Pr.84 Restart allowable range when servo OFF to ON		
67		○	Pr.89 Manual pulse generator/incremental synchronous encoder input type selection		
68+150n		○	Pr.90 Operation setting for speed-torque control mode		
	69+150n	×	Pr.95 External command signal selection		
70+150n		○	Pr.43 OPR method	OPR basic parameters	OPR parameters
71+150n		○	Pr.44 OPR direction		
72+150n 73+150n		○	Pr.45 OP address		
74+150n 75+150n		○	Pr.46 OPR speed		
76+150n 77+150n		○	Pr.47 Creep speed		
78+150n		○	Pr.48 OPR retry		

n: Axis No.-1

○: Compatible △: Partly compatible ×: Not compatible

Buffer memory address		Compatibility of setting value of QD77MS2/ QD77MS4 and QD77MS16	Item	Memory area	
QD77MS2 QD77MS4	QD77MS16				
80+150n 81+150n		○	Pr.50 Setting for the movement amount after near-point dog ON	OPR detailed parameters	OPR parameters
82+150n		○	Pr.51 OPR acceleration time selection		
83+150n		○	Pr.52 OPR deceleration time selection		
84+150n 85+150n		○	Pr.53 OP shift amount		
86+150n		○	Pr.54 OPR torque limit value		
87+150n		○	Pr.55 Operation setting for incompletion of OPR		
88+150n		○	Pr.56 Speed designation during OP shift		
89+150n		○	Pr.57 Dwell time during OPR retry		
100+150n		○	Pr.91 Optional data monitor: Data type setting 1	Expansion parameter	
101+150n		○	Pr.92 Optional data monitor: Data type setting 2		
102+150n		○	Pr.93 Optional data monitor: Data type setting 3		
103+150n		○	Pr.94 Optional data monitor: Data type setting 4		
147	105	○	Pr.96 Operation cycle setting		
106		○	Pr.97 SSCNET setting		
114		○	Pr.114 External command signal compensation valid/invalid setting		

n: Axis No.-1

○: Compatible △: Partly compatible ×: Not compatible

Buffer memory address		Compatibility of setting value of QD77MS2/ QD77MS4 and QD77MS16	Item		Memory area	
QD77MS2 QD77MS4	QD77MS16					
1200	4000	○	Md.1 In test mode flag		System monitor data	Monitor data
1206 1207	4006 4007	○	Md.130 OS version			
1208	4008	○	Md.134 Operation time			
1209	4009	○	Md.135 Maximum operation time			
1211	4011	○	Md.131 Digital oscilloscope executing			
1212+5p	4012+5p	○	Md.3 Start information	Start history		
1213+5p	4013+5p	○	Md.4 Start No.			
1440+p	4240+p	○	Md.54 Start Year: month			
1214+5p	4014+5p	○	Md.5 Start Day: hour			
1215+5p	4015+5p	○	Md.6 Start Minute: second			
1216+5p	4016+5p	○	Md.7 Error judgment			
1292	4092	○	Md.8 Start history pointer			
1293+4p	4093+4p	○	Md.9 Axis in which the error occurred	Error history		
1294+4p	4094+4p	○	Md.10 Axis error No.			
31300+p		○	Md.57 Servo alarm			
1456+p	4256+p	○	Md.55 Axis error occurrence (Year: month)			
129 5+4p	4095+4p	○	Md.11 Axis error occurrence (Day: hour)			
1296+4p	4096+4p	○	Md.12 Axis error occurrence (Minute: second)			
1357	4157	○	Md.13 Error history pointer			
1358+4p	4158+4p	○	Md.14 Axis in which the warning occurred	Warning history		
1359+4p	4159+4p	○	Md.15 Axis warning No.			
31316+p		○	Md.58 Servo warning			
1472+p	4272+p	○	Md.56 Axis warning occurrence (Year: month)			
1360+4p	4160+4p	○	Md.16 Axis warning occurrence (Day: hour)			
1361+4p	4161+4p	○	Md.17 Axis warning occurrence (Minute: second)			
1422	4222	○	Md.18 Warning history pointer			
1424 1425	4224 4225	○	Md.19 Number of write accesses to flash ROM			
1431	4231	○	Md.50 Forced stop input			
1432	4232	○	Md.51 Amplifier–less operation mode status			
1433	4233	○	Md.53 SSCNET control status			
1434	4234	○	Md.52 Communication between amplifiers axes searching flag			
1435	4235	○	Md.59 Module information			
1438	4238	○	Md.132 Operation cycle setting			
1439	4239	○	Md.133 Operation cycle over flag			

p: Pointer No.-1

○: Compatible △: Partly compatible ×: Not compatible

Buffer memory address		Compatibility of setting value of QD77MS2/ QD77MS4 and QD77MS16	Item	Memory area	
QD77MS2 QD77MS4	QD77MS16				
800+100n 801+100n	2400+100n 2401+100n	○	Md.20 Current feed value	Axis monitor data	Monitor data
802+100n 803+100n	2402+100n 2403+100n	○	Md.21 Machine feed value		
804+100n 805+100n	2404+100n 2405+100n	○	Md.22 Feedrate		
806+100n	2406+100n	○	Md.23 Axis error No.		
807+100n	2407+100n	○	Md.24 Axis warning No.		
808+100n	2408+100n	○	Md.25 Valid M code		
809+100n	2409+100n	○	Md.26 Axis operation status		
810+100n 811+100n	2410+100n 2411+100n	○	Md.27 Current speed		
812+100n 813+100n	2412+100n 2413+100n	○	Md.28 Axis feedrate		
814+100n 815+100n	2414+100n 2415+100n	○	Md.29 Speed-position switching control positioning amount		
816+100n	2416+100n	○	Md.30 External input signal		
817+100n	2417+100n	△	Md.31 Status		
818+100n 819+100n	2418+100n 2419+100n	○	Md.32 Target value		
820+100n 821+100n	2420+100n 2421+100n	○	Md.33 Target speed		
824+100n 825+100n	2424+100n 2425+100n	○	Md.34 Movement amount after near-point dog ON		
826+100n	2426+100n	○	Md.35 Torque limit stored value/forward torque limit stored value		
827+100n	2427+100n	○	Md.36 Special start data instruction code setting value		
828+100n	2428+100n	○	Md.37 Special start data instruction parameter setting value		
829+100n	2429+100n	○	Md.38 Start positioning data No. setting value.		
830+100n	2430+100n	○	Md.39 In speed limit flag		
831+100n	2431+100n	○	Md.40 In speed change processing flag		
832+100n	2432+100n	○	Md.41 Special start repetition counter		
833+100n	2433+100n	○	Md.42 Control system repetition counter		
834+100n	2434+100n	○	Md.43 Start data pointer being executed		
835+100n	2435+100n	○	Md.44 Positioning data No. being executed		
836+100n	2436+100n	○	Md.45 Block No. being executed		
837+100n	2437+100n	○	Md.46 Last executed positioning data No.		

n: Axis No.-1

○: Compatible △: Partly compatible ×: Not compatible

Buffer memory address		Compatibility of setting value of QD77MS2/ QD77MS4 and QD77MS16	Item		Memory area	
QD77MS2 QD77MS4	QD77MS16					
838+100n	2438+100n	△	Md.47 Positioning data being executed	Positioning identifier	Axis monitor data	Monitor data
839+100n	2439+100n	○		M code		
840+100n	2440+100n	○		Dwell time		
	2441+100n	×		Axis to be interpolated		
842+100n 843+100n	2442+100n 2443+100n	○		Command speed		
844+100n 845+100n	2444+100n 2445+100n	○		Positioning address		
846+100n 847+100n	2446+100n 2447+100n	○		Arc address		
848+100n 849+100n	2448+100n 2449+100n	○	Md.100 OPR re-travel value			
850+100n 851+100n	2450+100n 2451+100n	○	Md.101 Real current value			
852+100n 853+100n	2452+100n 2453+100n	○	Md.102 Deviation counter value			
854+100n 855+100n	2454+100n 2455+100n	○	Md.103 Motor rotation speed			
856+100n	2456+100n	○	Md.104 Motor current value			
858+100n	2458+100n	○	Md.125 Servo status3			
864+100n 865+100n 866+100n 867+100n 868+100n 869+100n	2464+100n 2465+100n 2466+100n 2467+100n 2468+100n 2469+100n	○	Md.106 Servo amplifier software No.			
870+100n	2470+100n	○	Md.107 Parameter error No.			
876+100n	2476+100n	○	Md.108 Servo status			
877+100n	2477+100n	○				
878+100n	2478+100n	○	Md.109 Regenerative load ratio/Optional data monitor output 1			
879+100n	2479+100n	○	Md.110 Effective load torque/Optional data monitor output 2			
880+100n	2480+100n	○	Md.111 Peak torque ratio/Optional data monitor output 3			
881+100n	2481+100n	○	Md.112 Optional data monitor output 4			
887+100n	2487+100n	○	Md.113 Semi/Fully closed loop status			
888+100n	2488+100n	○	Md.114 Servo alarm			
890+100n	2490+100n	○	Md.116 Encoder option information			
891+100n	2491+100n	○	Md.120 Reverse torque limit stored value			
892+100n 893+100n	2492+100n 2493+100n	○	Md.122 Speed during command			
894+100n	2494+100n	○	Md.123 Torque during command			
895+100n	2495+100n	○	Md.124 Control mode switching status			
899+100n	2499+100n	○	Md.48 Deceleration start flag			

n: Axis No.-1

○: Compatible △: Partly compatible ×: Not compatible

Buffer memory address		Compatibility of setting value of QD77MS2/ QD77MS4 and QD77MS16	Item	Memory area	
QD77MS2 QD77MS4	QD77MS16				
1500+100n	4300+100n	○	Cd.3 Positioning start No.	Axis control data	Control data
1501+100n	4301+100n	○	Cd.4 Positioning starting point No.		
1502+100n	4302+100n	○	Cd.5 Axis error reset		
1503+100n	4303+100n	○	Cd.6 Restart command		
1504+100n	4304+100n	○	Cd.7 M code OFF request		
1505+100n	4305+100n	○	Cd.8 External command valid		
1506+100n 1507+100n	4306+100n 4307+100n	○	Cd.9 New current value		
1508+100n 1509+100n	4308+100n 4309+100n	○	Cd.10 New acceleration time value		
1510+100n 1511+100n	4310+100n 4311+100n	○	Cd.11 New deceleration time value		
1512+100n	4312+100n	○	Cd.12 Acceleration/deceleration time change during speed change, enable/disable selection		
1513+100n	4313+100n	○	Cd.13 Positioning operation speed override		
1514+100n 1515+100n	4314+100n 4315+100n	○	Cd.14 New speed value		
1516+100n	4316+100n	○	Cd.15 Speed change request		
1517+100n	4317+100n	○	Cd.16 Inching movement amount		
1518+100n 1519+100n	4318+100n 4319+100n	○	Cd.17 JOG speed		
1520+100n	4320+100n	○	Cd.18 Interrupt request during continuous operation		
1521+100n	4321+100n	○	Cd.19 OPR request flag OFF request		
1522+100n 1523+100n	4322+100n 4323+100n	○	Cd.20 Manual pulse generator 1 pulse input magnification		
1524+100n	4324+100n	○	Cd.21 Manual pulse generator enable flag		
1525+100n	4325+100n	○	Cd.22 New torque value/forward new torque value		
1526+100n 1527+100n	4326+100n 4327+100n	○	Cd.23 Speed-position switching control movement amount change register		
1528+100n	4328+100n	○	Cd.24 Speed-position switching enable flag		
1530+100n 1531+100n	4330+100n 4331+100n	○	Cd.25 Position-speed switching control speed change register		
1532+100n	4332+100n	○	Cd.26 Position-speed switching enable flag		
1534+100n 1535+100n	4334+100n 4335+100n	○	Cd.27 Target position change value (New address)		
1536+100n 1537+100n	4336+100n 4337+100n	○	Cd.28 Target position change value (New speed)		
1538+100n	4338+100n	○	Cd.29 Target position change request flag		
	4339+100n	×	Cd.43 Simultaneous starting axis		

n: Axis No.-1

○: Compatible △: Partly compatible ×: Not compatible

Buffer memory address		Compatibility of setting value of QD77MS2/ QD77MS4 and QD77MS16	Item	Memory area	
QD77MS2 QD77MS4	QD77MS16				
1540+100n		×	Cd.30 Simultaneous starting axis start data No. (axis 1 start data No.)	Axis control data	Control data
	4340+100n		Cd.30 Simultaneous starting own axis start data No.		
1541+100n		×	Cd.31 Simultaneous starting axis start data No. (axis 2 start data No.)		
	4341+100n		Cd.31 Simultaneous starting axis start data No.1		
1542+100n		×	Cd.32 Simultaneous starting axis start data No. (axis 3 start data No.)		
	4342+100n		Cd.32 Simultaneous starting axis start data No.2		
1543+100n		×	Cd.33 Simultaneous starting axis start data No. (axis 4 start data No.)		
	4343+100n		Cd.33 Simultaneous starting axis start data No.3		
1544+100n	4344+100n	○	Cd.34 Step mode		
1545+100n	4345+100n	○	Cd.35 Step valid flag		
1546+100n	4346+100n	○	Cd.36 Step start information		
1547+100n	4347+100n	○	Cd.37 Skip command		
1548+100n	4348+100n	○	Cd.38 Teaching data selection		
1549+100n	4349+100n	○	Cd.39 Teaching positioning data No.		
1550+100n	4350+100n	○	Cd.40 ABS direction in degrees		
1551+100n	4351+100n	○	Cd.100 Servo OFF command		
1552+100n	4352+100n	○	Cd.101 Torque output setting value		
1554+100n	4354+100n	○	Cd.130 Parameter write request		
1555+100n	4355+100n	○	Cd.131 Parameter No·		
1556+100n 1557+100n	4356+100n 4357+100n	○	Cd.132 Change data		
1558+100n	4358+100n	○	Cd.133 Semi/Fully closed loop switching request		
1559+100n	4359+100n	○	Cd.108 Gain changing command		
1563+100n	4363+100n	○	Cd.112 Torque change function switching request		
1564+100n	4364+100n	○	Cd.113 Reverse new torque value		
1565+100n	4365+100n	○	Cd.136 PI-PID switching request		
1566+100n	4366+100n	○	Cd.45 Speed-position switching device selection		
1567+100n	4367+100n	○	Cd.46 Speed-position switching command		
1574+100n	4374+100n	○	Cd.138 Control mode switching request		
1575+100n	4375+100n	○	Cd.139 Control mode setting		
1576+100n 1577+100n	4376+100n 4377+100n	○	Cd.140 Command speed at speed control mode		

n: Axis No.-1

○: Compatible △: Partly compatible ×: Not compatible

Buffer memory address		Compatibility of setting value of QD77MS2/ QD77MS4 and QD77MS16	Item	Memory area	
QD77MS2 QD77MS4	QD77MS16				
1578+100n	4378+100n	○	Cd.141 Acceleration time at speed control mode	Axis control data	Control data
1579+100n	4379+100n	○	Cd.142 Deceleration time at speed control mode		
1580+100n	4380+100n	○	Cd.143 Command torque at torque control mode		
1581+100n	4381+100n	○	Cd.144 Torque time constant at torque control mode (Forward direction)		
1582+100n	4382+100n	○	Cd.145 Torque time constant at torque control mode (Negative direction)		
1584+100n 1585+100n	4384+100n 4385+100n	○	Cd.146 Speed limit value at torque control mode		
1586+100n 1587+100n	4386+100n 4387+100n	○	Cd.147 Speed limit value at continuous operation to torque control mode		
1588+100n	4388+100n	○	Cd.148 Acceleration time at continuous operation to torque control mode		
1589+100n	4389+100n	○	Cd.149 Deceleration time at continuous operation to torque control mode		
1590+100n	4390+100n	○	Cd.150 Target torque at continuous operation to torque control mode		
1591+100n	4391+100n	○	Cd.151 Torque time constant at continuous operation to torque control mode (Forward direction)		
1592+100n	4392+100n	○	Cd.152 Torque time constant at continuous operation to torque control mode (Negative direction)		
1593+100n	4393+100n	○	Cd.153 Control mode auto-shift selection		
1594+100n 1595+100n	4394+100n 4395+100n	○	Cd.154 Control mode auto-shift parameter		
1900	5900	○	Cd.1 Flash ROM write request	System control data	
1901	5901	○	Cd.2 Parameter initialization request		
1905	5905	○	Cd.41 Deceleration start flag valid		
1907	5907	○	Cd.42 Stop command processing for deceleration stop selection		
1926	5926	○	Cd.137 Amplifier-less operation mode switching request		
1928	5928 5929 5930 5931	△	Cd.44 External input signal operation device		
1909	5909	○	Cd.47 QD75MH initial value setting request		
1932	5932	○	Cd.102 SSCNET control command		

n: Axis No.-1

○: Compatible △: Partly compatible ×: Not compatible

Buffer memory address		Compatibility of setting value of QD77MS2/ QD77MS4 and QD77MS16	Item		Memory area		
QD77MS2 QD77MS4	QD77MS16						
	30100+10n	×	Cd.180 Axis stop		Expansion axis control data	Control data	
	30101+10n	×	Cd.181 Forward run JOG start				
	30102+10n	×	Cd.182 Reverse run JOG start				
	30103+10n	×	Cd.183 Execution prohibition flag				
2000+6000n	6000+1000n	○	Da.1 Operation pattern	Positioning identifier	No.1	Positioning data	Positioning data
		○	Da.2 Control system				
		○	Da.3 Acceleration time No.				
		○	Da.4 Deceleration time No.				
		×	Da.5 Axis to be interpolated				
2001+6000n	6001+1000n	○	Da.10 M code/condition data No. /Number of LOOP to LEND repetitions				
2002+6000n	6002+1000n	○	Da.9 Dwell time/JUMP destination positioning data No.				
	6003+1000n	×	Da.20 Axis to be interpolated No.1	Axis to be interpolated			
			Da.21 Axis to be interpolated No.2				
			Da.22 Axis to be interpolated No.3				
2004+6000n 2005+6000n	6004+1000n 6005+1000n	○	Da.8 Command speed				
2006+6000n 2007+6000n	6006+1000n 6007+1000n	○	Da.6 Positioning address/movement amount				
2008+6000n 2009+6000n	6008+1000n 6009+1000n	○	Da.7 Arc address				
2010+6000n to 2019+6000n	6010+1000n to 6019+1000n	△	No.2				
2020+6000n to 2029+6000n	6020+1000n to 6029+1000n	△	No.3				
to	to	to	to				
2990+6000n to 2999+6000n	6990+1000n to 6999+1000n	△	No.100				
3000+6000n to 3009+6000n	Set with GX Works2	△	No.101				
to		to	to				
7990+6000n to 7999+6000n		△	No.600				

n: Axis No.-1

○: Compatible △: Partly compatible ×: Not compatible

<table>
<tr><th colspan="4">Buffer memory address</th><th rowspan="2">Compatibility of setting value of QD77MS2/ QD77MS4 and QD77MS16</th><th rowspan="2">Item</th><th colspan="4" rowspan="2">Memory area</th></tr>
<tr><th colspan="2">QD77MS2
QD77MS4</th><th colspan="2">QD77MS16</th></tr>
<tr><td>26000+ 1000n</td><td></td><td>22000+ 400n</td><td></td><td>○</td><td>Da.11 Shape
Da.12 Start data No.</td><td rowspan="2">1st point</td><td rowspan="6">Block start data</td><td rowspan="19">Starting block 0</td><td rowspan="21">Positioning data (Starting block data)</td></tr>
<tr><td></td><td>26050+ 1000n</td><td></td><td>22050+ 400n</td><td>○</td><td>Da.13 Special start instruction
Da.14 Parameter</td></tr>
<tr><td>26001+ 1000n</td><td>26051+ 1000n</td><td>22001+ 400n</td><td>22051+ 400n</td><td>○</td><td colspan="2">2nd point</td></tr>
<tr><td>26002+ 1000n</td><td>26052+ 1000n</td><td>22002+ 400n</td><td>22052+ 400n</td><td>○</td><td colspan="2">3rd point</td></tr>
<tr><td colspan="2">to</td><td colspan="2">to</td><td>to</td><td colspan="2">to</td></tr>
<tr><td>26049+ 1000n</td><td>26099+ 1000n</td><td>22049+ 400n</td><td>22099+ 400n</td><td>○</td><td colspan="2">50th point</td></tr>
<tr><td colspan="2" rowspan="2">26100+1000n</td><td colspan="2" rowspan="2">22100+400n</td><td>○</td><td>Da.15 Condition target</td><td rowspan="9">No.1</td><td rowspan="13">Condition data</td></tr>
<tr><td>△</td><td>Da.16 Condition operator</td></tr>
<tr><td colspan="2" rowspan="4"></td><td colspan="2" rowspan="4">22101+400n</td><td rowspan="4">×</td><td>Da.23 Number of simultaneously starting axes</td></tr>
<tr><td>Da.24 Simultaneously starting axis No.1</td></tr>
<tr><td>Da.25 Simultaneously starting axis No.2</td></tr>
<tr><td>Da.26 Simultaneously starting axis No.3</td></tr>
<tr><td colspan="2">26102+1000n
26103+1000n</td><td colspan="2">22102+400n
22103+400n</td><td>○</td><td>Da.17 Address</td></tr>
<tr><td colspan="2">26104+1000n
26105+1000n</td><td colspan="2">22104+400n
22105+400n</td><td>△</td><td>Da.18 Parameter 1</td></tr>
<tr><td colspan="2">26106+1000n
26107+1000n</td><td colspan="2">22106+400n
22107+400n</td><td>△</td><td>Da.19 Parameter 2</td></tr>
<tr><td colspan="2">26110+1000n
to
26119+1000n</td><td colspan="2">22110+400n
to
22119+400n</td><td>△</td><td colspan="2">No.2</td></tr>
<tr><td colspan="2">26120+1000n
to
26129+1000n</td><td colspan="2">22120+400n
to
22129+400n</td><td>△</td><td colspan="2">No.3</td></tr>
<tr><td colspan="2">to</td><td colspan="2">to</td><td>to</td><td colspan="2">to</td></tr>
<tr><td colspan="2">26190+1000n
to
26199+1000n</td><td colspan="2">22190+400n
to
22199+400n</td><td>△</td><td colspan="2">No.10</td></tr>
<tr><td colspan="2">26200+1000n
to
26299+1000n</td><td colspan="2">22200+400n
to
22299+400n</td><td>○</td><td colspan="3">Block start data</td><td rowspan="2">Starting block 1</td></tr>
<tr><td colspan="2">26300+1000n
to
26399+1000n</td><td colspan="2">22300+400n
to
22399+400n</td><td>△</td><td colspan="3">Condition data</td></tr>
</table>

n: Axis No.-1

○: Compatible △: Partly compatible ×: Not compatible

Buffer memory address		Compatibility of setting value of QD77MS2/ QD77MS4 and QD77MS16	Item	Memory area	
QD77MS2 QD77MS4	QD77MS16				
26400+1000n to 26499+1000n	Set with GX Works2	○	Block start data	Starting block 2	Positioning data (Starting block data)
26500+1000n to 26599+1000n		△	Condition data		
26600+1000n to 26699+1000n		○	Block start data	Starting block 3	
26700+1000n to 26799+1000n		△	Condition data		
26800+1000n to 26899+1000n		○	Block start data	Starting block 4	
26900+1000n to 26999+1000n		△	Condition data		
30000 to 30099		○	Condition judgement target data of the condition data	PLC CPU memo area	Positioning data

n: Axis No.-1

○: Compatible △: Partly compatible ×: Not compatible

The following shows the relation between the buffer memory addresses of servo parameter and the various items.

