SIEMENS

SINUMERIK
SINUMERIK 808D ADVANCED
Commissioning Manual

Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

⚠DANGER
indicates that death or severe personal injury **will** result if proper precautions are not taken.

⚠WARNING
indicates that death or severe personal injury **may** result if proper precautions are not taken.

⚠CAUTION
indicates that minor personal injury can result if proper precautions are not taken.

NOTICE
indicates that property damage can result if proper precautions are not taken.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

⚠WARNING
Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

6FC5397-4EP10-1BA0, 12/2018

Preface

Applicable products

This manual is valid for the following control systems:

Control system	Software version
SINUMERIK 808D ADVANCED T (Turning) SINUMERIK 808D ADVANCED M (Milling)	V4.91: PPU16x.3/PPU15x.3 with spindle/feed servo system

Documentation components and target audience

End-user documentation	Target audience
Programming and Operating Manual (Turning)	Programmers and operators of turning machines
Programming and Operating Manual (Milling)	Programmers and operators of milling machines
Programming and Operating Manual (ISO Turning/Milling)	Programmers and operators of turning/milling machines
Programming and Operating Manual (Manual Machine Plus (MM+), Turning)	Programmers and operators of turning machines
Diagnostics Manual	Mechanical and electrical designers, commissioning engineers, machine operators, and service and maintenance personnel
Manufacturer/service documentation	**Target audience**
Commissioning Manual	Installation personnel, commissioning engineers, and service and maintenance personnel
Function Manual	Mechanical and electrical designers, technical professionals
Parameter Manual	Mechanical and electrical designers, technical professionals
Service Manual	Mechanical and electrical designers, technical professionals, commissioning engineers, and service and maintenance personnel
Readme file	
Third-party software - Licensing terms and copyright information	

My Documentation Manager (MDM)

Under the following link you will find information to individually compile your documentation based on the Siemens content:

www.siemens.com/mdm

Standard scope

This manual only describes the functionality of the standard version. Extensions or changes made by the machine tool manufacturer are documented by the machine tool manufacturer.

Technical support

Country	Hotline [1)]	Further service contact information:
Germany	+49 911 895 7222	• Worldwide Web site: https://support.industry.siemens.com/cs/ww/en/ • Chinese Web site: http://www.siemens.com.cn/808D
China	+86 400 810 4288	

[1)] You can find more hotline information at the worldwide Web site given above.

EC Declaration of Conformity

The EC Declaration of Conformity for the EMC Directive can be found on the Internet at https://support.industry.siemens.com/cs/ww/en/.

Here, enter the number "**59843164**" as the search term or contact your local Siemens office.

Product maintenance

The components are subject to continuous further development within the scope of product maintenance (improvements to robustness, discontinuations of components, etc).

These further developments are "spare parts-compatible" and do not change the article number.

In the scope of such spare parts-compatible further developments, connector positions are sometimes changed slightly. This does not cause any problems with proper use of the components. Please take this fact into consideration in special installation situations (e.g. allow sufficient clearance for the cable length).

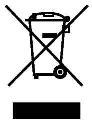
Use of third-party products

This document contains recommendations relating to third-party products. Siemens accepts the fundamental suitability of these third-party products.

You can use equivalent products from other manufacturers.

Siemens does not accept any warranty for the properties of third-party products.

Recycling and disposal



For environmentally-friendly recycling and disposal of your old device, please contact a company certified for the disposal of waste electrical and electronic equipment, and dispose of the old device as prescribed in the respective country of use.

Table of contents

1 Safety instructions

1.1 Fundamental safety instructions

1.1.1 General safety instructions

WARNING

Electric shock and danger to life due to other energy sources

Touching live components can result in death or severe injury.

- Only work on electrical devices when you are qualified for this job.
- Always observe the country-specific safety rules.

Generally, the following six steps apply when establishing safety:

1. Prepare for disconnection. Notify all those who will be affected by the procedure.
2. Isolate the drive system from the power supply and take measures to prevent it being switched back on again.
3. Wait until the discharge time specified on the warning labels has elapsed.
4. Check that there is no voltage between any of the power connections, and between any of the power connections and the protective conductor connection.
5. Check whether the existing auxiliary supply circuits are de-energized.
6. Ensure that the motors cannot move.
7. Identify all other dangerous energy sources, e.g. compressed air, hydraulic systems, or water. Switch the energy sources to a safe state.
8. Check that the correct drive system is completely locked.

After you have completed the work, restore the operational readiness in the inverse sequence.

WARNING

Risk of electric shock and fire from supply networks with an excessively high impedance

Excessively low short-circuit currents can lead to the protective devices not tripping or tripping too late, and thus causing electric shock or a fire.