(Note): The setting range is different depending on the servo amplifier model. Refer to the "Servo Amplifier Instruction Manual" for details.

Buffer memory address		Compatibility of setting value of QD77MS2/ QD77MS4 and QD77MS16	Item	Servo amplifier parameter No.	Memory area
QD77MS2 QD77MS4	QD77MS16				
30100+200n	28400+100n	○	Pr.100 Servo series	–	Servo parameters
30101+200n	28401+100n	○	–	PA01	
30102+200n	28402+100n	○	–	PA02	
30103+200n	28403+100n	○	–	PA03	
30104+200n	28404+100n	○	–	PA04	
30105+200n	28405+100n	○	–	PA05	
30106+200n	28406+100n	○	–	PA06	
30107+200n	28407+100n	○	–	PA07	
30108+200n	28408+100n	○	–	PA08	
30109+200n	28409+100n	○	–	PA09	
30110+200n	28410+100n	○	–	PA10	
30111+200n	28411+100n	○	–	PA11	
30112+200n	28412+100n	○	–	PA12	
30113+200n	28413+100n	○	–	PA13	
30114+200n	28414+100n	○	–	PA14	
30115+200n	28415+100n	○	–	PA15	
30116+200n	28416+100n	○	–	PA16	
30117+200n	28417+100n	○	–	PA17	
30118+200n	28418+100n	○	–	PA18	
30932+50n	Set with GX Works2	○	–	PA19	
64400+250n	64400+70n	○	–	PA20	
64401+250n	64401+70n	○	–	PA21	
64402+250n	64402+70n	○	–	PA22	
64403+250n	64403+70n	○	–	PA23	
64404+250n	64404+70n	○	–	PA24	
64405+250n	64405+70n	○	–	PA25	
64406+250n	64406+70n	○	–	PA26	
64407+250n	64407+70n	○	–	PA27	
64408+250n	64408+70n	○	–	PA28	
64409+250n	64408+70n	○	–	PA29	
64410+250n	64410+70n	○	–	PA30	
64411+250n	64411+70n	○	–	PA31	
64412+250n	64412+70n	○	–	PA32	

n: Axis No.-1

○: Compatible △: Partly compatible ×: Not compatible

Buffer memory address		Compatibility of setting value of QD77MS2/ QD77MS4 and QD77MS16	Item	Servo amplifier parameter No.	Memory area
QD77MS2 QD77MS4	QD77MS16				
30119+200n	28419+100n	○	–	PB01	Servo parameters
30120+200n	28420+100n	○	–	PB02	
30121+200n	28421+100n	○	–	PB03	
30122+200n	28422+100n	○	–	PB04	
30123+200n	28423+100n	○	–	PB05	
30124+200n	28424+100n	○	–	PB06	
30125+200n	28425+100n	○	–	PB07	
30126+200n	28426+100n	○	–	PB08	
30127+200n	28427+100n	○	–	PB09	
30128+200n	28428+100n	○	–	PB10	
30129+200n	28429+100n	○	–	PB11	
30130+200n	28430+100n	○	–	PB12	
30131+200n	28431+100n	○	–	PB13	
30132+200n	28432+100n	○	–	PB14	
30133+200n	28433+100n	○	–	PB15	
30134+200n	28434+100n	○	–	PB16	
30135+200n	28435+100n	○	–	PB17	
30136+200n	28436+100n	○	–	PB18	
30137+200n	28437+100n	○	–	PB19	
30138+200n	28438+100n	○	–	PB20	
30139+200n	28439+100n	○	–	PB21	
30140+200n	28440+100n	○	–	PB22	
30141+200n	28441+100n	○	–	PB23	
30142+200n	28442+100n	○	–	PB24	
30143+200n	28443+100n	○	–	PB25	
30144+200n	28444+100n	○	–	PB26	
30145+200n	28445+100n	○	–	PB27	
30146+200n	28446+100n	○	–	PB28	
30147+200n	28447+100n	○	–	PB29	
30148+200n	28448+100n	○	–	PB30	
30149+200n	28449+100n	○	–	PB31	
30150+200n	28450+100n	○	–	PB32	
30151+200n	28451+100n	○	–	PB33	
30152+200n	28452+100n	○	–	PB34	
30153+200n	28453+100n	○	–	PB35	
30154+200n	28454+100n	○	–	PB36	
30155+200n	28455+100n	○	–	PB37	
30156+200n	28456+100n	○	–	PB38	
30157+200n	28457+100n	○	–	PB39	
30158+200n	28458+100n	○	–	PB40	

n: Axis No.-1

○: Compatible △: Partly compatible ×: Not compatible

Buffer memory address		Compatibility of setting value of QD77MS2/ QD77MS4 and QD77MS16	Item	Servo amplifier parameter No.	Memory area
QD77MS2 QD77MS4	QD77MS16				
30159+200n	28459+100n	○	–	PB41	Servo parameters
30160+200n	28460+100n	○	–	PB42	
30161+200n	28461+100n	○	–	PB43	
30162+200n	28462+100n	○	–	PB44	
30163+200n	28463+100n	○	–	PB45	
64413+250n	64413+70n	○	–	PB46	
64414+250n	64414+70n	○	–	PB47	
64415+250n	64415+70n	○	–	PB48	
64416+250n	64416+70n	○	–	PB49	
64417+250n	64417+70n	○	–	PB50	
64418+250n	64418+70n	○	–	PB51	
64419+250n	64419+70n	○	–	PB52	
64420+250n	64420+70n	○	–	PB53	
64421+250n	64421+70n	○	–	PB54	
64422+250n	64422+70n	○	–	PB55	
64423+250n	64423+70n	○	–	PB56	
64424+250n	64424+70n	○	–	PB57	
64425+250n	64425+70n	○	–	PB58	
64426+250n	64426+70n	○	–	PB59	
64427+250n	64427+70n	○	–	PB60	
64428+250n	64428+70n	○	–	PB61	
64429+250n	64429+70n	○	–	PB62	
64430+250n	64430+70n	○	–	PB63	
64431+250n	64431+70n	○	–	PB64	
30164+200n	28464+100n	○	–	PC01	
30165+200n	28465+100n	○	–	PC02	
30166+200n	28466+100n	○	–	PC03	
30167+200n	28467+100n	○	–	PC04	
30168+200n	28468+100n	○	–	PC05	
30169+200n	28469+100n	○	–	PC06	
30170+200n	28470+100n	○	–	PC07	
30171+200n	28471+100n	○	–	PC08	
30172+200n	28472+100n	○	–	PC09	
30173+200n	28473+100n	○	–	PC10	
30174+200n	28474+100n	○	–	PC11	
30175+200n	28475+100n	○	–	PC12	
30176+200n	28476+100n	○	–	PC13	
30177+200n	28477+100n	○	–	PC14	
30178+200n	28478+100n	○	–	PC15	

n: Axis No.-1

○: Compatible △: Partly compatible ×: Not compatible

Buffer memory address		Compatibility of setting value of QD77MS2/ QD77MS4 and QD77MS16	Item	Servo amplifier parameter No.	Memory area
QD77MS2 QD77MS4	QD77MS16				
30179+200n	28479+100n	○	–	PC16	Servo parameters
30180+200n	28480+100n	○	–	PC17	
30181+200n	28481+100n	○	–	PC18	
30182+200n	28482+100n	○	–	PC19	
30183+200n	28483+100n	○	–	PC20	
30184+200n	28484+100n	○	–	PC21	
30185+200n	28485+100n	○	–	PC22	
30186+200n	28486+100n	○	–	PC23	
30187+200n	28487+100n	○	–	PC24	
30188+200n	28488+100n	○	–	PC25	
30189+200n	28489+100n	○	–	PC 26	
30190+200n	28490+100n	○	–	PC 27	
30191+200n	28491+100n	○	–	PC28	
30192+200n	28492+100n	○	–	PC29	
30193+200n	28493+100n	○	–	PC30	
30194+200n	28494+100n	○	–	PC31	
30195+200n	28495+100n	○	–	PC32	
64432+250n	64432+70n	○	–	PC33	
64433+250n	64433+70n	○	–	PC34	
64434+250n	64434+70n	○	–	PC35	
64435+250n	64435+70n	○	–	PC36	
64436+250n	64436+70n	○	–	PC37	
64437+250n	64437+70n	○	–	PC38	
64438+250n	64438+70n	○	–	PC39	
64439+250n	64439+70n	○	–	PC40	
64440+250n	64440+70n	○	–	PC41	
64441+250n	64441+70n	○	–	PC42	
64442+250n	64442+70n	○	–	PC43	
64443+250n	64443+70n	○	–	PC44	
64444+250n	64444+70n	○	–	PC45	
64445+250n	64445+70n	○	–	PC46	
64446+250n	64446+70n	○	–	PC47	
64447+250n	64447+70n	○	–	PC48	
64448+250n	64448+70n	○	–	PC49	
64449+250n	64449+70n	○	–	PC50	
64450+250n	64450+70n	○	–	PC51	
64451+250n	64451+70n	○	–	PC52	
64452+250n	64452+70n	○	–	PC53	
64453+250n	64453+70n	○	–	PC54	

n: Axis No.-1

○: Compatible △: Partly compatible ×: Not compatible

Buffer memory address		Compatibility of setting value of QD77MS2/ QD77MS4 and QD77MS16	Item	Servo amplifier parameter No.	Memory area
QD77MS2 QD77MS4	QD77MS16				
64454+250n	64454+70n	○	–	PC55	Servo parameters
64455+250n	64455+70n	○	–	PC56	
64456+250n	64456+70n	○	–	PC57	
64457+250n	64457+70n	○	–	PC58	
64458+250n	64458+70n	○	–	PC59	
64459+250n	64459+70n	○	–	PC60	
64460+250n	64460+70n	○	–	PC61	
64461+250n	64461+70n	○	–	PC62	
64462+250n	64462+70n	○	–	PC63	
64463+250n	64463+70n	○	–	PC64	
30196+200n	Set with GX Works2	○	–	PD01	
30197+200n		○	–	PD02	
30198+200n		○	–	PD03	
30199+200n		○	–	PD04	
30200+200n		○	–	PD05	
30201+200n		○	–	PD06	
30202+200n		○	–	PD07	
30203+200n		○	–	PD08	
30204+200n		○	–	PD09	
30205+200n		○	–	PD10	
30206+200n		○	–	PD11	
30207+200n		○	–	PD12	
30208+200n		○	–	PD13	
30209+200n		○	–	PD14	
30210+200n		○	–	PD15	
30211+200n		○	–	PD16	
30212+200n		○	–	PD17	
30213+200n		○	–	PD18	
30214+200n		○	–	PD19	
30215+200n		○	–	PD20	
30216+200n		○	–	PD21	
30217+200n		○	–	PD22	
30218+200n		○	–	PD23	
30219+200n		○	–	PD24	
30220+200n		○	–	PD25	
30221+200n		○	–	PD26	
30222+200n		○	–	PD27	
30223+200n		○	–	PD28	
30224+200n		○	–	PD29	
30225+200n		○	–	PD30	

n: Axis No.-1

○: Compatible △: Partly compatible ×: Not compatible

Buffer memory address		Compatibility of setting value of QD77MS2/ QD77MS4 and QD77MS16	Item	Servo amplifier parameter No.	Memory area
QD77MS2 QD77MS4	QD77MS16				
30226+200n	Set with GX Works2	○	–	PD31	Servo parameters
30227+200n		○	–	PD32	
64464+250n		○	–	PD33	
64465+250n		○	–	PD34	
64466+250n		○	–	PD35	
64467+250n		○	–	PD36	
64468+250n		○	–	PD37	
64469+250n		○	–	PD38	
64470+250n		○	–	PD39	
64471+250n		○	–	PD40	
64472+250n		○	–	PD41	
64473+250n		○	–	PD42	
64474+250n		○	–	PD43	
64475+250n		○	–	PD44	
64476+250n		○	–	PD45	
64477+250n		○	–	PD46	
64478+250n		○	–	PD47	
64479+250n		○	–	PD48	
30228+200n		○	–	PE01	
30229+200n		○	–	PE02	
30230+200n		○	–	PE03	
30231+200n		○	–	PE04	
30232+200n		○	–	PE05	
30233+200n		○	–	PE06	
30234+200n		○	–	PE07	
30235+200n		○	–	PE08	
30236+200n		○	–	PE09	
30237+200n		○	–	PE10	
30238+200n		○	–	PE11	
30239+200n		○	–	PE12	
30240+200n		○	–	PE13	
30241+200n		○	–	PE14	
30242+200n		○	–	PE15	
30243+200n		○	–	PE16	
30244+200n		○	–	PE17	
30245+200n		○	–	PE18	
30246+200n		○	–	PE19	
30247+200n		○	–	PE20	
30248+200n		○	–	PE21	
30249+200n		○	–	PE22	

n: Axis No.-1

○: Compatible △: Partly compatible ×: Not compatible

Buffer memory address		Compatibility of setting value of QD77MS2/ QD77MS4 and QD77MS16	Item	Servo amplifier parameter No.	Memory area
QD77MS2 QD77MS4	QD77MS16				
30250+200n	Set with GX Works2	○	–	PE23	Servo parameters
30251+200n		○	–	PE24	
30252+200n		○	–	PE25	
30253+200n		○	–	PE26	
30254+200n		○	–	PE27	
30255+200n		○	–	PE28	
30256+200n		○	–	PE29	
30257+200n		○	–	PE30	
30258+200n		○	–	PE31	
30259+200n		○	–	PE32	
30260+200n		○	–	PE33	
30261+200n		○	–	PE34	
30262+200n		○	–	PE35	
30263+200n		○	–	PE36	
30264+200n		○	–	PE37	
30265+200n		○	–	PE38	
30266+200n		○	–	PE39	
30267+200n		○	–	PE40	
64480+250n		○	–	PE41	
64481+250n		○	–	PE42	
64482+250n		○	–	PE43	
64483+250n		○	–	PE44	
64484+250n		○	–	PE45	
64485+250n		○	–	PE46	
64486+250n		○	–	PE47	
64487+250n		○	–	PE48	
64488+250n		○	–	PE49	
64489+250n		○	–	PE50	
64490+250n		○	–	PE51	
64491+250n		○	–	PE52	
64492+250n		○	–	PE53	
64493+250n		○	–	PE54	
64494+250n		○	–	PE55	
64495+250n		○	–	PE56	
64496+250n		○	–	PE57	
64497+250n		○	–	PE58	
64498+250n		○	–	PE59	
64499+250n		○	–	PE60	
64500+250n		○	–	PE61	
64501+250n		○	–	PE62	
64502+250n		○	–	PE63	
64503+250n		○	–	PE64	

n: Axis No.-1

○: Compatible △: Partly compatible ×: Not compatible

Buffer memory address		Compatibility of setting value of QD77MS2/ QD77MS4 and QD77MS16	Item	Servo amplifier parameter No.	Memory area
QD77MS2 QD77MS4	QD77MS16				
30268+200n	Set with GX Works2	○	–	PS01	Servo parameters
30269+200n		○	–	PS02	
30270+200n		○	–	PS03	
30271+200n		○	–	PS04	
30272+200n		○	–	PS05	
30273+200n		○	–	PS06	
30274+200n		○	–	PS07	
30275+200n		○	–	PS08	
30276+200n		○	–	PS09	
30277+200n		○	–	PS10	
30278+200n		○	–	PS11	
30279+200n		○	–	PS12	
30280+200n		○	–	PS13	
30281+200n		○	–	PS14	
30282+200n		○	–	PS15	
30283+200n		○	–	PS16	
30284+200n		○	–	PS17	
30285+200n		○	–	PS18	
30286+200n		○	–	PS19	
30287+200n		○	–	PS20	
30288+200n		○	–	PS21	
30289+200n		○	–	PS22	
30290+200n		○	–	PS23	
30291+200n		○	–	PS24	
30292+200n		○	–	PS25	
30293+200n		○	–	PS26	
30294+200n		○	–	PS27	
30295+200n		○	–	PS28	
30296+200n		○	–	PS29	
30297+200n		○	–	PS30	
30298+200n		○	–	PS31	
30299+200n		○	–	PS32	

n: Axis No.-1

○: Compatible △: Partly compatible ×: Not compatible

Buffer memory address		Compatibility of setting value of QD77MS2/ QD77MS4 and QD77MS16	Item	Servo amplifier parameter No.	Memory area
QD77MS2 QD77MS4	QD77MS16				
30900+50n	Set with GX Works2	○	–	PF01	Servo parameters
30901+50n		○	–	PF02	
30902+50n		○	–	PF03	
30903+50n		○	–	PF04	
30904+50n		○	–	PF05	
30905+50n		○	–	PF06	
30906+50n		○	–	PF07	
30907+50n		○	–	PF08	
30908+50n		○	–	PF09	
30909+50n		○	–	PF10	
30910+50n		○	–	PF11	
30911+50n		○	–	PF12	
30912+50n		○	–	PF13	
30913+50n		○	–	PF14	
30914+50n		○	–	PF15	
30915+50n		○	–	PF16	
64504+250n		○	–	PF17	
64505+250n		○	–	PF18	
64506+250n		○	–	PF19	
64507+250n		○	–	PF20	
64508+250n		○	–	PF21	
64509+250n		○	–	PF22	
64510+250n		○	–	PF23	
64511+250n		○	–	PF24	
64512+250n		○	–	PF25	
64513+250n		○	–	PF26	
64514+250n		○	–	PF27	
64515+250n		○	–	PF28	
64516+250n		○	–	PF29	
64517+250n		○	–	PF30	
64518+250n		○	–	PF31	
64519+250n		○	–	PF32	
64520+250n		○	–	PF33	
64521+250n		○	–	PF34	
64522+250n		○	–	PF35	
64523+250n		○	–	PF36	
64524+250n		○	–	PF37	
64525+250n		○	–	PF38	
64526+250n		○	–	PF39	
64527+250n		○	–	PF40	

n: Axis No.-1

○: Compatible △: Partly compatible ×: Not compatible

Buffer memory address		Compatibility of setting value of QD77MS2/ QD77MS4 and QD77MS16	Item	Servo amplifier parameter No.	Memory area
QD77MS2 QD77MS4	QD77MS16				
64528+250n	Set with GX Works2	○	–	PF41	Servo parameters
64529+250n		○	–	PF42	
64530+250n		○	–	PF43	
64531+250n		○	–	PF44	
64532+250n		○	–	PF45	
64533+250n		○	–	PF46	
64534+250n		○	–	PF47	
64535+250n		○	–	PF48	
30916+50n		○	–	Po01	
30917+50n		○	–	Po02	
30918+50n		○	–	Po03	
30919+50n		○	–	Po04	
30920+50n		○	–	Po05	
30921+50n		○	–	Po06	
30922+50n		○	–	Po07	
30923+50n		○	–	Po08	
30924+50n		○	–	Po09	
30925+50n		○	–	Po10	
30926+50n		○	–	Po11	
30927+50n		○	–	Po12	
30928+50n		○	–	Po13	
30929+50n		○	–	Po14	
30930+50n		○	–	Po15	
30931+50n		○	–	Po16	
64536+250n		○	–	Po17	
64537+250n		○	–	Po18	
64538+250n		○	–	Po19	
64539+250n		○	–	Po20	
64540+250n		○	–	Po21	
64541+250n		○	–	Po22	
64542+250n		○	–	Po23	
64543+250n		○	–	Po24	
64544+250n		○	–	Po25	
64545+250n		○	–	Po26	
64546+250n		○	–	Po27	
64547+250n		○	–	Po28	
64548+250n		○	–	Po29	
64549+250n		○	–	Po30	
64550+250n		○	–	Po31	
64551+250n		○	–	Po32	

n: Axis No.-1

○: Compatible △: Partly compatible ×: Not compatible

Buffer memory address		Compatibility of setting value of QD77MS2/ QD77MS4 and QD77MS16	Item	Servo amplifier parameter No.	Memory area
QD77MS2 QD77MS4	QD77MS16				
64552+250n	Set with GX Works2	○	–	PL01	Servo parameters
64553+250n		○	–	PL02	
64554+250n		○	–	PL03	
64555+250n		○	–	PL04	
64556+250n		○	–	PL05	
64557+250n		○	–	PL06	
64558+250n		○	–	PL07	
64559+250n		○	–	PL08	
64560+250n		○	–	PL09	
64561+250n		○	–	PL10	
64562+250n		○	–	PL11	
64563+250n		○	–	PL12	
64564+250n		○	–	PL13	
64565+250n		○	–	PL14	
64566+250n		○	–	PL15	
64567+250n		○	–	PL16	
64568+250n		○	–	PL17	
64569+250n		○	–	PL18	
64570+250n		○	–	PL19	
64571+250n		○	–	PL20	
64572+250n		○	–	PL21	
64573+250n		○	–	PL22	
64574+250n		○	–	PL23	
64575+250n		○	–	PL24	
64576+250n		○	–	PL25	
64577+250n		○	–	PL26	
64578+250n		○	–	PL27	
64579+250n		○	–	PL28	
64580+250n		○	–	PL29	
64581+250n		○	–	PL30	
64582+250n		○	–	PL31	
64583+250n		○	–	PL32	
64584+250n		○	–	PL33	
64585+250n		○	–	PL34	
64586+250n		○	–	PL35	
64587+250n		○	–	PL36	
64588+250n		○	–	PL37	
64589+250n		○	–	PL38	
64590+250n		○	–	PL39	
64591+250n		○	–	PL40	

n: Axis No.-1

○: Compatible △: Partly compatible ×: Not compatible

Buffer memory address		Compatibility of setting value of QD77MS2/ QD77MS4 and QD77MS16	Item	Servo amplifier parameter No.	Memory area
QD77MS2 QD77MS4	QD77MS16				
64592+250n	Set with GX Works2	○	–	PL41	Servo parameters
64593+250n		○	–	PL42	
64594+250n		○	–	PL43	
64595+250n		○	–	PL44	
64596+250n		○	–	PL45	
64597+250n		○	–	PL46	
64598+250n		○	–	PL47	
64599+250n		○	–	PL48	

n: Axis No.-1

○: Compatible △: Partly compatible ×: Not compatible

The following shows the relation between the buffer memory addresses for mark detection function and the various items.

(Note): Do not use the buffer memory address that not been described here for a "Maker setting".

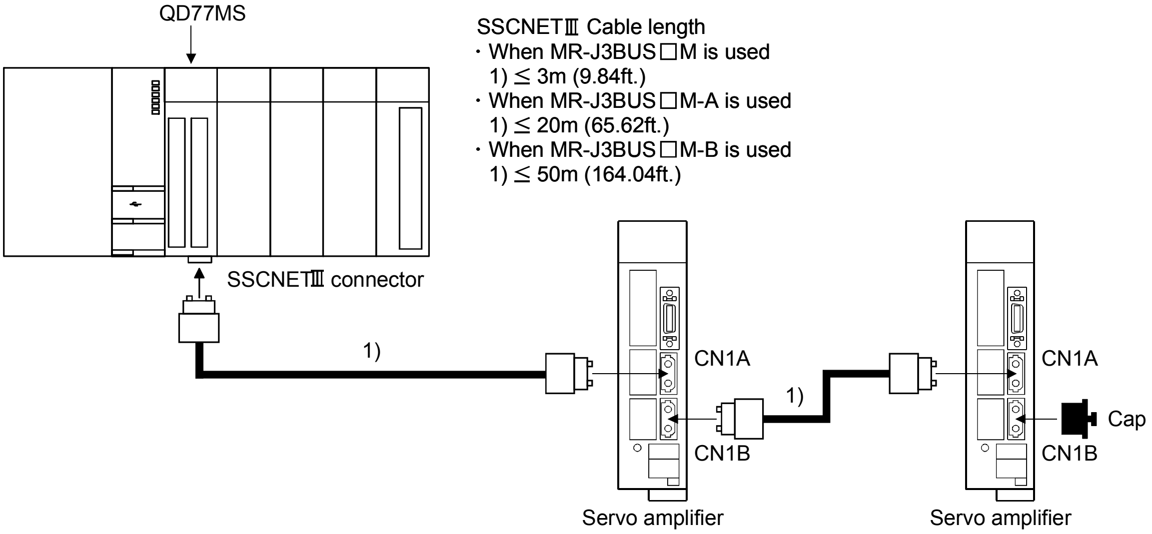
Buffer memory address		Compatibility of setting value of QD77MS2/ QD77MS4 and QD77MS16	Item		Memory area
QD77MS2 QD77MS4	QD77MS16				
54000+20k		○	Pr.800 Mark detection signal setting		Mark detection setting parameters
54001+20k		○	Pr.801 Mark detection signal compensation time		
54002+20k		○	Pr.802 Mark detection data type		
54003+20k		○	Pr.803 Mark detection data axis No.		
54004+20k 54005+20k		○	Pr.804 Mark detection data buffer memory No.		
54006+20k 54007+20k		○	Pr.805 Latch data range upper limit value		
54008+20k 54009+20k		○	Pr.806 Latch data range lower limit value		
54010+20k		○	Pr.807 Mark detection mode setting		
54640+10k		○	Cd.800 Number of mark detection clear request		Mark detection control data
54641+10k		○	Cd.801 Mark detection invalid flag		
54642+10k		○	Cd.802 Latch data range change request		
54960+80k		○	Md.800 Number of mark detection counter		Mark detection monitor data
54962+80k 54963+80k		○	Md.801 Mark detection data storage area	1	
54964+80k 54965+80k				2	
54966+80k 54967+80k				3	
to				to	
55024+80k 55025+80k				32	

k: Mark detection setting No.-1

○: Compatible △: Partly compatible ×: Not compatible

Appendix 2 Connection with servo amplifiers

SSCNETⅢ cables are used to connect between Simple Motion module and servo amplifier or between servo amplifiers.
Install the battery (MR-J3BAT) to servo amplifier to execute absolute position detection control.



(Note): It cannot communicate with that the connection of CN1A and CN1B is mistaken.

⚠CAUTION

- Be sure to connect SSCNETⅢ cable with the above connector. If the connection is mistaken, between the Simple Motion module and servo amplifier cannot be communicated.
- SSCNETⅢ connector to connect the SSCNETⅢ cable is put a cap to protect light device inside connector from dust. For this reason, do not remove a cap until just before connecting SSCNETⅢ cable. Then, when removing SSCNETⅢ cable, make sure to put a cap.
- Keep the cap and the tube for protecting light cord end of SSCNETⅢ cable in a plastic bag with a zipper of SSCNETⅢ cable to prevent them from becoming dirty.
- Do not remove the SSCNETⅢ cable while turning on the power supply of Simple Motion module and servo amplifier. Do not see directly the light generated from SSCNETⅢ connector of Simple Motion module or servo amplifier and the end of SSCNETⅢ cable. When the light gets into eye, may feel something is wrong for eye. (The light source of SSCNETⅢ cable complies with class1 defined in JISC6802 or IEC60825-1.)
- When exchanging the Simple Motion module or servo amplifier, make sure to put a cap on SSCNETⅢ connector. When asking repair of Simple Motion module or servo amplifier for some troubles, make also sure to put a cap on SSCNETⅢ connector. When the connector is not put a cap, the light device may be damaged at the transit. In this case, exchange and repair of light device is required.

Appendix 2.1 SSCNETⅢ cables

Generally use the SSCNETⅢ cables available as our products.
Refer to Appendix 2.3 for long distance cable up to 100[m] and ultra-long bending life cable.

(1) Model explanation

Numeral in the column of cable length on the table is a symbol put in the "□" part of cable model. Cables of which symbol exists are available.

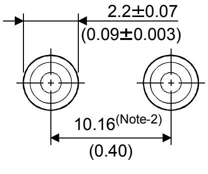
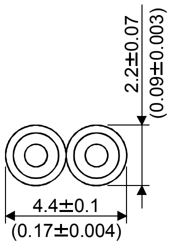
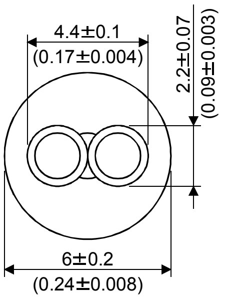
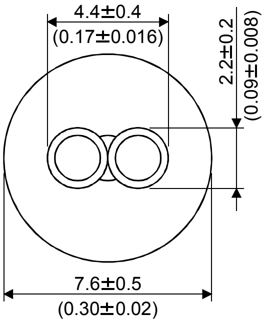
Table 2.1 SSCNETⅢ cable list

Cable model	Cable length [m(ft.)]											Bending life	Application/ remark
	0.15 (0.49)	0.3 (0.98)	0.5 (1.64)	1 (3.28)	3 (9.84)	5 (16.40)	10 (32.81)	20 (65.62)	30 (98.43)	40 (131.23)	50 (164.04)		
MR-J3BUS□M	015	03	05	1	3							Standard	Standard cord for inside panel
MR-J3BUS□M-A						5	10	20				Standard	Standard cable for outside panel
MR-J3BUS□M-B (Note-1)									30	40	50	Long bending life	Long distance cable

(Note-1): For the cable of less than 30m (98.43ft.), contact your nearest Mitsubishi sales representative.

(2) Specification

Table 2.2 SSCNETⅢ cable list

		Description			
SSCNETⅢ cable model		MR-J3BUS□M		MR-J3BUS□M-A	MR-J3BUS□M-B
SSCNETⅢ cable length [m(ft.)]		0.15 (0.49)	0.3 to 3 (0.98 to 9.84)	5 to 20 (16.40 to 65.62)	30 to 50 (98.43 to 164.04)
Optical cable (Cord)	Minimum bend radius [mm(inch)]	25(0.98)		Enforced covering cord: 50 (1.97) Cord: 25 (0.98)	Enforced covering cord: 50 (1.97) Cord: 30(1.18)
	Tension strength [N]	70	140	420 (Enforced covering cord)	980 (Enforced covering cord)
	Temperature range for use [°C(°F)] (Note-1)	-40 to 80 (-40 to 176)			-20 to 70 (-4 to 158)
	Ambient	Indoors (no direct sunlight), No solvent or oil			
	External appearance [mm(inch)]				

(Note-1): This temperature range for use is the value for optical cable (cord) only.
(Note-2): Dimension of connector fiber insert location. The distance of two cords is changed by how to bend it.

⚠CAUTION

- Please use the processing method and the processing treatment device that exists in the connector when you fix the cord part of the SSCNETⅢ cable to the connector.
- It must not cut squarely when you cut the cord part of the SSCNETⅢ cable, the cutting edge side must not be made smooth, and garbage etc. must not adhere.
- The damage etc. must not adhere to the optical cord part when you peel off the film of the cable of the SSCNETⅢ cable.
- If the end face of cord tip for the SSCNETⅢ cable is dirty, optical transmission is interrupted and it may cause malfunctions. If it becomes dirty, wipe with a bonded textile, etc. Do not use solvent such as alcohol.
- Do not add impossible power to the connector of the SSCNETⅢ cable.
- When incinerating the SSCNETⅢ cable (optical fiber), hydrogen fluoride gas or hydrogen chloride gas which is corrosive and harmful may be generated. For disposal of the SSCNETⅢ cable (optical fiber), request for specialized industrial waste disposal services who has incineration facility for disposing hydrogen fluoride gas or hydrogen chloride gas.

(a) MR-J3BUS□M

1) Model explanation

Type: MR-J3BUS□M - ✻

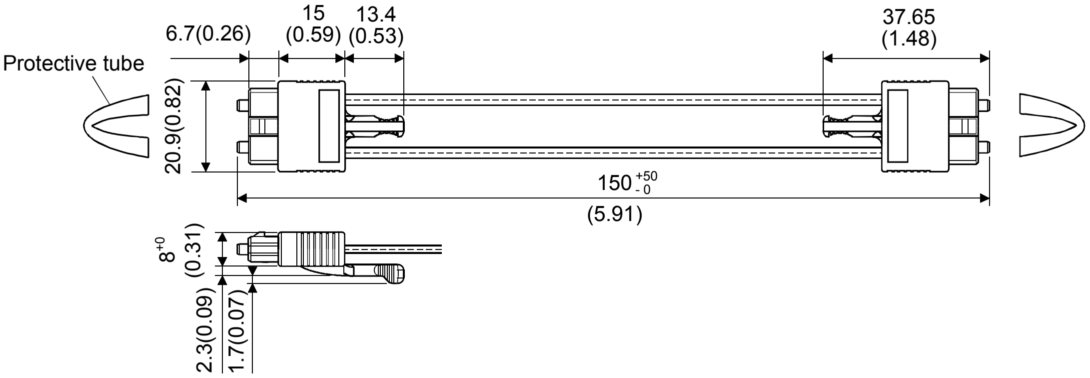
Symbol	Cable type
None	Standard cord for inside panel
A	Standard cable for outside panel
B	Long distance cable

Symbol	Cable length [m(ft.)]
015	0.15(0.49)
03	0.3(0.98)
05	0.5(1.64)
1	1(3.28)
3	3(9.84)
5	5(16.40)
10	10(32.81)
20	20(65.62)
30	30(98.43)
40	40(131.23)
50	50(164.04)

2) Exterior dimensions

- MR-J3BUS015M

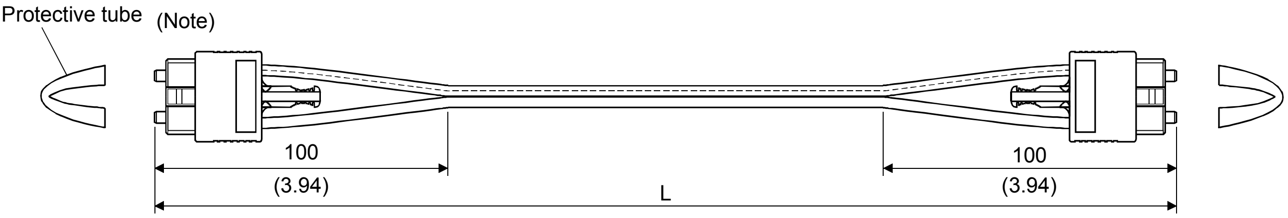
[Unit: mm(inch)]



- MR-J3BUS03M to MR-J3BUS3M

Refer to the table of this section (1) for cable length (L).

[Unit: mm(inch)]



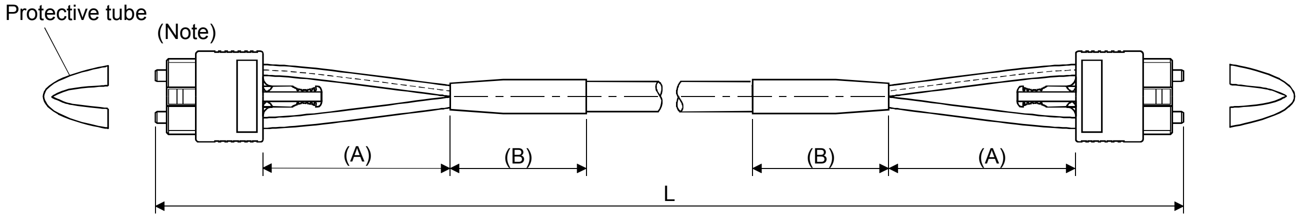
(Note): Dimension of connector part is the same as that of MR-J3BUS015M.

- MR-J3BUS5M-A to MR-J3BUS20M-A
- MR-J3BUS30M-B to MR-J3BUS50M-B

Refer to the table of this section (1) for cable length (L).

SSCNETⅢ Cable	Variation [mm(inch)]	
	A	B
MR-J3BUS5M-A to MR-J3BUS20M-A	100(3.94)	30(1.18)
MR-J3BUS30M-B to MR-J3BUS50M-B	150(5.91)	50(1.97)

[Unit: mm(inch)]



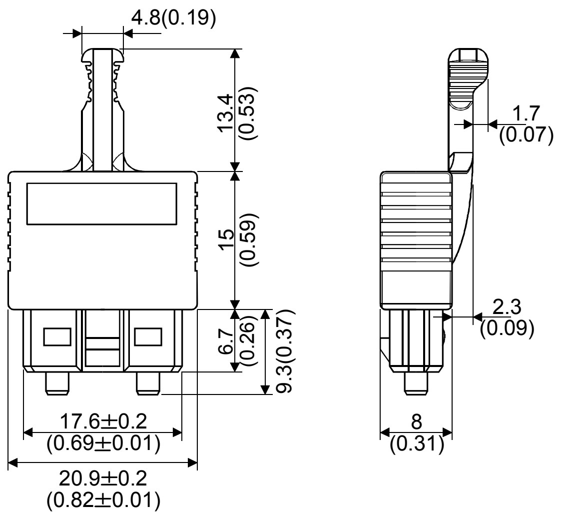
(Note): Dimension of connector part is the same as that of MR-J3BUS015M.

POINT

Keep the cap and the tube for protecting light cord end of SSCNETⅢ cable in a plastic bag with a zipper of SSCNETⅢ cable to prevent them from becoming dirty.

(b) SSCNETⅢ cable connector

[Unit: mm(inch)]



Appendix 2.2 Serial absolute synchronous encoder cable

Generally use the serial absolute synchronous encoder cables available as our products. If the required length is not found in our products, fabricate the cable on the customer side.

(1) Selection

The following table indicates the serial absolute synchronous encoder cables used with the serial absolute synchronous encoder.
Connector sets (MR-J3CN2) are also available for your fabrication.

Table 2.3 Wire models

Cable model	Cable length [m(ft.)]	Wire model
Q170ENCCBL☐M-A	2(6.56), 5(16.40), 10(32.81), 20(65.62), 30(98.43), 50(164.04)	J14B103715-00 12 pair (BLACK)

Use the following or equivalent twisted pair cables as the serial absolute synchronous encoder cables.

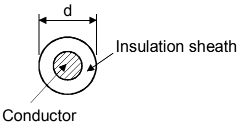
Table 2.4 Connector sets

Connector sets type	Description
MR-J3CN2	Servo amplifier connector

Table 2.5 Wire specifications

Wire model	Core size [mm^2]	Number of cores	Characteristics of one core			Finished OD [mm]$^{(\text{Note-2})}$
			Structure [Number of wires/mm]	Conductor resistance [Ω/km]	Insulating sheath OD d[mm]$^{(\text{Note-1})}$	
J14B103715-00 12 pair (BLACK)	0.2	24(12 pair)	40/0.08	105 or less	0.88	9.0

(Note-1): d is as shown below.



(Note-2): Standard OD (Outside Diameter). Maximum OD is about 10% larger.

⚠CAUTION

- When fabricating the encoder cable, do not make incorrect connection. Wrong connection will cause runaway or explosion.

(a) Q170ENCCBL☐M-A

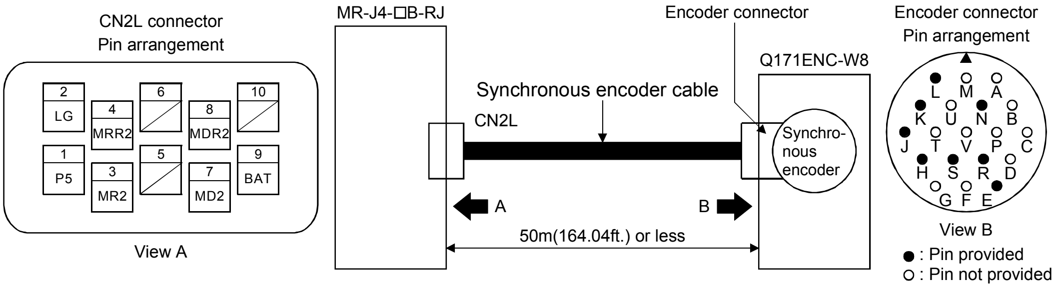
1) Model explanation

Type: Q170ENCCBL☐M - A

Symbol	Cable length [m(ft.)]
2	2(6.56)
5	5(16.40)
10	10(32.81)
20	20(65.62)
30	30(98.43)
50	50(164.04)

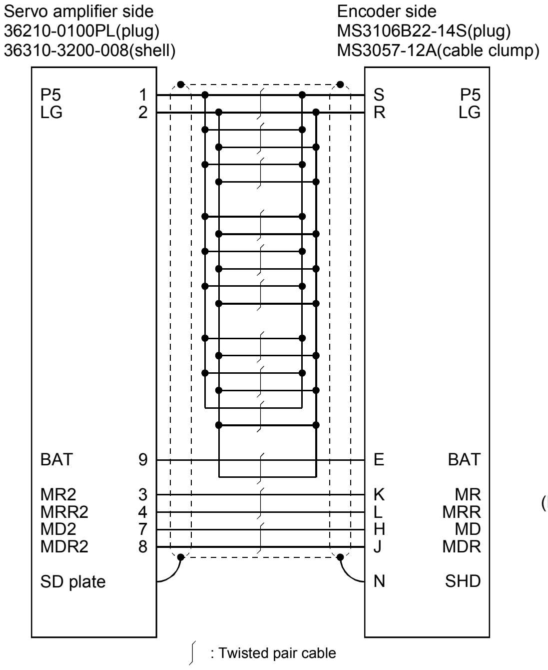
2) Connection diagram

When fabricating a cable, use the recommended wire and connector set MR-J3CN2 for encoder cable given on this section (1), and make the cable as show in the following connection diagram. Maximum cable length is 50m(164.04ft.).



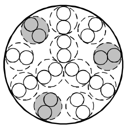
Pin	Signal
A	
B	
C	
D	
E	BAT
F	
G	
H	MD
J	MDR

Pin	Signal
K	MR
L	MRR
M	
N	SHD
P	
R	LG
S	P5
T	



Cable length 50m(164.04[ft.]) or less

(Note): Layout twisted pair for signal to avoid contact.



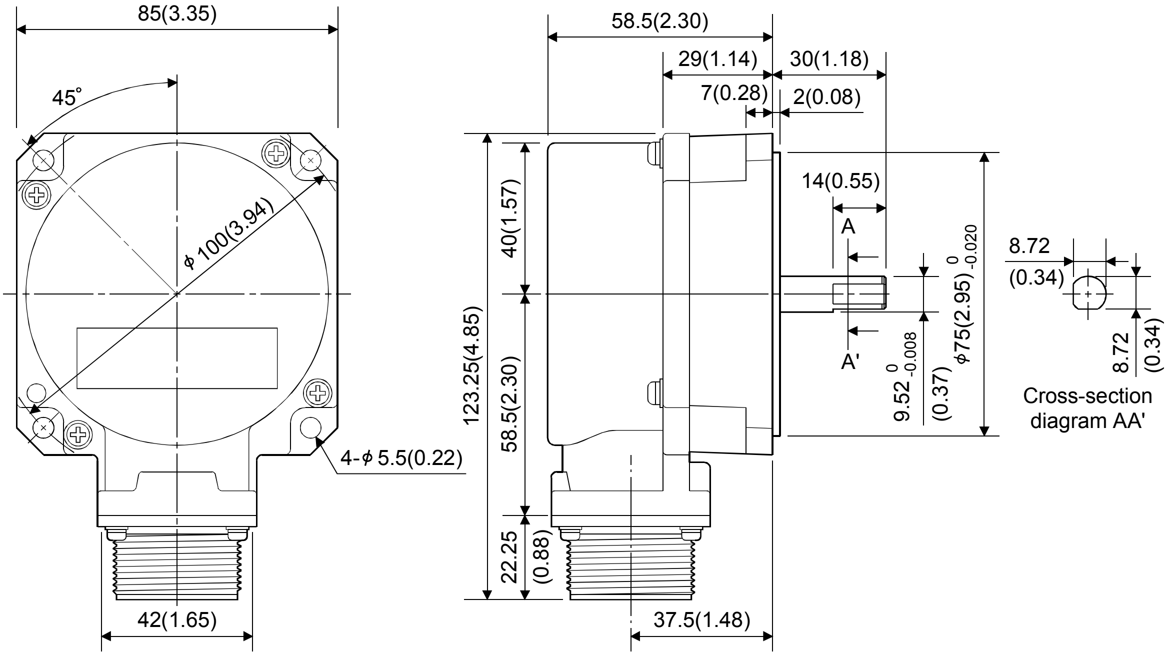
Cable cross-section diagram

- : Twisted pair for signal (BAT/LG, MR/MRR, MD/MDR)
- : Twisted pair (P5/LG)

(2) External dimension drawing

(a) Serial absolute synchronous encoder (Q171ENC-W8)

[Unit: mm (inch)]



Appendix 2.3 SSCNETⅢ cable (SC-J3BUS□M-C) manufactured by Mitsubishi Electric System & Service

POINT

- For the details of the SSCNETⅢ cables, contact your local sales office.
- Do not look directly at the light generated from CN1A/CN1B connector of servo amplifier or the end of SSCNETⅢ cable. The light can be a discomfort when it enters the eye.

The cable is available per 1[m] up to 100[m]. The number of the length (1 to 100) will be in the □ part in the cable model.

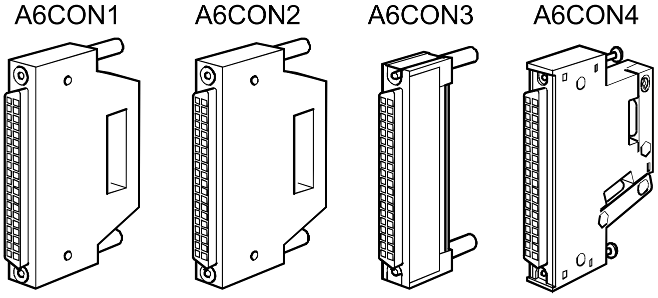
Cable model	Cable length [m(ft.)]	Bending life	Application/ remark
	1m to 100m (3.28ft. to 328.08ft.)		
SC-J3BUS□M-C	1 to 100 (3.28 to 328.08)	Ultra-long bending life	Long distance cable

Appendix 3 Connection with external device

Appendix 3.1 Connector

Mounted onto an external input signal connector of the QD77MS and used for wiring an external device. The "external device connector" includes the following 4 types.