- In the case of a conductor-conductor or conductor-ground short-circuit, ensure that the short-circuit current at the point where the inverter is connected to the line supply at least meets the minimum requirements for the response of the protective device used.
- You must use an additional residual-current device (RCD) if a conductor-ground short circuit does not reach the short-circuit current required for the protective device to respond. The required short-circuit current can be too low, especially for TT supply systems.

WARNING

Risk of electric shock and fire from supply networks with an excessively low impedance

Excessively high short-circuit currents can lead to the protective devices not being able to interrupt these short-circuit currents and being destroyed, and thus causing electric shock or a fire.

- Ensure that the prospective short-circuit current at the line terminal of the inverter does not exceed the breaking capacity (SCCR or Icc) of the protective device used.

WARNING

Electric shock if there is no ground connection

For missing or incorrectly implemented protective conductor connection for devices with protection class I, high voltages can be present at open, exposed parts, which when touched, can result in death or severe injury.

- Ground the device in compliance with the applicable regulations.

WARNING

Electric shock due to connection to an unsuitable power supply

When equipment is connected to an unsuitable power supply, exposed components may carry a hazardous voltage that might result in serious injury or death.

- Only use power supplies that provide SELV (Safety Extra Low Voltage) or PELV- (Protective Extra Low Voltage) output voltages for all connections and terminals of the electronics modules.

WARNING

Electric shock due to damaged motors or devices

Improper handling of motors or devices can damage them.

Hazardous voltages can be present at the enclosure or at exposed components on damaged motors or devices.

- Ensure compliance with the limit values specified in the technical data during transport, storage and operation.
- Do not use any damaged motors or devices.

WARNING

Electric shock due to unconnected cable shields

Hazardous touch voltages can occur through capacitive cross-coupling due to unconnected cable shields.

- As a minimum, connect cable shields and the cores of cables that are not used at one end at the grounded housing potential.

WARNING

Arcing when a plug connection is opened during operation

Opening a plug connection when a system is operation can result in arcing that may cause serious injury or death.

- Only open plug connections when the equipment is in a voltage-free state, unless it has been explicitly stated that they can be opened in operation.

WARNING

Electric shock due to residual charges in power components

Because of the capacitors, a hazardous voltage is present for up to 5 minutes after the power supply has been switched off. Contact with live parts can result in death or serious injury.

- Wait for 5 minutes before you check that the unit really is in a no-voltage condition and start work.

NOTICE

Property damage due to loose power connections

Insufficient tightening torques or vibration can result in loose power connections. This can result in damage due to fire, device defects or malfunctions.

- Tighten all power connections to the prescribed torque.
- Check all power connections at regular intervals, particularly after equipment has been transported.

WARNING

Spread of fire from built-in devices

In the event of fire outbreak, the enclosures of built-in devices cannot prevent the escape of fire and smoke. This can result in serious personal injury or property damage.

- Install built-in units in a suitable metal cabinet in such a way that personnel are protected against fire and smoke, or take other appropriate measures to protect personnel.
- Ensure that smoke can only escape via controlled and monitored paths.

WARNING

Active implant malfunctions due to electromagnetic fields

Inverters generate electromagnetic fields (EMF) in operation. People with active implants in the immediate vicinity of this equipment are at particular risk.

- As the operator of an EMF-emitting installation, assess the individual risks of persons with active implants. The following clearances are usually adequate:
  - No clearance to closed control cabinets and shielded MOTION-CONNECT supply cables
  - Forearm length (approx. 35 cm clearance) to distributed drive systems and open control cabinets

WARNING

Active implant malfunctions due to permanent-magnet fields

Even when switched off, electric motors with permanent magnets represent a potential risk for persons with heart pacemakers or implants if they are close to converters/motors.

- If you have a heart pacemaker or implant, maintain a minimum distance of 2 m.
- When transporting or storing permanent-magnet motors always use the original packing materials with the warning labels attached.
- Clearly mark the storage locations with the appropriate warning labels.
- IATA regulations must be observed when transported by air.

WARNING

Unexpected movement of machines caused by radio devices or mobile phones

When radio devices or mobile phones with a transmission power > 1 W are used in the immediate vicinity of components, they may cause the equipment to malfunction. Malfunctions may impair the functional safety of machines and can therefore put people in danger or lead to property damage.

- If you come closer than around 2 m to such components, switch off any radios or mobile phones.
- Use the "SIEMENS Industry Online Support app" only on equipment that has already been switched off.

NOTICE

Damage to motor insulation due to excessive voltages

When operated on systems with grounded line conductor or in the event of a ground fault in the IT system, the motor insulation can be damaged by the higher voltage to ground. If you use motors that have insulation that is not designed for operation with grounded line conductors, you must perform the following measures:

- IT system: Use a ground fault monitor and eliminate the fault as quickly as possible.
- TN or TT systems with grounded line conductor: Use an isolating transformer on the line side.