(1) Appearance



(2) Connector type

Type	Model
	Connector
Soldering type, useable for straight out	A6CON1
Crimp-contact type, useable for straight out	A6CON2
Pressure-displacement type	A6CON3
Soldering type, useable for straight out and diagonal out	A6CON4

(3) Specifications of the connector

Part name	Specification		
Applicable connector	A6CON1, A6CON4	A6CON2	A6CON3
Applicable wire size	0.3 mm^2	AWG24 to AWG28	AWG28 (twisted)/ AWG30 (single wire)

(Note): The external input signal connector has been prepared. Please purchase them by customer.

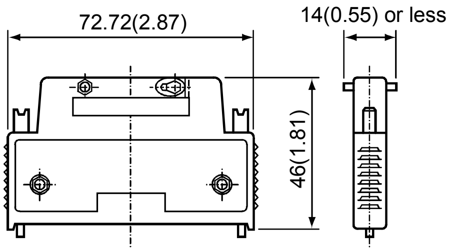
Specialized tool

- Pressure-bonding tool for A6CON2
  Model name: FCN-363T-T005/H
- Pressure welding tool for A6CON3
  Model name: FCN-367T-T012/H (locator plate)
  : FCN-707T-T001/H (cable cutter)
  : FCN-707T-T101/H (hand press)
- Contact for the specialized tool: Fujitsu component LTD.

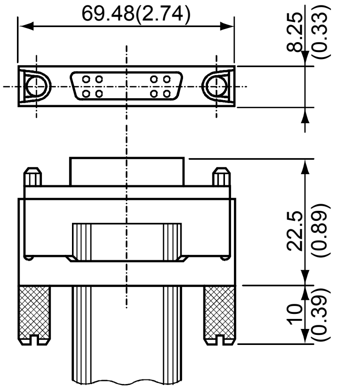
(4) External dimension drawing

Unit: mm (inch)

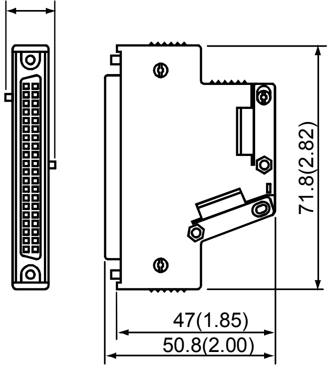
A6CON1/A6CON2



A6CON3



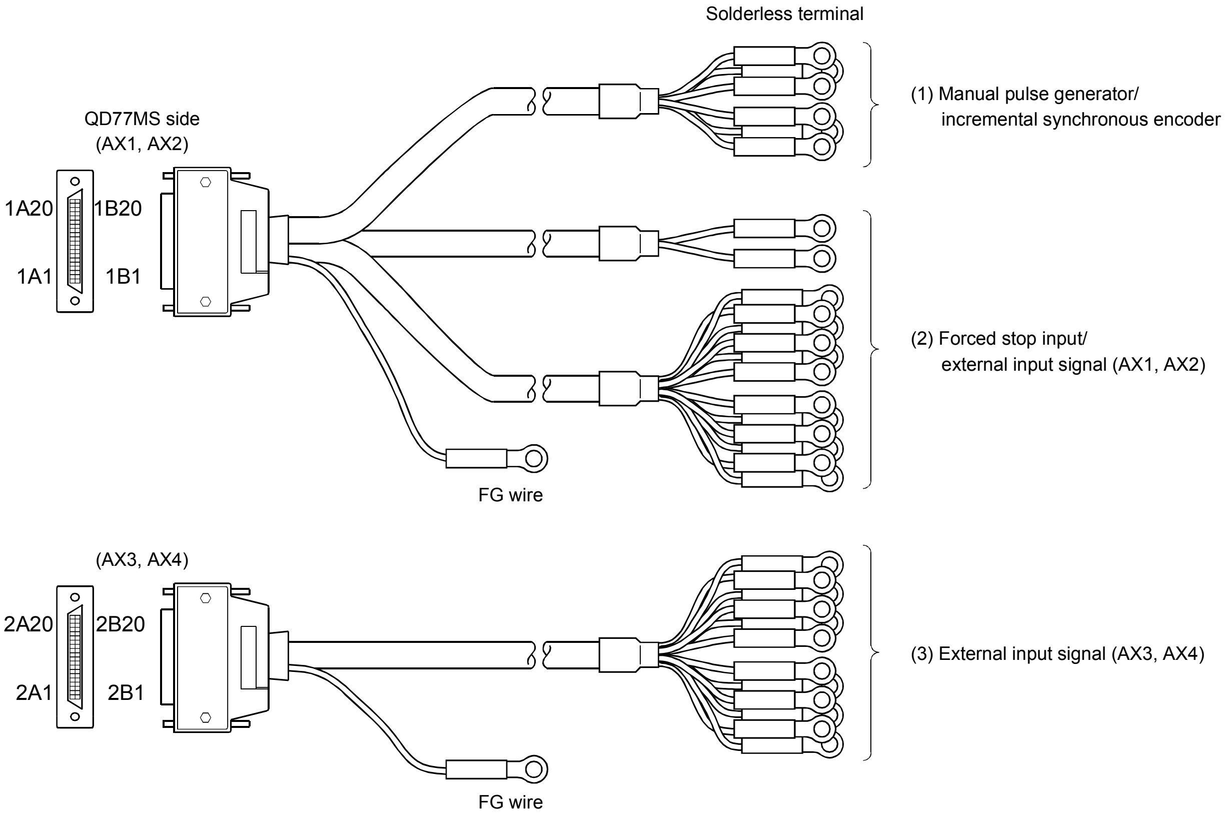
A6CON4



Appendix 3.2 External input signal cable

The external input signal cable is not prepared as an option. Fabricate the cable on the customer side.

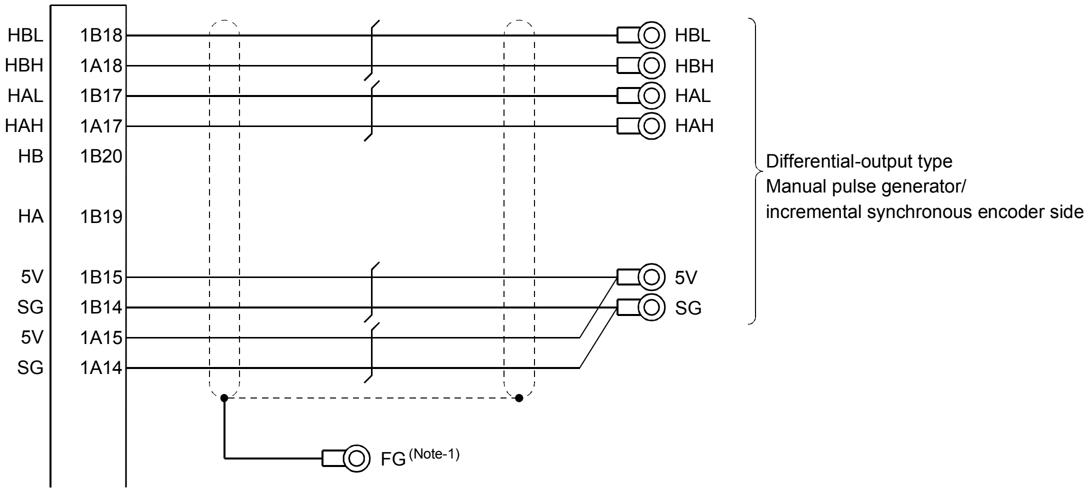
Make the cable as shown in the following connection diagram.



(1) Manual pulse generator/ Incremental synchronous encoder

(a) Differential-output type

Make the cable within 30m (98.43ft.).

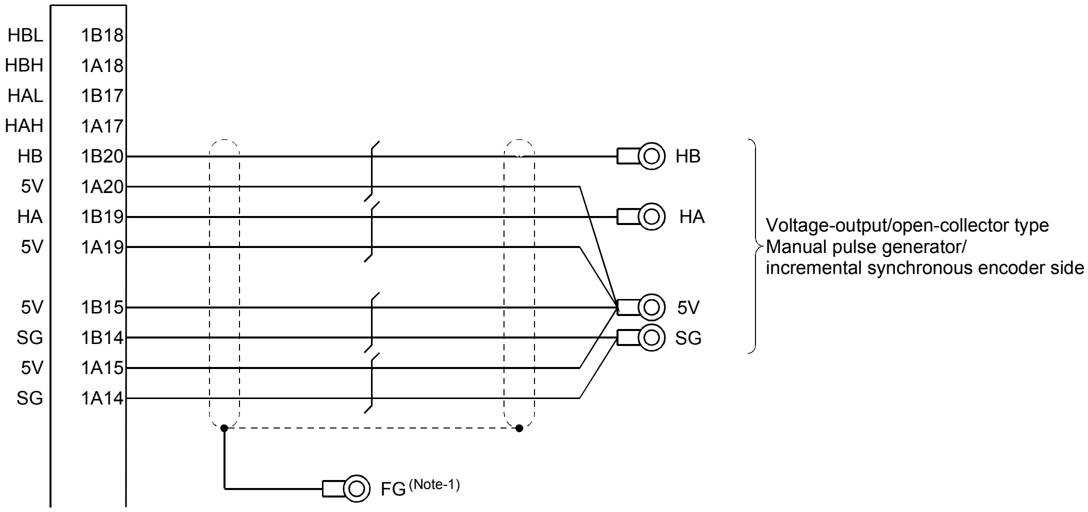


∫ : Twisted pair cable

(Note-1): Ground FG terminal on the used equipment side.
Also, connect it to the shell of connector side.

(b) Voltage-output/Open-collector type

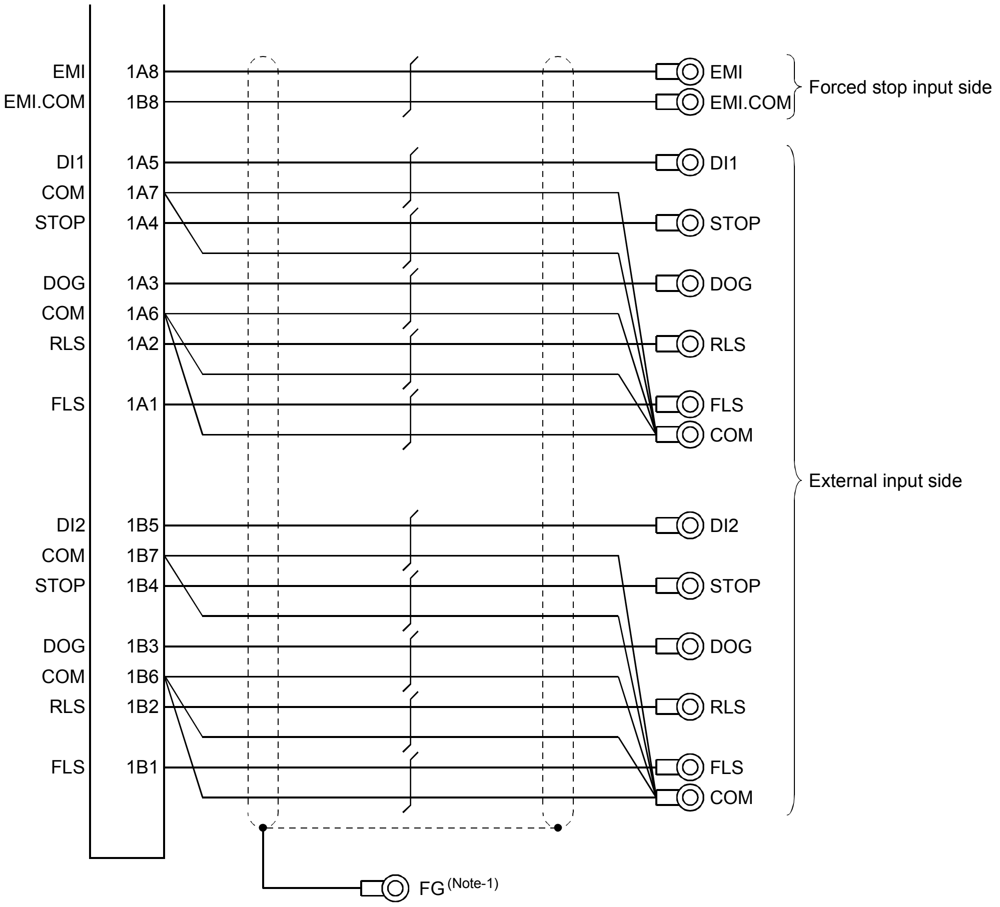
Make the cable within 10m (32.81ft.).



∫: Twisted pair cable

(Note-1): Ground FG terminal on the used equipment side.
Also, connect it to the shell of connector side.

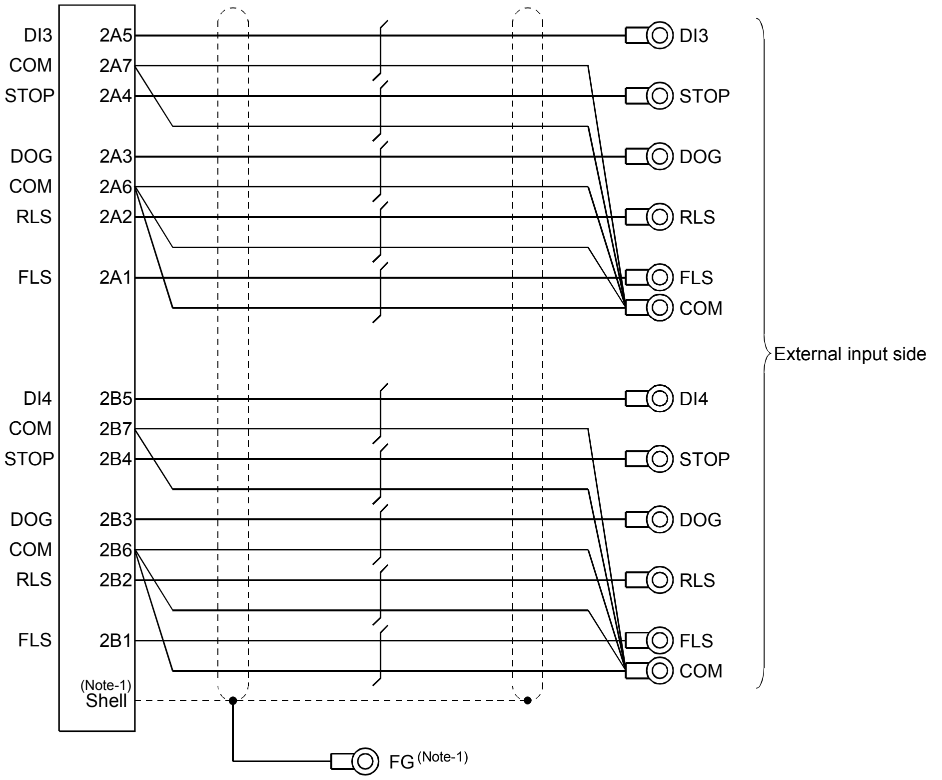
(2) Forced stop input/ External input signal (AX1, AX2)



∫: Twisted pair cable

(Note-1): Ground FG terminal on the used equipment side.
Also, connect it to the shell of connector side.

(3) External input signal (AX3, AX4)



∫: Twisted pair cable

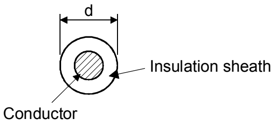
(Note-1): Ground FG terminal on the used equipment side.
Also, connect it to the shell of connector side.

1) The following table indicates the external input signal cables. Make selection according to your operating conditions.

Table 3.1 Table of wire specifications

Wire model	Core size [mm^2]	Number of cores	Characteristics of one core			Finish OD [mm]$^{\text{(Note-2)}}$
			Structure [Number of wires/mm]	Conductor resistance [Ω/km]	Insulating sheath OD d[mm]$^{\text{(Note-1)}}$	
17/0.16 1P SRV-SV(2464)-K	0.3mm^2	2(1 pairs)	17/0.16	57.5	0.77	5.3
17/0.16 4P SRV-SV(2464)-K	0.3mm^2	8(4 pairs)	17/0.16	57.5	0.77	7.6
17/0.16 10P SRV-SV(2464)-K	0.3mm^2	20(10 pairs)	17/0.16	57.5	0.77	10.0

(Note-1): d is as shown below.



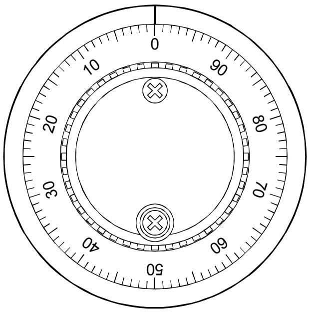
(Note-2): Standard OD. Max. OD is about 10% larger.

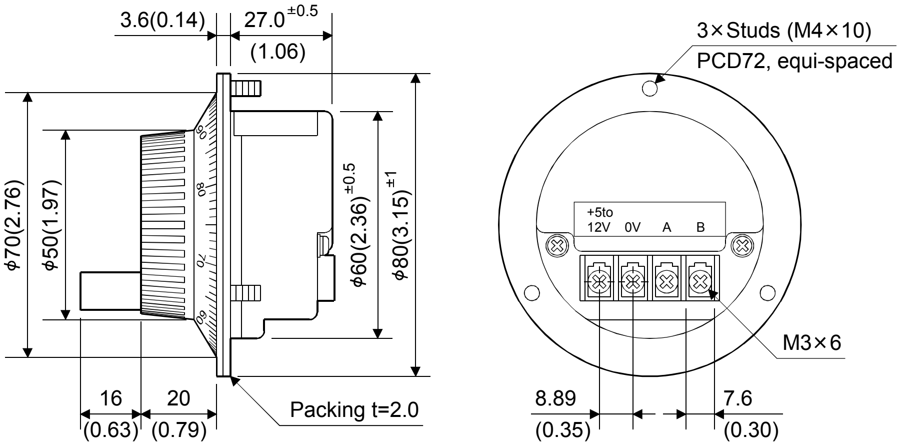
⚠CAUTION

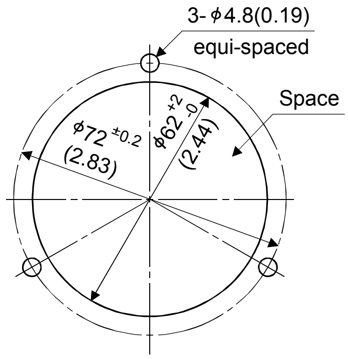
- When fabricating the cable, do not make incorrect connection. Wrong connection will cause runaway or explosion.

Appendix 3.3 Manual pulse generator (MR-HDP01)

(1) External dimension drawing







The figure of processing a disc

Appendix 4 Comparisons with positioning modules /LD77MH models

Appendix 4.1 Differences with QD75MH models

(1) Differences of performance specifications

Item		QD77MS2	QD77MS4	QD77MS16	QD75MH2	QD75MH4
Number of control axes		2	4	16	2	4
Operation cycle [ms]		0.88/1.77			1.77	
Control system	Speed-torque control	○			×	
Synchronous control		○			×	
Starting time (1-axis linear)	Trapezoidal acceleration/ deceleration	0.88ms		1.77ms	3.5ms	
	S-curve acceleration/ deceleration				4.0ms	
SSCNET communication		SSCNETⅢ/H or SSCNETⅢ			SSCNETⅢ	
Compatible servo amplifier		MR-J4-□B/MR-J4W-□B/ MR-J3-□B/MR-J3W-□B/MR-J3-□B-RJ006/ MR-J3-□BS/MR-J3-□B-RJ004/ MR-J3-□B-RJ080W			MR-J3-□B/MR-J3W-□B/MR-J3-□B-RJ006/ MR-J3-□BS/MR-J3-□B-RJ004/ MR-J3-□B-RJ080W (Note-1)	
Controlled servo parameter group	SSCNETⅢ/H	PA, PB, PC, PD, PE, PS, PF, Po, PL			×	
	SSCNETⅢ	PA, PB, PC, PD, PE, PS, PF, Po			PA, PB, PC, PD, PE, PS	
Monitor data refresh cycle [ms]		Operation cycle			1.77	Other than the following
					56.8	Machine feed value, Feedrate, Axis feedrate, External input signal, Forced stop input
Manual pulse generator	Signal input form	Set "differential-output type" or "voltage-output/open-collector type" by parameter (Pr.89).			Automatic recognition of "differential-output type" or "voltage-output/open-collector type" by hardware	
	1 pulse input magnification	1 to 10000			1 to 1000 (Note-1)	
Machine OPR function (OPR method)		5 types (Near-point dog method, Count method 1) 2), Data set method, Scale origin signal detection method)			4 types (Near-point dog method, Count method 1) 2), Data set method)	
External signal selection function		External input signal of QD77MS (FLS, RLS, DOG, STOP, DI) / External input signal of servo amplifier (FLS, RLS, DOG) / external input signal via CPU (buffer memory : FLS, RLS, DOG)			External input signal of QD75MH (FLS, RLS, DOG, STOP, CHG) / external input signal of servo amplifier (FLS, RLS, DOG)	
Torque change function		Forward/reverse same setting and individual setting			Forward/reverse same setting only (Note-1)	
Amplifier-less operation function		○			× (Note-1)	
Virtual servo amplifier function		○			×	
Mark detection function		○			×	
Optional data monitor function		○			×	
Module error collection function		○			×	

Differences of performance specifications (Continued)

Item \ Model		QD77MS2	QD77MS4	QD77MS16	QD75MH2	QD75MH4
Connect/disconnect function of SSCNET communication		○			×	
History data (Start, Error, Warning)		Information display of "Year, Month, Day, Hour, Minute, Second"			Information display of "Hour, Minute, Second"	
5VDC internal current consumption [A]		0.6		0.75	0.60	
Mass [kg]		0.15	0.16		0.15	0.16
External command signal	Switching signal	DI signal (External start or speed-position switching can be selected by parameter.)			CHG signal (External start or speed-position switching can be selected by parameter.)	
Speed-position/position-speed switching control		Speed-position switching can be selected by external command signal (DI), near-point dog signal (DOG) or "Cd.46 Speed-position switching command".			Speed-position switching by external command signal (CHG).	
Programming tool		GX Works2, MR Configurator2			GX Works2/ GX Developer, GX Configurator-QP	
Upper limit value of electronic gear setting range		(Note-2)			10000	

○ : Possible, × : Not possible

(Note-1): These functions are equal to the QD77MS's specification in the following version of QD75MH.
Rating plate: 110720000000000-B or later, Product information: 110520000000000-B or later

(Note-2): The value varies depending on the product information as follows.
Before 150410000000000 : 20000,
150410000000000 or later: 320000

(2) Differences of function

(a) Added functions

Functions	Remarks
Scale origin signal detection method OPR	Refer to Section 8.2.7.
Speed-torque control	Refer to Section 12.1.
Virtual servo amplifier function	Refer to Section 14.8.
Driver communication function	Refer to Section 14.9.
Mark detection function	Refer to Section 14.10.
Optional data monitor function	Refer to Section 14.11.
Module error collection function	Refer to Section 14.12.
Connect/disconnect function of SSCNET communication	Refer to Section 14.13.
QD75MH initial value setting function	Refer to Section 14.14.
Compatible with servo driver VCII series manufactured by Nikki Denso Co., Ltd.	Refer to Appendix 6.1.
Compatible with inverter FR-A700 series	Refer to Appendix 6.2.
Synchronous encoder via servo amplifier	Refer to "MELSEC-Q/L QD77MS/QD77GF/LD77MS/LD77MH Simple Motion Module User's Manual (Synchronous Control)".

(b) Changed functions

<table>
<tr><th rowspan="2">Function</th><th rowspan="2">Description</th><th colspan="5">Specification</th></tr>
<tr><th>QD77MS2</th><th>QD77MS4</th><th>QD77MS16</th><th>QD75MH2</th><th>QD75MH4</th></tr>
<tr><td>Input signal [X0]</td><td>Signal name</td><td colspan="3">READY</td><td colspan="2">QD75 READY</td></tr>
<tr><td>Pr.7 Bias speed at start</td><td>Range of setting value</td><td colspan="3"><Setting unit is PLS>
0 to 1000000000 [PLS/s]</td><td colspan="2">Maker setting</td></tr>
<tr><td>Pr.8 Speed limit value</td><td>Range of setting value</td><td colspan="3"><Control unit is PLS>
1 to 1000000000 [PLS/s]</td><td colspan="2"><Control unit is PLS>
1 to 50000000 [PLS/s]</td></tr>
<tr><td>Pr.22 Input signal logic selection</td><td>Range of setting value</td><td colspan="3">b8: Only the value specified against the axis 1 is valid</td><td colspan="2">No limitation</td></tr>
<tr><td>Pr.24 Manual pulse generator /Incremental synchronous encoder input selection</td><td>Name</td><td colspan="3">Manual pulse generator/Incremental synchronous encoder input selection</td><td colspan="2">Manual pulse generator input selection</td></tr>
<tr><td>Pr.31 JOG speed limit value</td><td>Range of setting value</td><td colspan="3"><Control unit is PLS>
1 to 1000000000 [PLS/s]</td><td colspan="2"><Control unit is PLS>
1 to 50000000 [PLS/s]</td></tr>
<tr><td>Pr.42 External command function selection</td><td>Range of setting value</td><td colspan="3">0: External positioning start
1: External speed change request
2: Speed-position, position-speed switching request
3: Skip request
4: High speed input request</td><td colspan="2">0: External positioning start
1: External speed change request
2: Speed-position, position-speed switching request
3: Skip request</td></tr>
<tr><td>Pr.43 OPR method</td><td>Range of setting value</td><td colspan="3">0: Near-point dog method
4: Count method 1)
5: Count method 2)
6: Data set method
7: Scale origin signal detection method</td><td colspan="2">0: Near-point dog method
4: Count method 1)
5: Count method 2)
6: Data set method</td></tr>
<tr><td>Pr.46 OPR speed</td><td>Range of setting value</td><td colspan="3"><Control unit is PLS>
1 to 1000000000 [PLS/s]</td><td colspan="2"><Control unit is PLS>
1 to 50000000 [PLS/s]</td></tr>
<tr><td>Pr.47 Creep speed</td><td>Range of setting value</td><td colspan="3"><Control unit is PLS>
1 to 1000000000 [PLS/s]</td><td colspan="2"><Control unit is PLS>
1 to 50000000 [PLS/s]</td></tr>
<tr><td>Pr.80 External input signal selection</td><td>Range of setting value</td><td colspan="3">0: External input signal of QD77MS QD77MS2 QD77MS4
1: External input signal of servo amplifier
2: Buffer memory of QD77MS
3: External input signal 1 of QD77MS QD77MS16
4: External input signal 2 of QD77MS QD77MS16
5: External input signal 3 of QD77MS QD77MS16
6: External input signal 4 of QD77MS QD77MS16</td><td colspan="2">0: External input signal of QD75MH
1: External input signal of servo amplifier</td></tr>
<tr><td>Pr.89 Manual pulse generator /Incremental synchronous encoder input type selection</td><td>New parameter</td><td colspan="3">0: Differential-output type
1: Voltage-output/Open-collector type</td><td colspan="2">No setting
(Automatic recognition by hardware)</td></tr>
</table>

Changed functions (Continued)

Function	Description	Specification				
		QD77MS2	QD77MS4	QD77MS16	QD75MH2	QD75MH4
Pr.91 Optional data monitor: Data type setting 1	New parameter	0: No setting 1: Effective load ratio 2: Regenerative load ratio 3: Peak load ratio 4: Load to motor inertia ratio 5: Position loop gain 1 6: Bus voltage 7: Servo motor speed 8: Motor encoder ABS counter 9: Unit power consumption 10: Instantaneous torque 12: Motor thermistor temperature 13: Torque equivalent to disturbance 14: Overload alarm margin 15: Excessive error alarm margin 16: Settling time 17: Overshoot amount 20: Position feedback 21: Motor ENC within-1-rev position 22: Select droop pulses 23: Unit cumulative power consumption 24: Load side encoder information 1 25: Load side encoder information 2 26: Z-phase counter 27: Motor-side/load-side position deviation 28: Motor-side/load-side speed deviation			No parameter setting	
Pr.92 Optional data monitor: Data type setting 2						
Pr.93 Optional data monitor: Data type setting 3						
Pr.94 Optional data monitor: Data type setting 4						
Pr.95 External command signal selection	New parameter	No parameter setting		0: Not used 1: DI1 2: DI2 3: DI3 4: DI4	No parameter setting	
Pr.96 Operation cycle setting	New parameter	0: 0.88ms 1: 1.77ms			No parameter setting	
Pr.97 SSCNET setting	New parameter	0: SSCNETⅢ 1: SSCNETⅢ/H			No parameter setting	
Pr.114 External command signal compensation valid/invalid setting	New parameter	0: Invalid 1: Valid			No parameter setting	
Starting history	Information display of starting time	Starting time is displayed by "Year, Month, Day, Hour, Minute, Second". Md.54 Start Year: month Md.5 Start Day: hour Md.6 Start Minute: second			Starting time is displayed by "Hour, Minute, Second". Md.5 Start Hour Md.6 Start Minute: second	
Axis error occurrence time	Information display of axis error occurrence time	Occurrence time of axis error is displayed by "Year, Month, Day, Hour, Minute, Second". Md.55 Axis error occurrence (Year: month) Md.11 Axis error occurrence (Day: hour) Md.12 Axis error occurrence (Minute: second)			Occurrence time of axis error is displayed by "Hour, Minute, Second". Md.11 Axis error occurrence (Hour) Md.12 Axis error occurrence (Minute: second)	

Changed functions (Continued)

Function	Description	Specification				
		QD77MS2	QD77MS4	QD77MS16	QD75MH2	QD75MH4
Axis warning occurrence time	Information display of axis warning occurrence time	Occurrence time of axis warning is displayed by "Year, Month, Day, Hour, Minute, Second". Md.56 Axis warning occurrence (Year: month) Md.16 Axis warning occurrence (Day: hour) Md.17 Axis warning occurrence (Minute: second)			Occurrence time of axis warning is displayed by "Hour, Minute, Second". Md.16 Axis warning occurrence (Hour) Md.17 Axis warning occurrence (Minute: second)	
Md.26 Axis operation status	Range of monitor value	-2: Step standby -1: Error 0: Standby 1: Stopped 2: Interpolation 3: JOG operation 4: Manual pulse generator operation 5: Analyzing 6: Special start standby 7: OPR 8: Position control 9: Speed control 10: Speed control in speed-position switching control 11: Position control in speed-position switching control 12: Position control in position-speed switching control 13: Speed control in position-speed switching control 15: Synchronous control 20: Servo amplifier has not been connected/servo amplifier power OFF 21: Servo OFF 30: Control mode switch 31: Speed control 32: Torque control 33: Continuous operation to torque control			-2: Step standby -1: Error 0: Standby 1: Stopped 2: Interpolation 3: JOG operation 4: Manual pulse generator operation 5: Analyzing 6: Special start standby 7: OPR 8: Position control 9: Speed control 10: Speed control in speed-position switching control 11: Position control in speed-position switching control 12: Position control in position-speed switching control 13: Speed control in position-speed switching control 20: Servo amplifier has not been connected/servo amplifier power OFF 21: Servo OFF	
Md.31 Status	Range of monitor value	b0: In speed control flag b1: Speed-position switching latch flag b2: Command in-position flag b3: OPR request flag b4: OPR complete flag b5: Position-speed switching latch flag b9: Axis warning detection b10: Speed change 0 flag b12: M code ON QD77MS16 b13: Error detection QD77MS16 b14: Start complete QD77MS16 b15: Positioning complete QD77MS16			b0: In speed control flag b1: Speed-position switching latch flag b2: Command in-position flag b3: OPR request flag b4: OPR complete flag b5: Position-speed switching latch flag b9: Axis warning detection b10: Speed change 0 flag	

Changed functions (Continued)

Function	Description	Specification				
		QD77MS2	QD77MS4	QD77MS16	QD75MH2	QD75MH4
Md.47 Positioning data being executed	Storage item	Positioning identifier (Da.1 to Da.4, Da.5 QD77MS2 QD77MS4) Positioning address (Da.6) Arc address (Da.7) Command speed (Da.8) Dwell time (Da.9) M code (Da.10) Axis to be interpolated (Da.20 to Da.22) QD77MS16			Positioning identifier (Da.1 to Da.5) Positioning address (Da.6) Arc address (Da.7) Command speed (Da.8) Dwell time (Da.9) M code (Da.10)	
Md.57 Servo alarm	New monitor data	The LED display details of servo amplifier detection alarm			No monitor data	
Md.58 Servo warning	New monitor data	The LED display details of servo amplifier detection warning			No monitor data	
Md.59 Module information	New monitor data	b0: Number of axes b12: Module information			No monitor data	
Md.107 Parameter error No.	Range of monitor value	<SSCNETⅢ/H> 1 to 64 : PA01 to PA64 65 to 128 : PB01 to PB64 129 to 192: PC01 to PC64 193 to 256: PD01 to PD64 257 to 320: PE01 to PE64 321 to 384: PF01 to PF64 385 to 448: Po01 to Po64 449 to 512: PS01 to PS64 513 to 576: PL01 to PL64 <SSCNETⅢ> 1 to 18 : PA01 to PA18 19 to 63 : PB01 to PB45 64 to 95 : PC01 to PC32 96 to 127 : PD01 to PD32 128 to 167: PE01 to PE40 168 to 183: PF01 to PF16 184 to 199: Po01 to Po16 200 to 231: PS01 to PS32 232 : PA19			<SSCNETⅢ> 1 to 18 : PA01 to PA18 19 to 63 : PB01 to PB45 64 to 95 : PC01 to PC32 96 to 127: PD01 to PD32	
Md.108 Servo status	Range of monitor value	Low-order buffer memory b0: Zero point pass b3: Zero speed b4: Speed limit b8: PID control			Low-order buffer memory b0: Zero point pass b3: Zero speed	
		High-order buffer memory b0: READY ON b1: Servo ON b2, b3: Control mode b7: Servo alarm b12: In-position b13: Torque limit b14: Absolute position lost b15: Servo warning			High-order buffer memory b0: READY ON b1: Servo ON b7: Servo alarm b12: In-position b13: Torque limit b14: Absolute position lost b15: Servo warning	

Changed functions (Continued)

Function	Description	Specification				
		QD77MS2	QD77MS4	QD77MS16	QD75MH2	QD75MH4
Md.109 Regenerative load ratio/Optional data monitor output 1	Name	Regenerative load ratio/Optional data monitor output 1			Regenerative load ratio	
Md.110 Effective load torque/ Optional data monitor output 2		Effective load torque/Optional data monitor output 2			Effective load torque	
Md.111 Peak torque ratio/ Optional data monitor output 3		Peak torque ratio/Optional data monitor output 3			Peak torque ratio	
Md.112 Optional data monitor output 4	New monitor data	Content set in "Pr.94 Optional data monitor: Data type setting 4" is displayed.			No monitor data	
Md.113 Semi/Fully closed loop status	Buffer memory address	Axis 1: 887 Axis 2: 987	Axis 1: 887 Axis 2: 987 Axis 3: 1087 Axis 4: 1187	Axis 1: 2487 Axis 2: 2587 Axis 3: 2687 Axis 4: 2787 to Axis 16: 3987	Axis 1: 881 Axis 2: 981	Axis 1: 881 Axis 2: 981 Axis 3: 1081 Axis 4: 1181
Md.116 Encoder option information	New storage item	Compatible with continuous operation to torque control Compatible with scale measurement mode			No storage item	
Md.132 Operation cycle setting	New monitor data	0: 0.88ms 1: 1.77ms			No monitor data	
Md.133 Operation cycle over flag		0: OFF 1: ON (Operation cycle over occurred.)			No monitor data	
Md.134 Operation time		Operation time [μs]			No monitor data	
Md.135 Maximum operation time		Maximum operation time [μs]			No monitor data	
Cd.14 New speed value	Range of setting value	<Control unit is PLS> 0 to 1000000000 [PLS/s]			<Control unit is PLS> 0 to 50000000 [PLS/s]	
Cd.17 JOG speed	Range of setting value	<Control unit is PLS> 1 to 1000000000 [PLS/s]			<Control unit is PLS> 1 to 50000000 [PLS/s]	
Cd.24 Speed-position switching enable flag	Details of setting value	0: Speed control will not be taken over by position control even when the signal set in "Cd.45 Speed-position switching device selection" comes ON. 1: Speed control will be taken over by position control when the signal set in "Cd.45 Speed-position switching device selection" comes ON.			0: Speed control will not be taken over by position control even when the external command signal [CHG] comes ON. 1: Speed control will be taken over by position control when the external command signal [CHG] comes ON	
Cd.25 Position-speed switching control speed change register	Range of setting value	<Control unit is PLS> 0 to 1000000000 [PLS/s]			<Control unit is PLS> 0 to 50000000 [PLS/s]	
Cd.26 Position-speed switching enable flag	Details of setting value	0: Position control will not be taken over by speed control even when the signal set in "Cd.45 Speed-position switching device selection" comes ON. 1: Position control will be taken over by speed control when the signal set in "Cd.45 Speed-position switching device selection" comes ON.			0: Position control will not be taken over by speed control even when the external command signal [CHG] comes ON. 1: Position control will be taken over by speed control when the external command signal [CHG] comes ON.	

Changed functions (Continued)

Function	Description	Specification				
		QD77MS2	QD77MS4	QD77MS16	QD75MH2	QD75MH4
Cd.28 Target position change value (New speed)	Range of setting value	<Control unit is PLS> 0 to 1000000000 [PLS/s]			<Control unit is PLS> 0 to 50000000 [PLS/s]	
Cd.30 Simultaneous starting own axis start data No.	Name	Cd.30 Simultaneous starting axis start data No. (axis 1 start data No.)		Cd.30 Simultaneous starting own axis start data No.	Cd.30 Simultaneous starting axis start data No. (axis 1 start data No.)	
Cd.31 Simultaneous starting axis start data No.1		Cd.31 Simultaneous starting axis start data No. (axis 2 start data No.)		Cd.31 Simultaneous starting axis start data No.1	Cd.31 Simultaneous starting axis start data No. (axis 2 start data No.)	
Cd.32 Simultaneous starting axis start data No.2		No control data	Cd.32 Simultaneous starting axis start data No. (axis 3 start data No.)	Cd.32 Simultaneous starting axis start data No.2	No control data	Cd.32 Simultaneous starting axis start data No. (axis 3 start data No.)
Cd.33 Simultaneous starting axis start data No.2		No control data	Cd.33 Simultaneous starting axis start data No. (axis 4 start data No.)	Cd.33 Simultaneous starting axis start data No.3	No control data	Cd.33 Simultaneous starting axis start data No. (axis 4 start data No.)
Cd.43 Simultaneous starting axis	New control data	No control data		Number of simultaneous starting axes 2 to 4: 2 axes to 4 axes Simultaneous starting axis No. 0 to F: Axis 1 to Axis 16	No control data	

Changed functions (Continued)

Function	Description	Specification				
		QD77MS2	QD77MS4	QD77MS16	QD75MH2	QD75MH4
Cd.44 External input signal operation device	New control data	b0 : Axis 1 (Axis 5, Axis 9, Axis 13) Upper limit signal (FLS) b1 : Axis 1 (Axis 5, Axis 9, Axis 13) Lower limit signal (RLS) b2 : Axis 1 (Axis 5, Axis 9, Axis 13) Near-point dog signal (DOG) b3 : Axis 1 (Axis 5, Axis 9, Axis 13) STOP signal (STOP) b4 : Axis 2 (Axis 6, Axis 10, Axis 14) Upper limit signal (FLS) b5 : Axis 2 (Axis 6, Axis 10, Axis 14) Lower limit signal (RLS) b6 : Axis 2 (Axis 6, Axis 10, Axis 14) Near-point dog signal (DOG) b7 : Axis 2 (Axis 6, Axis 10, Axis 14) STOP signal (STOP) b8 : Axis 3 (Axis 7 , Axis 11, Axis 15) Upper limit signal (FLS) b9 : Axis 3 (Axis 7, Axis 11, Axis 15) Lower limit signal (RLS) b10 : Axis 3 (Axis 7, Axis 11, Axis 15) Near-point dog signal (DOG) b11 : Axis 3 (Axis 7, Axis 11, Axis 15) STOP signal (STOP) b12 : Axis 4 (Axis 8, Axis 12, Axis 16) Upper limit signal (FLS) b13 : Axis 4 (Axis 8, Axis 12, Axis 16) Lower limit signal (RLS) b14 : Axis 4 (Axis 8, Axis 12, Axis 16) Near-point dog signal (DOG) b15 : Axis 4 (Axis 8, Axis 12, Axis 16) STOP signal (STOP)			No control data	
Cd.45 Speed-position switching device selection	New control data	<Speed-position switching control> 0: Use the external command signal for switching from speed control to position control 1: Use the near-point dog signal for switching from speed control to position control 2: Use "Cd.46 Speed-position switching command" for switching from speed control to position control <Position-speed switching control> 0: Use the external command signal for switching from position control to speed control 1: Use the near-point dog signal for switching from position control to speed control 2: Use "Cd.46 Speed-position switching command" for switching from position control to speed control			No control data	

Changed functions (Continued)

Function	Description	Specification				
		QD77MS2	QD77MS4	QD77MS16	QD75MH2	QD75MH4
Cd.46 Speed-position switching command	New control data	<Speed-position switching control> 0: Not switch from speed control to position control 1: Switch from speed control to position control <Position-speed switching control> 0: Not switch from position control to speed control 1: Switch from position control to speed control			No control data	
Cd.47 QD75MH initial value setting request	New control data	1: Requests QD75MH initial value setting			No control data	
Cd.130 Parameter write request	Range of setting value	1 : 1 word write request 2 : 2 words write request Other than 1 and 2: Not request			No control data	
Cd.131 Parameter No.	Range of setting value	<MR-J4(W)-B> 0: PA group 1: PB group 2: PC group 3: PD group 4: PE group 5: PF group 9: Po group A: PS group B: PL group <VCII series> 0: Group 0 1: Group 1 2: Group 2 3: Group 3 4: Group 4 5: Group 5 6: Group 6 7: Group 7 8: Group 8 9: Group 9			No control data	
Cd.132 Change data	New control data	Set the change value of servo parameter set in "Cd.131 Parameter No.".			No control data	
Cd.140 Command speed at speed control mode	Range of setting value	<Control unit is PLS> -1000000000 to 1000000000 [PLS/s]			No control data	
Cd.146 Speed limit value at torque control mode	Range of setting value	<Control unit is PLS> 0 to 1000000000 [PLS/s]			No control data	
Cd.147 Speed limit value at continuous operation to torque control mode	Range of setting value	<Control unit is PLS> -1000000000 to 1000000000 [PLS/s]			No control data	
Cd.802 Latch data range change request	New control data	1: Change in the next Operation cycle of the requested 2: Change in the next DI input of the requested			No control data	
Axis stop	Input/output signal	Y4, Y5	Y4 to Y7	Cd.180 Axis stop	Y4, Y5	Y4 to Y7
Forward run JOG start		Y8, YA	Y8, YA, YC, YE	Cd.181 Forward run JOG start	Y8, YA	Y8, YA, YC, YE
Reverse run JOG start		Y9, YB	Y9, YB, YD, YF	Cd.182 Reverse run JOG start	Y9, YB	Y9, YB, YD, YF

Changed functions (Continued)

Function	Description	Specification				
		QD77MS2	QD77MS4	QD77MS16	QD75MH2	QD75MH4
Execution prohibition flag	Input/output signal	Y14, Y15	Y14 to Y17	Cd.183 Execution prohibition flag	Y14, Y15	Y14 to Y17
Axis to be interpolated	Item of buffer memory	Da.5 Axis to be interpolated		Da.20 Axis to be interpolated No.1 Da.21 Axis to be interpolated No.2 Da.22 Axis to be interpolated No.3	Da.5 Axis to be interpolated	
Da.8 Command speed	Range of setting value	<Control unit is PLS> 1 to 1000000000 [PLS/s]			<Control unit is PLS> 1 to 50000000 [PLS/s]	
Da.16 Condition operator	Range of setting value	01: **=P1 02: **≠P1 03: **≤P1 04: **≥P1 05: P1≤**≤P2 06: **≤P1,P2≤** 07: DEV=ON 08: DEV=OFF 10: Axis 1 selected 20: Axis 2 selected 30: Axis 1 and 2 selected	01: **=P1 02: **≠P1 03: **≤P1 04: **≥P1 05: P1≤**≤P2 06: **≤P1,P2≤** 07: DEV=ON 08: DEV=OFF 10: Axis 1 selected 20: Axis 2 selected 30: Axis 1 and 2 selected 40: Axis 3 selected 50: Axis 1 and 3 selected 60: Axis 2 and 3 selected 70: Axis 1, 2 and 3 selected 80: Axis 4 selected 90: Axis 1 and 4 selected A0: Axis 2 and 4 selected B0: Axis 1, 2 and 4 selected C0: Axis 3 and 4 selected D0: Axis 1, 3 and 4 selected E0: Axis 2, 3 and 4 selected	01: **=P1 02: **≠P1 03: **≤P1 04: **≥P1 05: P1≤**≤P2 06: **≤P1,P2≤** 07: DEV=ON 08: DEV=OFF	01: **=P1 02: **≠P1 03: **≤P1 04: **≥P1 05: P1≤**≤P2 06: **≤P1,P2≤** 07: DEV=ON 08: DEV=OFF 10: Axis 1 selected 20: Axis 2 selected 30: Axis 1 and 2 selected	01: **=P1 02: **≠P1 03: **≤P1 04: **≥P1 05: P1≤**≤P2 06: **≤P1,P2≤** 07: DEV=ON 08: DEV=OFF 10: Axis 1 selected 20: Axis 2 selected 30: Axis 1 and 2 selected 40: Axis 3 selected 50: Axis 1 and 3 selected 60: Axis 2 and 3 selected 70: Axis 1, 2 and 3 selected 80: Axis 4 selected 90: Axis 1 and 4 selected A0: Axis 2 and 4 selected B0: Axis 1, 2 and 4 selected C0: Axis 3 and 4 selected D0: Axis 1, 3 and 4 selected E0: Axis 2, 3 and 4 selected

Changed functions (Continued)

Function	Description	Specification				
		QD77MS2	QD77MS4	QD77MS16	QD75MH2	QD75MH4
Da.18 Parameter 1	Range of setting value	Set by "Da.16 Condition operator".		Set by "Da.16 Condition operator" and "Da.23 Number of simultaneously starting axes".	Set by "Da.16 Condition operator".	
Da.19 Parameter 2	Range of setting value	Set by "Da.16 Condition operator".		Set by "Da.16 Condition operator" and "Da.23 Number of simultaneously starting axes".	Set by "Da.16 Condition operator".	
Da.23 Number of simultaneously starting axes	New positioning data	No positioning data		2: 2 axes 3: 3 axes 4: 4 axes	No positioning data	
Da.24 Simultaneously starting axis No.1 Da.25 Simultaneously starting axis No.2 Da.26 Simultaneously starting axis No.3	New positioning data	No positioning data		0: Axis 1 selected 1: Axis 2 selected 2: Axis 3 selected 3: Axis 4 selected 4: Axis 5 selected 5: Axis 6 selected 6: Axis 7 selected 7: Axis 8 selected 8: Axis 9 selected 9: Axis 10 selected A: Axis 11 selected B: Axis 12 selected C: Axis 13 selected D: Axis 14 selected E: Axis 15 selected F: Axis 16 selected	No positioning data	

Appendix 4.2 Differences with LD77MH models

(1) Differences of performance specifications

Item		QD77MS2	QD77MS4	QD77MS16	LD77MH4	LD77MH16
Number of control axes		2	4	16	4	16
Operation cycle [ms]		0.88/1.77			0.88	0.88/1.77
Starting time (1-axis linear)	Trapezoidal acceleration/ deceleration	0.88ms		1.77ms	0.88ms	1.77ms
	S-curve acceleration/ deceleration					
SSCNET communication		SSCNETⅢ/H or SSCNETⅢ			SSCNETⅢ	
Compatible servo amplifier		MR-J4-□B/MR-J4W-□B/ MR-J3-□B/MR-J3W-□B/MR-J3-□B-RJ006/ MR-J3-□BS/MR-J3-□B-RJ004/ MR-J3-□B-RJ080W			MR-J3-□B/MR-J3W-□B/MR-J3-□B-RJ006/ MR-J3-□BS/MR-J3-□B-RJ004/ MR-J3-□B-RJ080W (Note-1)	
Controlled servo parameter group	SSCNETⅢ/H	PA, PB, PC, PD, PE, PS, PF, Po, PL			—	
	SSCNETⅢ	PA, PB, PC, PD, PE, PS, PF, Po			PA, PB, PC, PD, PE, PS, PF (Note-1), Po (Note-1)	
External signal selection function		External input signal of QD77MS (FLS, RLS, DOG, STOP, DI) / External input signal of servo amplifier (FLS, RLS, DOG) / external input signal via CPU (buffer memory : FLS, RLS, DOG)			External input signal of servo amplifier (FLS, RLS, DOG) / external input signal via CPU (buffer memory : FLS, RLS, DOG)	
Connection connector		A6CON1, A6CON4: Soldering type, Optional A6CON2: Crimp contact type, Optional A6CON3: Pressure-displacement type, Optional			LD77MHIOCON: Soldering type	
Applicable wire size		A6CON1, A6CON4: 0.3mm^2 A6CON2: AWG24 to AWG28 (0.2mm^2 to 0.08mm^2) A6CON3: AWG28 (Stranded, 0.08mm^2) AWG30 (Solid, 0.05mm^2)			LD77MHIOCON: AWG24 to AWG30 (0.2 to 0.05mm^2)	
5VDC internal current consumption [A]		0.6		0.75	0.55	0.70
Number of module occupied slots		1			2	
Outline dimensions [mm(inch)]		98.0(3.86) (H)×27.4(1.08) (W)×90.0(3.54) (D)			90.0(3.54) (H)×45.0(1.77) (W)×95.0(3.74) (D)	
Mass [kg]		0.15	0.16		0.22	
Saving area for servo parameter		Internal memory (nonvolatile)			Flash ROM	
Programming tool		GX Works2, MR Configurator2			GX Works2, MR Configurator2/ GX Developer, GX Configurator-QP (Note-1),	
Upper limit value of electronic gear setting range		(Note-2)			20000	

(Note-1): GX Configurator-QP does not support with a part of LD77MH4 function and LD77MH16.

(Note-2): The value varies depending on the product information as follows.
Before 150410000000000 : 20000,
150410000000000 or later: 320000

(2) Differences of function

(a) Added functions

Functions	Remarks
Driver communication function (SSCNETⅢ/H)	Refer to Section 14.9.
QD75MH initial value setting function	Refer to Section 14.14.
Compatible with servo driver VCII series manufactured by Nikki Denso Co., Ltd.	Refer to Appendix 6.1.
Compatible with inverter FR-A700 series	Refer to Appendix 6.2.
Synchronous encoder via servo amplifier	Refer to "MELSEC-Q/L QD77MS/QD77GF/LD77MS/LD77MH Simple Motion Module User's Manual (Synchronous Control)".

(b) Changed functions

Function	Description	Specification				
		QD77MS2	QD77MS4	QD77MS16	LD77MH4	LD77MH16
Input signal [X0]	Signal name	READY			LD77 READY	
Driver communication function	Function name	Driver communication function			Master-slave operation function	
Pr.7 Bias speed at start	Range of setting value	<Setting unit is PLS> 0 to 1000000000 [PLS/s]			<Setting unit is PLS> 0 to 50000000 [PLS/s]	
Pr.8 Speed limit value	Range of setting value	<Control unit is PLS> 1 to 1000000000 [PLS/s]			<Control unit is PLS> 1 to 50000000 [PLS/s]	
Pr.22 Input signal logic selection	Range of setting value	No limitation			b4: Only the value specified against the axis 1 is valid	
Pr.24 Manual pulse generator /Incremental synchronous encoder input selection	Range of setting value	0: A-phase/B-phase multiplied by 4 1: A-phase/B-phase multiplied by 2 2: A-phase/B-phase multiplied by 1 3: PLS/SIGN			0: A-phase/B-phase multiplied by 4 2: A-phase/B-phase multiplied by 1 3: PLS/SIGN	
Pr.31 JOG speed limit value	Range of setting value	<Control unit is PLS> 1 to 1000000000 [PLS/s]			<Control unit is PLS> 1 to 50000000 [PLS/s]	
Pr.46 OPR speed	Range of setting value	<Control unit is PLS> 1 to 1000000000 [PLS/s]			<Control unit is PLS> 1 to 50000000 [PLS/s]	
Pr.47 Creep speed	Range of setting value	<Control unit is PLS> 1 to 1000000000 [PLS/s]			<Control unit is PLS> 1 to 50000000 [PLS/s]	
Pr.80 External input signal selection	Range of setting value	0: External input signal of QD77MS QD77MS2 QD77MS4 1: External input signal of servo amplifier 2: Buffer memory of QD77MS 3: External input signal 1 of QD77MS QD77MS16 4: External input signal 2 of QD77MS QD77MS16 5: External input signal 3 of QD77MS QD77MS16 6: External input signal 4 of QD77MS QD77MS16			1: External input signal of servo amplifier 2: Buffer memory of LD77MH	
Pr.89 Manual pulse generator /Incremental synchronous encoder input type selection	Default value	1: Voltage-output/open-collector type			0: Differential-output type	

Changed functions (Continued)

Function	Description	Specification				
		QD77MS2	QD77MS4	QD77MS16	LD77MH4	LD77MH16
Pr.91 Optional data monitor: Data type setting 1	Range of setting value	0 : No setting 1 : Effective load ratio 2 : Regenerative load ratio 3 : Peak load ratio 4 : Load to motor inertia ratio 5 : Position loop gain 1 6 : Bus voltage 7 : Servo motor speed 8 : Motor encoder ABS counter 9 : Unit power consumption 10 : Instantaneous torque 12 : Motor thermistor temperature 13 : Torque equivalent to disturbance 14 : Overload alarm margin 15 : Excessive error alarm margin 16 : Settling time 17 : Overshoot amount 20 : Position feedback 21 : Motor ENC within-1-rev position 22 : Select droop pulses 23 : Unit cumulative power consumption 24 : Load side encoder information 1 25 : Load side encoder information 2 26 : Z-phase counter 27 : Motor-side/load-side position deviation 28 : Motor-side/load-side speed deviation			0 : No setting 1 : Effective load ratio 2 : Regenerative load ratio 3 : Peak load ratio 4: Load to motor inertia ratio 5 : Position loop gain 1 6 : Bus voltage 7 : Servo motor speed 20 : Position feedback 21 : Motor ENC within-1-rev position 22 : Select droop pulses	
Pr.92 Optional data monitor: Data type setting 2						
Pr.93 Optional data monitor: Data type setting 3						
Pr.94 Optional data monitor: Data type setting 4						
Pr.96 Operation cycle setting	Compatible model	0: 0.88ms 1: 1.77ms			No parameter setting	0: 0.88ms 1: 1.77ms
Pr.97 SSCNET setting	New parameter	0: SSCNETⅢ 1: SSCNETⅢ/H			No parameter setting	
Pr.114 External command signal compensation valid/invalid setting	New parameter	0: Invalid 1: Valid			No parameter setting	
Pr.439 Cam axis length per cycle	Default value	4194304			262144	
Pr.441 Cam stroke amount						
Md.57 Servo alarm	New monitor data	The LED display details of servo amplifier detection alarm			No monitor data	
Md.58 Servo warning	New monitor data	The LED display details of servo amplifier detection warning			No monitor data	
Md.59 Module information	Storage value	1000H	1001H	1002H	0001H	0002H

Changed functions (Continued)

Function	Description	Specification				
		QD77MS2	QD77MS4	QD77MS16	LD77MH4	LD77MH16
Md.107 Parameter error No.	Range of monitor value	<SSCNETⅢ/H> 1 to 64 : PA01 to PA64 65 to 128 : PB01 to PB64 129 to 192: PC01 to PC64 193 to 256: PD01 to PD64 257 to 320: PE01 to PE64 321 to 384: PF01 to PF64 385 to 448: Po01 to Po64 449 to 512: PS01 to PS64 513 to 576: PL01 to PL64 <SSCNETⅢ> 1 to 18 : PA01 to PA18 19 to 63 : PB01 to PB45 64 to 95 : PC01 to PC32 96 to 127 : PD01 to PD32 128 to 167: PE01 to PE40 168 to 183: PF01 to PF16 184 to 199: Po01 to Po16 200 to 231: PS01 to PS32 232 : PA19			<SSCNETⅢ> 1 to 18 : PA01 to PA18 19 to 63 : PB01 to PB45 64 to 95 : PC01 to PC32 96 to 127 : PD01 to PD32 128 to 167: PE01 to PE40 168 to 183: PF01 to PF16 184 to 199: Po01 to Po16 200 to 231: PS01 to PS32 232 : PA19	
Md.116 Encoder option information	New storage item	Compatible with continuous operation to torque control Compatible with scale measurement mode			No storage item	
Md.132 Operation cycle setting	Compatible model	0: 0.88ms 1: 1.77ms			No monitor data	0: 0.88ms 1: 1.77ms
Md.133 Operation cycle over flag	Compatible model	0: OFF 1: ON (Operation cycle over occurred.)			No monitor data	0: OFF 1: ON (Operation cycle over occurred.)
Cd.14 New speed value	Range of setting value	<Control unit is PLS> 0 to 1000000000 [PLS/s]			<Control unit is PLS> 0 to 50000000 [PLS/s]	
Cd.17 JOG speed	Range of setting value	<Control unit is PLS> 1 to 1000000000 [PLS/s]			<Control unit is PLS> 1 to 50000000 [PLS/s]	
Cd.25 Position-speed switching control speed change register	Range of setting value	<Control unit is PLS> 0 to 1000000000 [PLS/s]			<Control unit is PLS> 0 to 50000000 [PLS/s]	
Cd.28 Target position change value (New speed)	Range of setting value	<Control unit is PLS> 0 to 1000000000 [PLS/s]			<Control unit is PLS> 0 to 50000000 [PLS/s]	
Cd.47 QD75MH initial value setting request	New control data	1: Requests QD75MH initial value setting			No control data	
Cd.130 Parameter write request	Range of setting value	1 : 1 word write request 2 : 2 words write request Other than 1 and 2: Not request			1 : Write request Other than 1: Not request	

Changed functions (Continued)

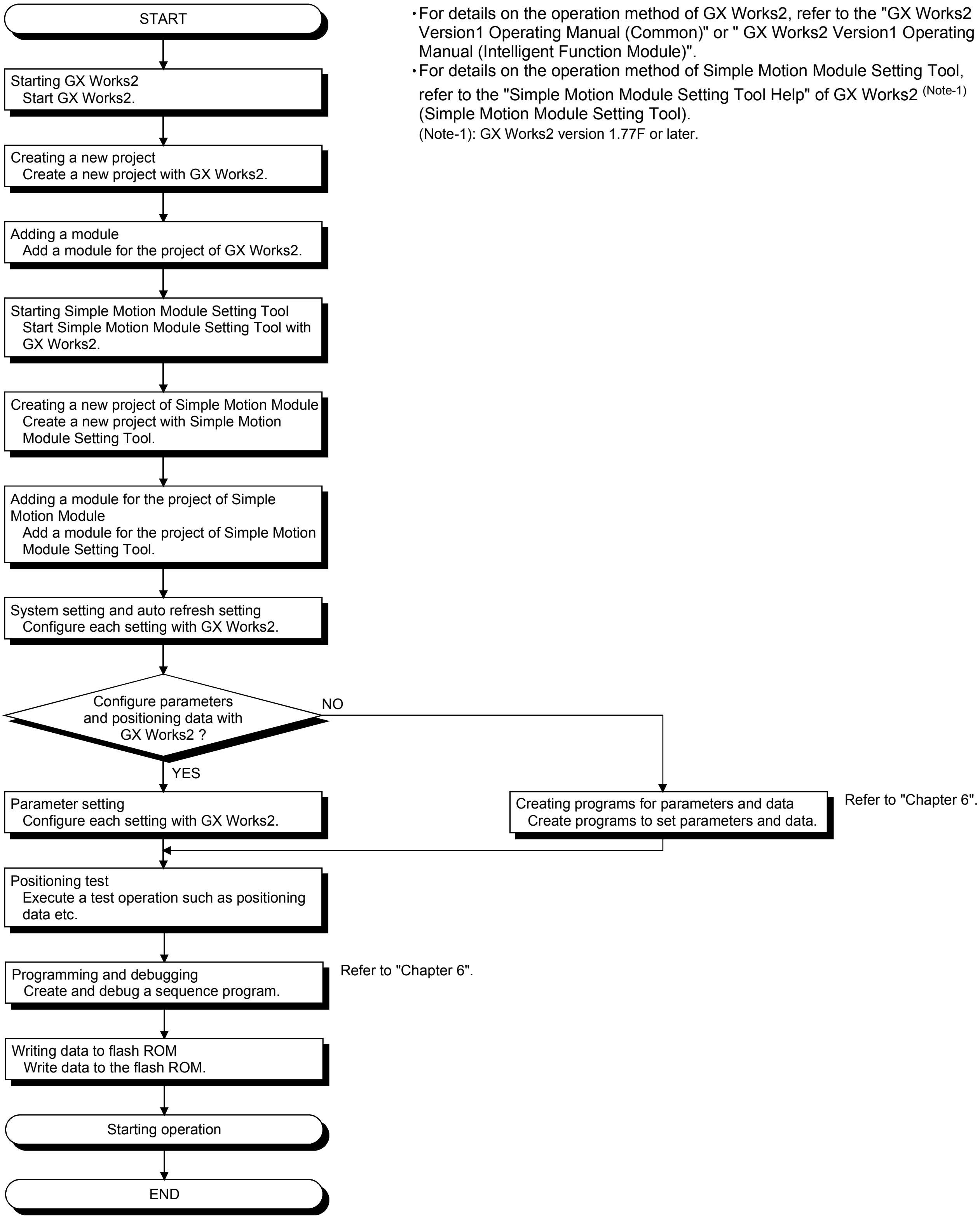
Function	Description	Specification				
		QD77MS2	QD77MS4	QD77MS16	LD77MH4	LD77MH16
Cd.131 Parameter No.	Range of setting value	<MR-J4(W)-B> 0: PA group 1: PB group 2: PC group 3: PD group 4: PE group 5: PF group 9: Po group A: PS group B: PL group <VCII series> 0: Group 0 1: Group 1 2: Group 2 3: Group 3 4: Group 4 5: Group 5 6: Group 6 7: Group 7 8: Group 8 9: Group 9			<MR-J3(W)-B> 0: PA group 1: PB group 2: PC group 3: PD group 4: PE group 5: PF group 9: Po group A: PS group	
Cd.132 Change data	New control data	Set the change value of servo parameter set in "Cd.131 Parameter No.".			No control data	
Cd.140 Command speed at speed control mode	Range of setting value	<Control unit is PLS> -1000000000 to 1000000000 [PLS/s]			<Control unit is PLS> -50000000 to 50000000 [PLS/s]	
Cd.146 Speed limit value at torque control mode	Range of setting value	<Control unit is PLS> 0 to 1000000000 [PLS/s]			<Control unit is PLS> 0 to 50000000 [PLS/s]	
Cd.147 Speed limit value at continuous operation to torque control mode	Range of setting value	<Control unit is PLS> -1000000000 to 1000000000 [PLS/s]			<Control unit is PLS> -50000000 to 50000000 [PLS/s]	
Cd.802 Latch data range change request	New control data	1: Change in the next Operation cycle of the requested 2: Change in the next DI input of the requested			No control data	
Da.8 Command speed	Range of setting value	<Control unit is PLS> 1 to 1000000000 [PLS/s]			<Control unit is PLS> 1 to 50000000 [PLS/s]	

Appendix 5 When using GX Works2

Use the "Simple Motion Module Setting Tool" for Simple Motion module various setting. The following shows the procedure for positioning operation when GX Works2 is used.

- For details on the operation method of GX Works2, refer to the "GX Works2 Version1 Operating Manual (Common)" or " GX Works2 Version1 Operating Manual (Intelligent Function Module)".
- For details on the operation method of Simple Motion Module Setting Tool, refer to the "Simple Motion Module Setting Tool Help" of GX Works2 (Note-1) (Simple Motion Module Setting Tool).

(Note-1): GX Works2 version 1.77F or later.



Appendix 6 Compatible devices with SSCNETⅢ

Appendix 6.1 Servo driver VCII series manufactured by Nikki Denso Co., Ltd.

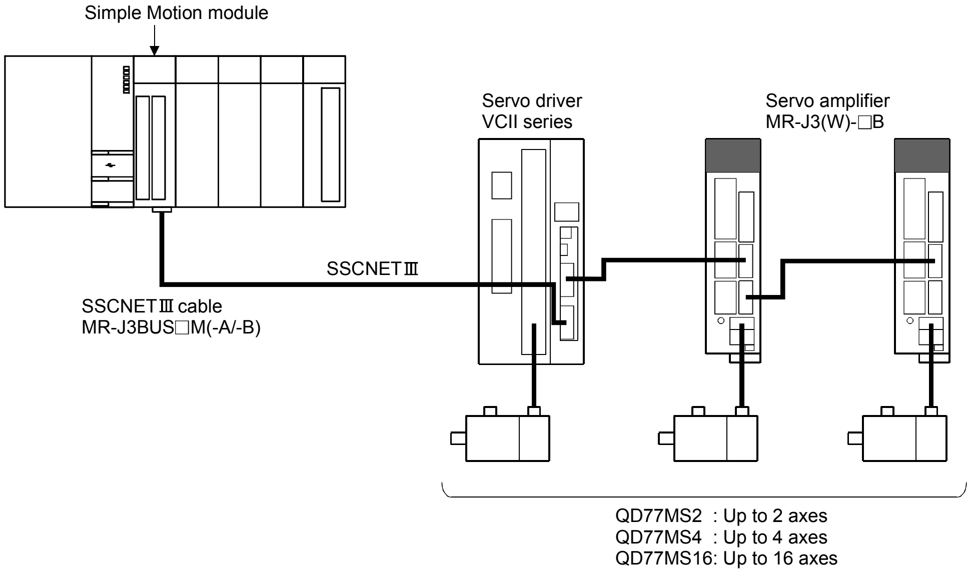
The direct drive τDISC/τiD roll/τServo compass/τLinear series, etc. manufactured by Nikki Denso Co., Ltd. can be controlled by connecting with the servo driver VCII series manufactured by the company using SSCNETⅢ.
Contact to Nikki Denso overseas sales office for details of VCII series.

The details shown below explain about the "Connection with VCII series".
[1] Connecting method
[2] Comparisons of specifications with MR-J3(W)-B
[3] Precautions during control
[4] VCII series detection error/warning

[1] Connecting method

(1) System configuration

The system configuration using VCII series is shown below.
Set "0: SSCNETⅢ" in "Pr.97 SSCNET setting" to use VCII series.



(2) Parameter setting

To connect VCII series, set the following parameters.

Setting item		Setting value	Default value	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
Pr.100	Servo series	96: VCII series (manufactured by Nikki Denso Co., Ltd.)	0	30100+200n	28400+100n
PA03	Absolute position detection system	0: Disabled (used in incremental system) 1: Enabled (used in absolute position detection system)	0	30103+200n	28403+100n

n: Axis No.-1

POINT

Parameters set in VCII series are not controlled by Simple Motion module.
However, match the servo parameter "Absolute position detection system (PA03)" with the setting of VCII series. Otherwise, it does not operate correctly.

[2] Comparisons of specifications with MR-J3(W)-B

Item		VCII series (Note-1)	MR-J3(W)-B
Pr.100 Servo series		96: VCII series (manufactured by Nikki Denso Co., Ltd.)	1: MR-J3-☐B, MR-J3W-☐B (2-axis type) 3: MR-J3-☐B-RJ006 (For fully closed loop control) MR-J3-☐BS (For safety servo) 4: MR-J3-☐B-RJ004 (For linear servo) 6: MR-J3-☐B-RJ080W (For direct drive motor)
Control of servo amplifier parameters		Controlled by VCII series. (Note-2)	Controlled by Simple Motion module.
Detailed parameter 1	Pr.80 External input signal selection	External input signals of VCII series are available.	External input signals of servo amplifier are available.
Expansion parameter	Pr.91 to Pr.94 Optional data monitor: Data type setting	The following items can be monitored. 1: Effective load ratio 2: Regenerative load ratio 3: Peak load ratio 5: Position loop gain 1 8: Absolute position encoder multiple revolution counter 20: Position feedback 21: Absolute position encoder single revolution position	The following items can be monitored. 1: Effective load ratio 2: Regenerative load ratio 3: Peak load ratio 4: Load inertia moment ratio 5: Position loop gain 1 6: Bus voltage 7: Servo motor speed 8: Absolute position encoder multiple revolution counter 12: Motor thermistor temperature 20: Position feedback 21: Absolute position encoder single revolution position 22: Select droop pulses 24: Load side encoder information 1 25: Load side encoder information 2 26: Z-phase counter
Absolute position detection system		Possible (Note-3)	Possible
OPR method		Near-point dog method, Count method 1), 2), Data set method, Scale origin signal detection method	
Positioning control, Expansion control		Position control mode, Speed control mode, Torque control mode (Note-4)	Position control mode, Speed control mode, Torque control mode, Continuous operation to torque control mode
Torque limit value change		Possible (Separate setting: Restrictions (Note-5))	Possible
Gain changing command		Valid	Valid
PI-PID switching command		Valid	Valid
Control loop (semi/fully) switching command		Invalid	Valid when using servo amplifier for fully closed loop control (MR-J3-☐B-RJ006)
Amplifier-less operation function		Possible (Operates artificially as the followings during amplifier-less operation. Servo amplifier type: MR-J3-10B, Motor type: HF-KP053)	
Servo parameter change request		Possible (2 words write/2 words read)	Possible (1 word write/1 word read)

Item	VCII series (Note-1)	MR-J3(W)-B
Driver communication	Not possible	Possible (Note-6)
Monitoring of servo parameter error No.	Not possible	Possible
Servo alarm/warning (Error history/warning history)	Alarm codes/warning codes detected by VCII series are stored in "Servo alarm/warning".	Alarm codes/warning codes detected by servo amplifier are stored in "Servo alarm/warning".
Programming tool	MR Configurator2 is not available. Use VCII data editing software.	MR Configurator2 is available.

(Note-1): Confirm the specifications of VCII series for details.

(Note-2): Match the absolute position detection system setting in each setting of VCII series and Simple Motion module.

(Note-3): The direct drive τDISC series manufactured by Nikki Denso Co., Ltd. can restore the absolute position in the range from -2147483648 to 2147483647. Confirm the specifications of VCII series for restrictions by the version of VCII series.

(Note-4): There are restrictions by the version of VCII series.

(Note-5): The specification of torque limit direction differs by the version of VCII series. Confirm the specifications of VCII series for details.

(Note-6): Refer to the "Servo Amplifier Instruction Manual" for the servo amplifiers that can be used.

[3] Precautions during control

(1) Absolute position system (ABS)/Incremental system (INC)

Match the absolute position system setting in each setting of VCII series and Simple Motion module. Otherwise, "VCII series parameter setting error" (warning code: 126) occurs, and it is controlled by the setting of VCII series side.

(2) OPR

When "1" is set in the first digit of the parameter of VCII series "Select function for SSCNETⅢ on communicate mode (P612)", it is possible to carry out the home position return (OPR) without passing the zero point. (Return to origin after power is supplied will be executed when passing of Motor Z phase is not necessary.) When "0" is set, "OPR zero point not passed" (error code: 210) occurs because the OPR is executed without passing the motor Z phase (Motor reference position signal).

(3) Control mode

Control modes that can be used are shown below.

- Position control mode (speed control including position control and position loop)
- Speed control mode (speed control not including position loop)
- Torque control mode (torque control)

However, it is not available to switch to continuous operation to torque control mode of expansion control "Speed-torque control". If the mode is switched to continuous operation to torque control mode, "Continuous operation to torque control not supported" (error code: 550) occurs and the operation stops.

"1: Feedback torque" cannot be set in "Torque initial value selection (b4 to b7)" of "Pr.90 Operation setting for speed-torque control mode". If it is set, "Torque initial value selection invalid" (warning code: 521) occurs and the command value immediately after switching is the same as the case of selecting "0: Command torque".

(4) Servo parameter

(a) Control of servo parameters

Parameters of VCII series are not controlled by Simple Motion module. Therefore, even though the parameter of VCII series is changed during the communication between Simple Motion module and VCII series, it does not reflect to the buffer memory.

(b) Servo parameter change request

Change request of servo parameter ("Cd.130 Parameter write request" to "Cd.132 Change data") can be executed. However, the servo parameter of VCII series is controlled in a unit of 2 words, so that it is necessary to set "2: 2 words write request" in "Cd.130 Parameter write request" for executing the parameter write. If 1 word write is executed to VCII series, the parameter write is failure, and "3" is stored in "Cd.130 Parameter write request".

When the servo parameter of VCII series is changed by the servo parameter change request, the parameter value after changing the servo parameter cannot be confirmed using VCII data editing software. Also, when the power of VCII series is turned OFF, the parameter changed by the servo parameter change request becomes invalid, and the value written by VCII data editing software becomes valid.

(5) Optional data monitor

The following table shows data types that can be set.

Data type	Unit
Effective load ratio	[%]
Regenerative load ratio	[%]
Peak load ratio	[%]
Position loop gain 1	[rad/s]
Absolute position encoder multiple revolution counter	[rev]
Position feedback (Used point: 2 words)	[PLS]
Absolute position encoder single revolution position (Used point: 2 words)	[PLS]

(6) Gain changing command, PI-PID switching request, Semi/Fully closed loop switching request

Gain changing command and PI-PID switching request are available. Semi/fully closed loop switching request becomes invalid.

(7) Driver communication

The driver communication is not supported. If the driver communication is set in a servo parameter, "Driver communication setting error" (error code: 975) will occur when the power is turned ON, and any servo amplifiers including VCII series cannot be connected.

[4] VCII series detection error/warning

(1) Error

When an error occurs on VCII series, the error detection signal turns ON, and the error code (61440 to 61695) is stored in "Md.23 Axis error No.".
The servo alarm No. of VCII series is stored in "Md.114 Servo alarm" and "Md.57 Servo alarm" in error history.
However, "0" is always stored in "Md.107 Parameter error No.".

The detection error list for VCII series is shown below.
Confirm the specifications of VCII series for details of the errors/warnings.

Classification of errors	Error code	Servo alarm No.	VCII series LED display	Name	Remarks
Servo driver VCII series	61441 (F001H)	1H	1-0	IPM error	
	61443 (F003H)	3H	1-3	Excessive voltage error	
	61445 (F005H)	5H	3-0	Encoder-related error	
	61446 (F006H)	6H	1-4	Over speed error	
	61447 (F007H)	7H	1-5	Overload error	
	61449 (F009H)	9H	1-8	AC-off detection error	
	61450 (F00AH)	AH	3-1	At-power-ON motor shaft error	
	61453 (F00DH)	DH	4-0	Deviation over flow	
	61454 (F00EH)	EH	4-1	Deviation error	
	61457 (F011H)	11H	5-0	Forward over travel	
	61458 (F012H)	12H	5-1	Reverse over travel	
	61459 (F013H)	13H	5-2	Forward software over travel	
	61460 (F014H)	14H	5-3	Reverse software over travel	
	61465 (F019H)	19H	E-0	Absolute encoder battery error	
	61467 (F01BH)	1BH	3-2	Serial encoder count error	
	61468 (F01CH)	1CH	E-2	Absolute encoder over flow error	
	61469 (F01DH)	1DH	E-3	Absolute encoder count error	
	61470 (F01EH)	1EH	3-3	Serial encoder/IPU communication error	
	61472 (F020H)	20H	2-0	Motor type none-setup	
	61473 (F021H)	21H	2-1	Motor type incompatible	
	61474 (F022H)	22H	A-1	EEPROM (Nonvolatile memory) writing error	
	61475 (F023H)	23H	A-2	Rated speed command Invalid 1	
	61476 (F024H)	24H	A-3	Rated speed command Invalid 2	
	61477 (F025H)	25H	1-2	Main power supply shortage error	
	61480 (F028H)	28H	1-6	IPM overload error	
	61481 (F029H)	29H	1-7	Regenerative resistor overload error	
	61483 (F02BH)	2BH	6-0	Address setting error	
	61484 (F02CH)	2CH	6-1	Positioning timeover	
	61485 (F02DH)	2DH	6-d	Successive control command invalid	
	61486 (F02EH)	2EH	E-1	Absolute encoder backup error	
	61487 (F02FH)	2FH	6-2	Positioning data over flow	
	61488 (F030H)	30H	6-3	1-rotation data no-setting	
	61489 (F031H)	31H	1-A	Servo control error	
	61490 (F032H)	32H	6-4	Program end command non-setup	
	61491 (F033H)	33H	6-5	Sub-routine call nesting over	
	61492 (F034H)	34H	9-4	Receive error 1	
	61493 (F035H)	35H	1-C	Command frequency error	

Classification of errors	Error code	Servo alarm No.	VCII series LED display	Name	Remarks
Servo driver VCII series	61494 (F036H)	36H	9-5	Receive error 2	
	61495 (F037H)	37H	6-9	Division invalid	
	61496 (F038H)	38H	6-A	Positioning volume error	
	61498 (F03AH)	3AH	6-b	Invalid command	
	61499 (F03BH)	3BH	6-C	Indirect data No. invalid	
	61500 (F03CH)	3CH	7	Data sustain error 1	
	61501 (F03DH)	3DH	7	Data sustain error 2	
	61502 (F03EH)	3EH	7	Data sustain error 3	
	61503 (F03FH)	3FH	7	Data sustain error 4	
	61504 (F040H)	40H	7	Data sustain error 5	
	61505 (F041H)	41H	7	Data sustain error 6	
	61506 (F042H)	42H	7	Data sustain error 7	
	61507 (F043H)	43H	7	Data sustain error 8	
	61508 (F044H)	44H	7	Data sustain error 9	
	61509 (F045H)	45H	7	Data sustain error 10	
	61510 (F046H)	46H	7	Data sustain error 11	
	61511 (F047H)	47H	7	Data sustain error 12	
	61512 (F048H)	48H	7	Data sustain error 13	
	61513 (F049H)	49H	7	Data sustain error 14	
	61514 (F04AH)	4AH	7	Data sustain error 15	
	61515 (F04BH)	4BH	7	Data sustain error 16	
	61516 (F04CH)	4CH	7	Data sustain error 17	
	61517 (F04DH)	4DH	7	Data sustain error 18	
	61518 (F04EH)	4EH	7	Data sustain error 19	
	61519 (F04FH)	4FH	7	Data sustain error 20	
	61520 (F050H)	50H	7	Data sustain error 21	
	61521 (F051H)	51H	7	Data sustain error 22	
	61522 (F052H)	52H	7	Data sustain error 23	
	61523 (F053H)	53H	7	Data sustain error 24	
	61524 (F054H)	54H	7	Data sustain error 25	
	61525 (F055H)	55H	7	Data sustain error 26	
	61526 (F056H)	56H	7	Data sustain error 27	
	61527 (F057H)	57H	7	Data sustain error 28	
	61528 (F058H)	58H	7	Data sustain error 29	
	61529 (F059H)	59H	7	Data sustain error 30	
	61530 (F05AH)	5AH	7	Data sustain error 31	
	61531 (F05BH)	5BH	7	Data sustain error 32	
	61532 (F05CH)	5CH	7	Data sustain error 33	
	61533 (F05DH)	5DH	7	Data sustain error 34	
	61534 (F05EH)	5EH	7	Data sustain error 35	
	61535 (F05FH)	5FH	7	Data sustain error 36	
	61536 (F060H)	60H	7	Data sustain error 37	
	61538 (F062H)	62H	7	Data sustain error 39	
	61539 (F063H)	63H	7	Data sustain error 40	
	61540 (F064H)	64H	7	Data sustain error 41	
	61542 (F066H)	66H	7	Data sustain error 43	
	61543 (F067H)	67H	7	Data sustain error 44	
	61548 (F06CH)	6CH	A-7	Rated speed command Invalid 3	
	61549 (F06DH)	6DH	1-b	Input power supply error	
	61550 (F06EH)	6EH	—	FLASH (Nonvolatile memory) writing error	

Classification of errors	Error code	Servo alarm No.	VCII series LED display	Name	Remarks
Servo driver VCII series	61551 (F06FH)	6FH	9-3	Remote sequence control receive timeout	
	61553 (F071H)	71H	9-1	Remote sequence control IC defect	
	61554 (F072H)	72H	9-2	Remote sequence control communication-OFF	
	61555 (F073H)	73H	A-4	Servo control communication disconnection error	
	61557 (F075H)	75H	A-5	Servo control communication error	
	61559 (F077H)	77H	3-4	Linear sensor resolution error	
	61560 (F078H)	78H	6-0	Free curve motion data error	
	61561 (F079H)	79H	6-1	Standard position return data error	
	61562 (F07AH)	7AH	6-2	Slave axis movement error	
	61570 (F082H)	82H	3-5	IPU error	
	61571 (F083H)	83H	3-6	Serial number check error	
	61572 (F084H)	84H	3-7	Serial number none-setup (Empty)	
	61575 (F087H)	87H	3-8	τDISC motor 1-rotation position detection speed error	
	61576 (F088H)	88H	3-9	τDISC absolute encoder light-receiving element error	
	61577 (F089H)	89H	3-A	τDISC absolute encoder light-emitting element error	
	61579 (F08BH)	8BH	3-b	Magnetic pole detection error	
	61610 (F0AAH)	AAH	E-5	Over speed	
	61611 (F0ABH)	ABH	E-6	Initialization error	
	61612 (F0ACH)	ACH	E-7	Hardware error	
	61613 (F0ADH)	ADH	E-8	Absolute data error	
	61614 (F0AEH)	AEH	E-9	Transducer error	
	61615 (F0AFH)	AFH	E-A	Signal strength error	
	61630 (F0BEH)	BEH	E-5	Encoder and IPU communication error	
	61631 (F0BFH)	BFH	E-6	Encoder and IPU cable disconnection	
	61632 (F0C0H)	C0H	E-7	Encoder backup error	
	61633 (F0C1H)	C1H	E-8	IPU backup error	
	61695 (F0FFH)	FFH	—	Internal circuit fault	

(2) Warning

When a warning occurs on VCII series, the warning code (61440 to 61695) is stored in "Md.24 Axis warning No.".

The servo warning No. of VCII series is stored in "Md.58 Servo warning" in warning history.

The detection warning list for VCII series is shown below.

Classification of warnings	Warning code	Servo warning No.	VCII series LED display	Name	Remarks
Servo driver VCII series	61448 (F008H)	8H	F-0	Overload precaution	
	61455 (F00FH)	FH	F-1	Deviation abnormal warning	
	61466 (F01AH)	1AH	F-4	Absolute encoder battery error warning	
	61482 (F02AH)	2AH	F-3	Zero return incomplete automatic startup warning	
	61552 (F070H)	70H	F-5	Remote sequence control communication stand-by warning	
	61558 (F076H)	76H	F-2	Main power supply low voltage detection warning	
	61564 (F07CH)	7CH	F-6	Remote sequence control SW change warning	
	61616 (F0B0H)	B0H	F-b	Signal strength warning	
	61617 (F0B1H)	B1H	F-C	Thermal warning	
	61634 (F0C2H)	C2H	F-b	Encoder position sensing part deterioration warning	
	61670 (F0E6H)	E6H	F-7	Driver emergency stop	
	61671 (F0E7H)	E7H	F-8	Controller emergency stop	

Appendix 6.2 Inverter FR-A700 series

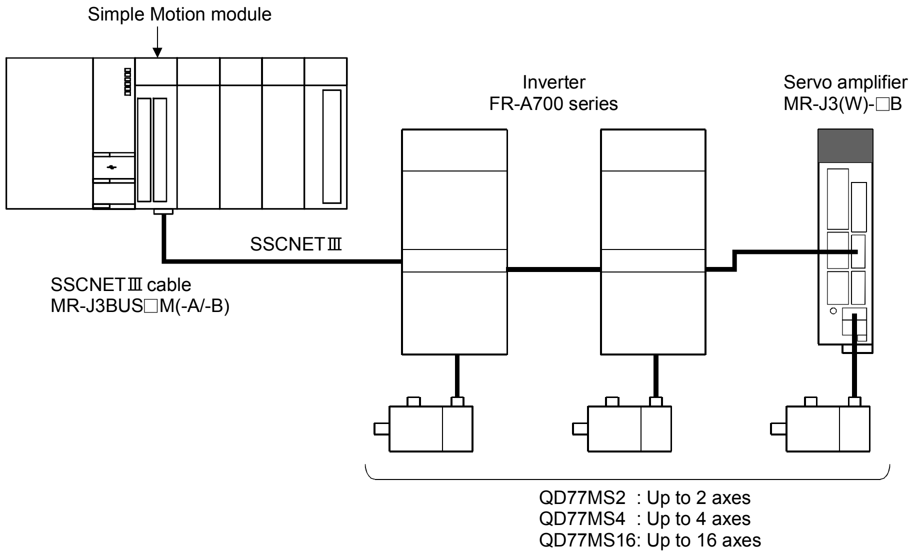
FR-A700 series can be connected via SSCNETⅢ by using built-in option FR-A7AP and FR-A7NS.

The details shown below explain about the "Connection with FR-A700 series".
[1] Connecting method
[2] Comparisons of specifications with MR-J3(W)-B
[3] Precautions during control
[4] FR-A700 series detection error/warning

[1] Connecting method

(1) System configuration

The system configuration using FR-A700 series is shown below.
Set "0: SSCNETⅢ" in "Pr.97 SSCNET setting" to use FR-A700 series.



(2) Parameter setting

To connect FR-A700 series, execute flash ROM writing after setting the following parameters to buffer memory. The setting value is valid at power supply ON or PLC CPU reset.
"Pr.97 SSCNET setting": "0: SSCNETⅢ"
"Pr.100 Servo series" : "64: FR-A700 series (Inverter)"

Setting item		Setting details	Setting value	Default value	Buffer memory address	
					QD77MS2 QD77MS4	QD77MS16
Pr.97	SSCNET setting	Set the servo network. (Only the value specified against the axis 1 is valid.)	0: SSCNETⅢ 1: SSCNETⅢ/H	1	106	
Pr.100	Servo series	Used to select the servo amplifier series to connect to the Simple Motion module. POINT • Be sure to set up servo series. Communication with servo amplifier isn't started by the initial value "0" in default value. (The LED indication of servo amplifier indicates "Ab".)	0: Servo series is not set 1: MR-J3-□B MR-J3W-□B (2-axis type) 3: MR-J3-□B-RJ006 (For fully closed loop control) MR-J3-□BS (For safety servo) 4: MR-J3-□B-RJ004 (For linear servo) 6: MR-J3-□B-RJ080W (For direct drive motor) 32: MR-J4-□B MR-J4W-□B (2-axis type and 3-axis type) 64: FR-A700 series (Inverter) 96: VCII series (manufactured by Nikki Denso Co., Ltd.) 4097: Virtual servo amplifier (MR-J3) 4128: Virtual servo amplifier (MR-J4)	0	30100+200n	28400+100n

n: Axis No.-1

(3) Control of FR-A700 series parameters

Parameters set in FR-A700 series are not controlled by Simple Motion module. Set the parameters by connecting FR-A700 series directly with the operation panel on the front of inverter (FR-DU07/FR-PU07) or FR Configurator that is inverter setup software. Confirm the specifications of FR-A700 series for details of the setting items.

POINT

In the state of connecting between FR-A700 series and Simple Motion module, only a part of parameters can be set if the parameter of the inverter "Pr.77 Parameter write selection" is in the initial state. Set "2: Write parameters during operation" to rewrite the parameters of FR-A700 series.

(4) Reset selection/disconnected PU detection/PU stop selection

When PU stop is executed in FR-A700 series, position error excessive, etc. occur because a command from Simple Motion module does not stop. Set "0 to 3" in the parameter of the inverter "Pr.75 Reset selection/disconnected PU detection/PU stop selection". To stop FR-A700 series, use the stop signal and the forced stop of Simple Motion module, or use the output stop (MRS) of FR-A700 series.

Setting item		Default value	Setting value	Details
Pr.75	Reset selection/ disconnected PU detection/ PU stop selection	14	0	• Reset input is always enabled. • If the PU is disconnected, operation will be continued. • PU stop is disabled at SSCNETⅢ connection.
			1	• A reset can be input only when the protective function is activated. • If the PU is disconnected, operation will be continued. • PU stop is disabled at SSCNETⅢ connection.
			2	• Reset input is always enabled. • When the PU is disconnected, the inverter trips. • PU stop is disabled at SSCNETⅢ connection.
			3	• A reset can be input only when the protective function is activated. • When the PU is disconnected, the inverter trips. • PU stop is disabled at SSCNETⅢ connection.
			14	• Reset input is always enabled. • If the PU is disconnected, operation will be continued. • Deceleration stop by PU stop in any operation mode.
			15	• A reset can be input only when the protective function is activated. • If the PU is disconnected, operation will be continued. • Deceleration stop by PU stop in any operation mode.
			16	• Reset input is always enabled. • When the PU is disconnected, the inverter trips. • Deceleration stop by PU stop in any operation mode.
			17	• A reset can be input only when the protective function is activated. • When the PU is disconnected, the inverter trips. • Deceleration stop by PU stop in any operation mode.

(Note): Note that the default value is set to "14". (Change the value to "1 to 3".)

(5) In-position range

Set the servo parameter "In-position range (PA10)" and the parameter of the inverter "Pr.426 In-position width" to be matched. Otherwise, it may not operate correctly.

Setting item		Default value	Setting range	Buffer memory address	
				QD77MS2 QD77MS4	QD77MS16
PA10	In-position range	100 (PLS)	0 to 65535 (PLS)	30110+200n	28410+100n

n: Axis No.-1

Setting item		Default value	Setting range	Details
Pr.426	In-position width	100 (PLS)	0 to 32767 (PLS)	When droop pulses have fallen below the setting value, the in-position signal turns ON.

(6) Optional data monitor setting

The following table shows data types that can be set.

Data type	Name at FR-A700 series use
Effective load ratio	Motor load factor
Load inertia moment ratio	Load inertia ratio
Position loop gain 1	Position loop gain
Bus voltage	Converter output voltage
Absolute position encoder multiple revolution counter	Absolute position encoder multiple revolution counter
Position feedback	Position feedback
Absolute position encoder single revolution position	Absolute position encoder single revolution position

POINT

When FR-A700 series is used, each data is delayed for "update delay time + communication cycle" because of the update cycle of the inverter.

Data type	Update delay time of FR-A700 series
Effective load ratio	12.5ms
Load inertia moment ratio	56ms or more (up to 2500ms)
Position loop gain 1	56ms or more (up to 2500ms)
Bus voltage	9.888ms
Absolute position encoder multiple revolution counter	222μs
Position feedback	222μs
Absolute position encoder single revolution position	222μs

(7) External input signal

Set as the followings to fetch the external input signal (FLS/RLS/DOG) via FR-A700 series.

- Set "1: External input signal of servo amplifier" in "Pr.80 External input signal selection".
- Set the parameters of the inverter as below.
  (Otherwise, each signal remains OFF.)

Setting item		Default value	Setting value	Details
Pr.178	STF terminal function selection	60	60	Use with the default value.
Pr.179	STR terminal function selection	61	61	Use with the default value.
Pr.185	JOG terminal function selection	5	76	Set 76 (Near-point dog).
Pr.449	SSCNETⅢ input filter setting	4	0: None 1: 0.88ms 2: 1.77ms 3: 2.66ms 4: 3.55ms	Set the input filter setting value at reading an external signal.

- Set the servo parameter of Simple Motion module "Input filter setting (PD11)" to be the same value as the parameter of the inverter "Pr.449 SSCNETⅢ input filter setting".

Setting item		Default value	Setting value	Details
PD11	Input filter setting	4	0: None 1: 0.88ms 2: 1.77ms 3: 2.66ms 4: 3.55ms	Set the input filter setting value at reading an external signal.

[2] Comparisons of specifications with MR-J3(W)-B

Item		FR-A700 series (Note-1)	MR-J3(W)-B
Pr.100 Servo series		64: FR-A700 series (Inverter)	1: MR-J3-☐B, MR-J3W-☐B (2-axis type)
Control of servo amplifier parameters		Set directly by inverter. (Not controlled by Simple Motion module.)	Controlled by Simple Motion module.
Detailed parameter 1	Pr.80 External input signal selection	External input signals of FR-A700 series are available.	External input signals of servo amplifier are available.
Expansion parameter	Pr.91 to Pr.94 Optional data monitor: Data type setting	The following items can be monitored. 1: Effective load ratio 4: Load inertia moment ratio 5: Position loop gain 1 6: Bus voltage 8: Absolute position encoder multiple revolution counter 20: Position feedback 21: Absolute position encoder single revolution position	The following items can be monitored. 1: Effective load ratio 2: Regenerative load ratio 3: Peak load ratio 4: Load inertia moment ratio 5: Position loop gain 1 6: Bus voltage 7: Servo motor speed 8: Absolute position encoder multiple revolution counter 12: Motor thermistor temperature 20: Position feedback 21: Absolute position encoder single revolution position 22: Select droop pulses 24: Load side encoder information 1 25: Load side encoder information 2 26: Z-phase counter
Absolute position detection system		Not possible	Possible
Positioning control, Expansion control		Position control mode, Speed control mode, Torque control mode	Position control mode, Speed control mode, Torque control mode, Continuous operation to torque control mode
Gain changing command		Valid	Valid
PI-PID switching command		Valid	Valid
Control loop (semi/fully) switching command		Invalid	Valid when using servo amplifier for fully closed loop control (MR-J3-☐B-RJ006)
Servo parameter write/read		Not possible	Possible
Amplifier-less operation function		Possible (Note-2)	Possible
		(Operates artificially as the followings during amplifier-less operation. Servo amplifier type: MR-J3-10B, Motor type: HF-KP053)	
Driver communication		Not possible	Possible (Note-3)
Monitoring of servo parameter error No.		Not possible	Possible
Servo alarm/warning (Error history/warning history)		Alarm codes/warning codes detected by FR-A700 series are stored in "Servo alarm/warning".	Alarm codes/warning codes detected by servo amplifier are stored in "Servo alarm/warning".
Programming tool		MR Configurator2 is not available. Use FR-DU07/FR-PU07 or FR Configurator.	MR Configurator2 is available.

(Note-1): Confirm the specifications of FR-A700 series for details.

(Note-2): Parameters set in FR-A700 series are not controlled by Simple Motion module. Therefore, the operation is the same as when the servo parameter "Rotation direction selection/travel direction selection (PA14)" is set as below during amplifier-less operation mode.

Setting item		Setting value	Details
PA14	Rotation direction selection/travel direction selection	0	Positioning address increase: CCW or positive direction
			Positioning address decrease: CW of negative direction

(Note-3): Refer to the "Servo Amplifier Instruction Manual" for the servo amplifiers that can be used.

[3] Precautions during control

(1) Absolute position system (ABS)/Incremental system (INC)

When using FR-A700 series, absolute position system (ABS) cannot be used. Even though "1: Enable (used in absolute position detection system)" is set in the servo parameter "Absolute position detection system (PA03)", the servo amplifier operates as incremental system.

- When the Simple Motion module is powered ON, OPR request is turned ON and the current feed value is set to 0. (The current feed value is not set to 0 if only the power of inverter is turned OFF to ON.)
- Errors at absolute position system (1201 to 1205) are not detected.

(2) Control mode

Control modes that can be used are shown below.

- Position control mode (speed control including position control and position loop)
- Speed control mode (speed control not including position loop)
- Torque control mode (torque control)

However, it is not available to switch to continuous operation to torque control mode of expansion control "Speed-torque control". If the mode is switched to continuous operation to torque control mode, "Continuous operation to torque control not supported" (error code: 550) occurs and the operation stops.

"1: Feedback torque" cannot be set in "Torque initial value selection (b4 to b7)" of "Pr.90 Operation setting for speed-torque control mode". If it is set, "Torque initial value selection invalid" (warning code: 521) occurs and the command value immediately after switching is the same as the case of selecting "0: Command torque".

(3) Driver communication

The driver communication is not supported. If the driver communication is set in a servo parameter, "Driver communication setting error" (error code: 975) will occur when the power is turned ON.

(4) Control mode switching of speed-torque control

The axis connected with FR-A700 series takes more time to switch the control mode than the axis connected with the servo amplifier.

Switching operation	Switching time at the servo amplifier use	Switching time at FR-A700 series use
Position control mode → Speed control mode	6 to 11ms	19 to 24ms
Seed control mode → Position control mode		
Position control mode → Torque control mode		
Torque control mode → Position control mode		
Speed control mode → Torque control mode		
Torque control mode → Speed control mode		

[4] FR-A700 series detection error/warning

(1) Error

When an error occurs on FR-A700 series, the error code (61696 to 61951) is stored in "Md.23 Axis error No.".

The alarm No. of FR-A700 series is stored in "Md.114 Servo alarm" and "Md.57 Servo alarm" in error history.

However, "0" is always stored in "Md.107 Parameter error No." and "Absolute position lost (b14)" of "Md.108 Servo status".

The detection error list for FR-A700 series is shown below.

Confirm the specifications of FR-A700 series for details of the errors/warnings.

Classification of errors	Error code	Alarm No. of FR-A700 series	FR-A700 series LED display	Name	Remarks
Inverter FR-A700 series	61712 (F110H)	10H	E.OC1	Overcurrent trip during acceleration	
	61713 (F111H)	11H	E.OC2	Overcurrent trip during constant speed	
	61714 (F112H)	12H	E.OC3	Overcurrent trip during deceleration or stop	
	61715 (F113H)	13H	E.OV1	Regenerative overvoltage trip during acceleration	
	61716 (F114H)	14H	E.OV2	Regenerative overvoltage trip during constant speed	
	61717 (F115H)	15H	E.OV3	Regenerative overvoltage trip during deceleration or stop	
	61718 (F116H)	16H	E.THM	Motor overload trip (electronic thermal relay function)	
	61719 (F117H)	17H	E.THT	Inverter overload trip (electronic thermal relay function)	
	61720 (F118H)	18H	E.IPF	Instantaneous power failure	
	61721 (F119H)	19H	E.UVT	Undervoltage	
	61728 (F120H)	20H	E.BE	Brake transistor alarm detection	
	61729 (F121H)	21H	E.GF	Output side earth (ground) fault overcurrent	
	61730 (F122H)	22H	E.OHT	External thermal relay operation	
	61731 (F123H)	23H	E.OLT	Stall prevention stop	
	61732 (F124H)	24H	E.OPT	Option fault	
	61735 (F127H)	27H	E.PE	Parameter storage device fault	
	61736 (F128H)	28H	E.PUE	PU disconnection	
	61737 (F129H)	29H	E.RET	Retry count excess	Not be output when using FR-A7NS.
	61744 (F130H)	30H	E.CPU	CPU fault	
	61745 (F131H)	31H	E.ILF	Input phase loss	
	61746 (F132H)	32H	E.FIN	Heatsink overheat	
	61747 (F133H)	33H	E.OS	Overspeed occurrence	
	61748 (F134H)	34H	E.OSD	Speed deviation excess detection	
	61749 (F135H)	35H	E.ECT	Signal loss detection	
	61750 (F136H)	36H	E.OD	Excessive position fault	

Classification of errors	Error code	Alarm No. of FR-A700 series	FR-A700 series LED display	Name	Remarks
Inverter FR-A700 series	61752 (F138H)	38H	E.MB1	Brake sequence fault	Not be output when using FR-A7NS.
	61753 (F139H)	39H	E.MB2		
	61760 (F140H)	40H	E.MB3		
	61761 (F141H)	41H	E.MB4		
	61762 (F142H)	42H	E.MB5		
	61763 (F143H)	43H	E.MB6		
	61764 (F144H)	44H	E.MB7		
	61765 (F145H)	45H	E.P24	24VDC power output short circuit	
	61766 (F146H)	46H	E.CTE	Operation panel power supply short circuit, RS-485 terminal power supply short circuit	
	61767 (F147H)	47H	E.LF	Output phase loss	
	61768 (F148H)	48H	E.PTC	PTC thermistor operation	
	61769 (F149H)	49H	E.PE2	Parameter storage device fault	
	61776 (F150H)	50H	E.CDO	Output current detection value exceeded	
	61777 (F151H)	51H	E.IOH	Inrush current limit circuit fault	
	61778 (F152H)	52H	E.SER	Communication fault (inverter)	
	61779 (F153H)	53H	E.AIE	Analog input fault	
	61781 (F155H)	55H	E.USB	USB communication fault	
	61782 (F156H)	56H	E.1	Option fault	
	61783 (F157H)	57H	E.2		
	61784 (F158H)	58H	E.3		
	61792 (F160H)	60H	E.5	CPU fault	
	61793 (F161H)	61H	E.6		
	61794 (F162H)	62H	E.7		
	61798 (F166H)	66H	E.11	Opposite rotation deceleration fault	
	61800 (F168H)	68H	E.13	Internal circuit fault	
	61808 (F170H)	70H	E.EP	Encoder phase fault	
	61840 (F190H)	90H	E.OP3	Communication option fault	
	61841 (F191H)	91H	E.OP3		
	61842 (F192H)	92H	E.OP3		
	61843 (F193H)	93H	E.OP3		
	61951 (F1FFH)	—	E.OP3	Internal circuit fault	

(2) Warning

When a warning occurs on FR-A700 series, the warning code (61696 to 61951) is stored in "Md.24 Axis warning No.".

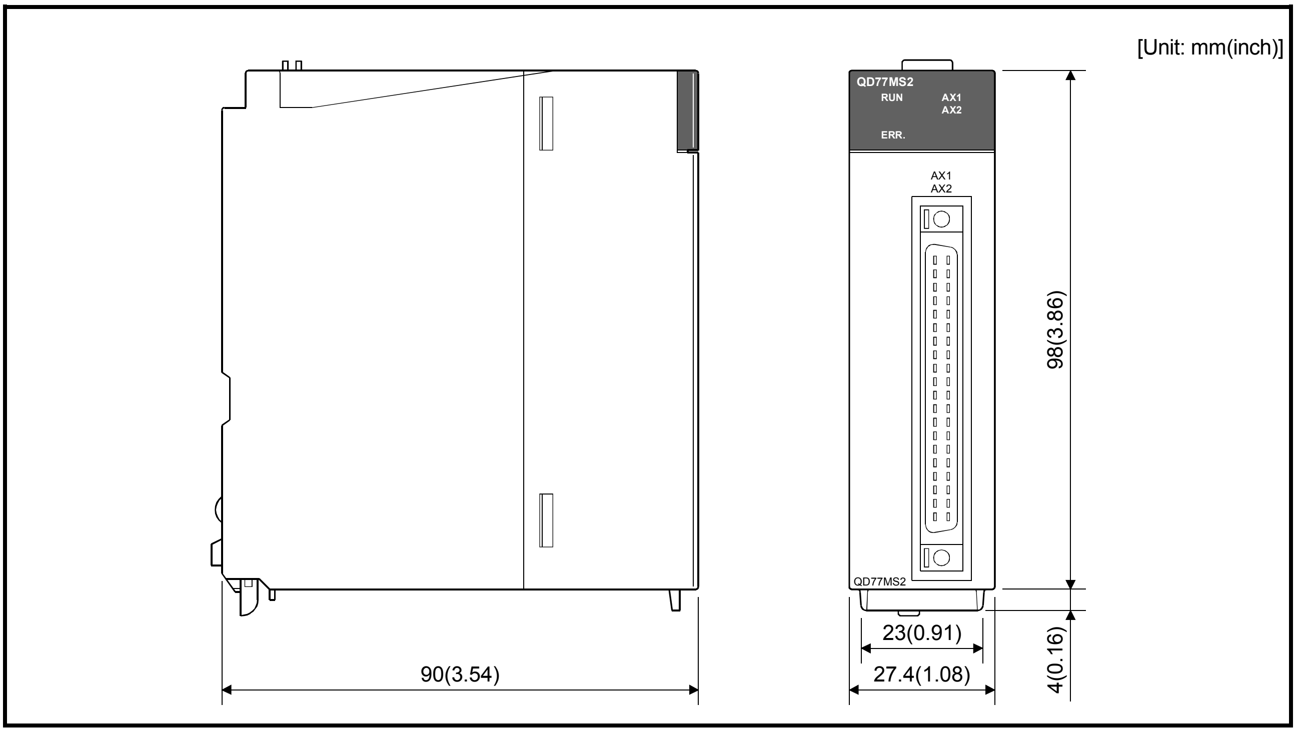
The warning No. of FR-A700 series is stored in "Md.58 Servo warning" in warning history.

The detection warning list for FR-A700 series is shown below.

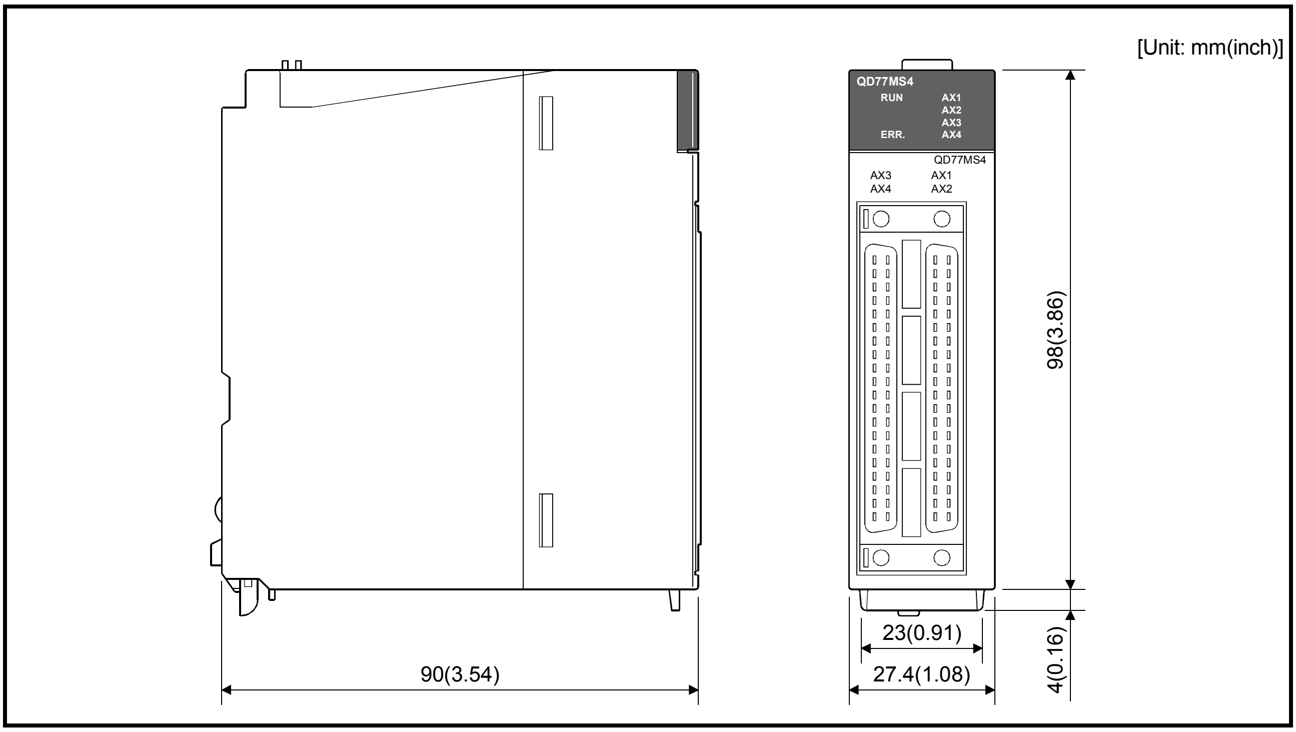
Classification of warnings	Warning code	Warning No. of FR-A700 series	FR-A700 series LED display	Name	Remarks
Inverter FR-A700 series	61924 (F1E4H)	E4H	—	Parameter write error	
	61926 (F1E6H)	E6H	—	Output stop	
	61927 (F1E7H)	E7H	—	Emergency stop	
	61936 (F1F0H)	F0H	OL	Stall prevention (overcurrent)	
	61937 (F1F1H)	F1H	oL	Stall prevention (overvoltage)	
	61938 (F1F2H)	F2H	PS	PU stop	
	61939 (F1F3H)	F3H	RB	Regenerative brake pre-alarm	
	61940 (F1F4H)	F4H	TH	Electronic thermal relay function pre-alarm	
	61941 (F1F5H)	F5H	MT	Maintenance signal output	
	61942 (F1F6H)	F6H	CP	Parameter copy	
	61943 (F1F7H)	F7H	SL	Speed limit indication (Output during speed limit)	
	61944 (F1F8H)	F8H	Fn	Fan alarm	

Appendix 7 External dimension drawing

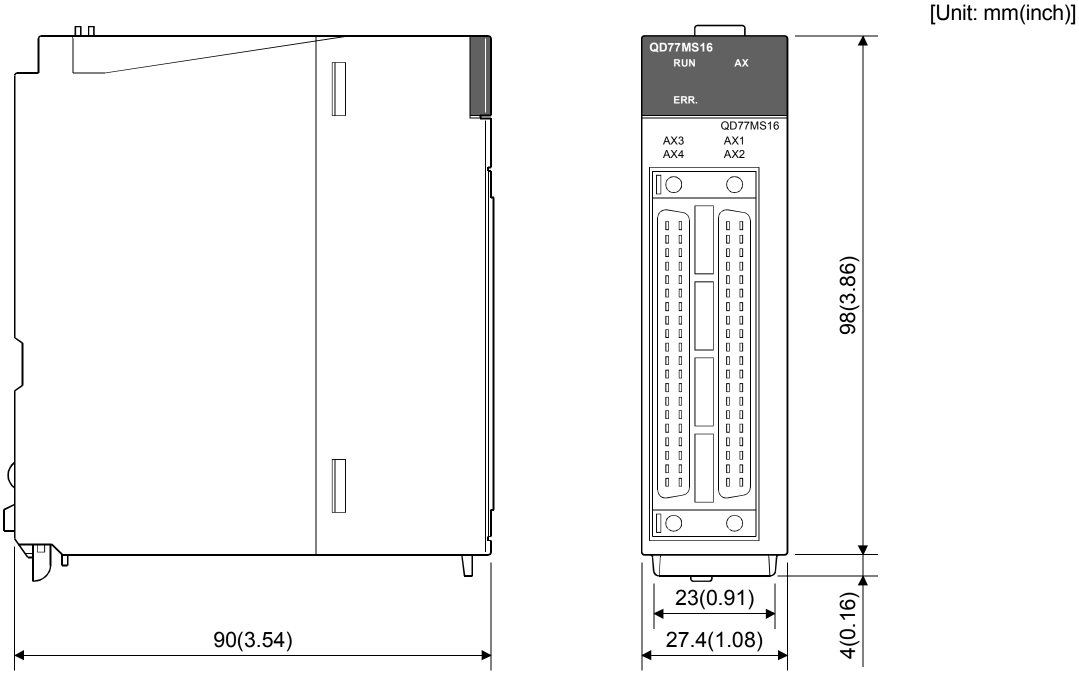
[1] QD77MS2



[2] QD77MS4



[3] QD77MS16


[Unit: mm(inch)]
QD77MS16
RUN
AX
ERR.
QD77MS16
AX3
AX4
AX1
AX2
98(3.86)
23(0.91)
90(3.54)
27.4(1.08)
4(0.16)

WARRANTY

Please confirm the following product warranty details before using this product.

1. Gratis Warranty Term and Gratis Warranty Range

If any faults or defects (hereinafter "Failure") found to be the responsibility of Mitsubishi occurs during use of the product within the gratis warranty term, the product shall be repaired at no cost via the sales representative or Mitsubishi Service Company.
However, if repairs are required onsite at domestic or overseas location, expenses to send an engineer will be solely at the customer's discretion. Mitsubishi shall not be held responsible for any re-commissioning, maintenance, or testing on-site that involves replacement of the failed module.

[Gratis Warranty Term]

The gratis warranty term of the product shall be for one year after the date of purchase or delivery to a designated place.
Note that after manufacture and shipment from Mitsubishi, the maximum distribution period shall be six (6) months, and the longest gratis warranty term after manufacturing shall be eighteen (18) months. The gratis warranty term of repair parts shall not exceed the gratis warranty term before repairs.

[Gratis Warranty Range]

(1) The range shall be limited to normal use within the usage state, usage methods and usage environment, etc., which follow the conditions and precautions, etc., given in the instruction manual, user's manual and caution labels on the product.
(2) Even within the gratis warranty term, repairs shall be charged for in the following cases.
  1. Failure occurring from inappropriate storage or handling, carelessness or negligence by the user. Failure caused by the user's hardware or software design.
  2. Failure caused by unapproved modifications, etc., to the product by the user.
  3. When the Mitsubishi product is assembled into a user's device, Failure that could have been avoided if functions or structures, judged as necessary in the legal safety measures the user's device is subject to or as necessary by industry standards, had been provided.
  4. Failure that could have been avoided if consumable parts (battery, backlight, fuse, etc.) designated in the instruction manual have been correctly serviced or replaced.
  5. Failure caused by external irresistible forces such as fires or abnormal voltages, and Failure caused by force majeure such as earthquakes, lightning, wind and water damage.
  6. Failure caused by reasons unpredictable by scientific technology standards at time of shipment from Mitsubishi.
  7. Any other failure found to not be the responsibility of Mitsubishi or that admitted not to be so by the user.

2. Onerous repair term after discontinuation of production

(1) Mitsubishi shall accept onerous product repairs for seven (7) years after production of the product is discontinued. Discontinuation of production shall be notified with Mitsubishi Technical Bulletins, etc.
(2) Product supply (including repair parts) is not available after production is discontinued.

3. Overseas service

Overseas, repairs shall be accepted by Mitsubishi's local overseas FA Center. Note that the repair conditions at each FA Center may differ.

4. Exclusion of loss in opportunity and secondary loss from warranty liability

Regardless of the gratis warranty term, Mitsubishi shall not be liable for compensation to damages caused by any cause found not to be the responsibility of Mitsubishi, loss in opportunity, lost profits incurred to the user by Failures of Mitsubishi products, special damages and secondary damages whether foreseeable or not, compensation for damages to products other than Mitsubishi products, replacement by the user, maintenance of on-site equipment, start-up test run and other tasks.

5. Changes in product specifications

The specifications given in the catalogs, manuals or technical documents are subject to change without prior notice.

MELSEC-Q QD77MS Simple Motion Module User's Manual

Positioning Control

MODEL	QD77MS-U-S-E
MODEL CODE	1XB947
IB(NA)-0300185-B(1309)MEE	

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