WARNING

Fire due to inadequate ventilation clearances

Inadequate ventilation clearances can cause overheating of components with subsequent fire and smoke. This can cause severe injury or even death. This can also result in increased downtime and reduced service lives for devices/systems.

- Ensure compliance with the specified minimum clearance as ventilation clearance for the respective component.

WARNING

Unrecognized dangers due to missing or illegible warning labels

Dangers might not be recognized if warning labels are missing or illegible. Unrecognized dangers may cause accidents resulting in serious injury or death.

- Check that the warning labels are complete based on the documentation.
- Attach any missing warning labels to the components, where necessary in the national language.
- Replace illegible warning labels.

NOTICE

Device damage caused by incorrect voltage/insulation tests

Incorrect voltage/insulation tests can damage the device.

- Before carrying out a voltage/insulation check of the system/machine, disconnect the devices as all converters and motors have been subject to a high voltage test by the manufacturer, and therefore it is not necessary to perform an additional test within the system/machine.

WARNING

Unexpected movement of machines caused by inactive safety functions

Inactive or non-adapted safety functions can trigger unexpected machine movements that may result in serious injury or death.

- Observe the information in the appropriate product documentation before commissioning.
- Carry out a safety inspection for functions relevant to safety on the entire system, including all safety-related components.
- Ensure that the safety functions used in your drives and automation tasks are adjusted and activated through appropriate parameterizing.
- Perform a function test.
- Only put your plant into live operation once you have guaranteed that the functions relevant to safety are running correctly.

Note

Important safety notices for Safety Integrated functions

If you want to use Safety Integrated functions, you must observe the safety notices in the Safety Integrated manuals.

WARNING

Malfunctions of the machine as a result of incorrect or changed parameter settings

As a result of incorrect or changed parameterization, machines can malfunction, which in turn can lead to injuries or death.

- Protect the parameterization (parameter assignments) against unauthorized access.
- Handle possible malfunctions by taking suitable measures, e.g. emergency stop or emergency off.

WARNING

Injury caused by moving or ejected parts

Contact with moving motor parts or drive output elements and the ejection of loose motor parts (e.g. feather keys) out of the motor enclosure can result in severe injury or death.

- Remove any loose parts or secure them so that they cannot be flung out.
- Do not touch any moving parts.
- Safeguard all moving parts using the appropriate safety guards.

WARNING

Fire due to inadequate cooling

Inadequate cooling can cause the motor to overheat, resulting in death or severe injury as a result of smoke and fire. This can also result in increased failures and reduced service lives of motors.

- Comply with the specified cooling requirements for the motor.

WARNING

Fire due to incorrect operation of the motor

When incorrectly operated and in the case of a fault, the motor can overheat resulting in fire and smoke. This can result in severe injury or death. Further, excessively high temperatures destroy motor components and result in increased failures as well as shorter service lives of motors.

- Operate the motor according to the relevant specifications.
- Only operate the motors in conjunction with effective temperature monitoring.
- Immediately switch off the motor if excessively high temperatures occur.

CAUTION

Burn injuries caused by hot surfaces

In operation, the motor can reach high temperatures, which can cause burns if touched.

- Mount the motor so that it is not accessible in operation.

Measures when maintenance is required:

- Allow the motor to cool down before starting any work.
- Use the appropriate personnel protection equipment, e.g. gloves.

1.1.2 Equipment damage due to electric fields or electrostatic discharge

Electrostatic sensitive devices (ESD) are individual components, integrated circuits, modules or devices that may be damaged by either electric fields or electrostatic discharge.

NOTICE

Equipment damage due to electric fields or electrostatic discharge

Electric fields or electrostatic discharge can cause malfunctions through damaged individual components, integrated circuits, modules or devices.

- Only pack, store, transport and send electronic components, modules or devices in their original packaging or in other suitable materials, e.g conductive foam rubber of aluminum foil.
- Only touch components, modules and devices when you are grounded by one of the following methods:
  - Wearing an ESD wrist strap
  - Wearing ESD shoes or ESD grounding straps in ESD areas with conductive flooring
- Only place electronic components, modules or devices on conductive surfaces (table with ESD surface, conductive ESD foam, ESD packaging, ESD transport container).

1.1.3 Warranty and liability for application examples

Application examples are not binding and do not claim to be complete regarding configuration, equipment or any eventuality which may arise. Application examples do not represent specific customer solutions, but are only intended to provide support for typical tasks.

As the user you yourself are responsible for ensuring that the products described are operated correctly. Application examples do not relieve you of your responsibility for safe handling when using, installing, operating and maintaining the equipment.

1.1.4 Industrial security

Note

Industrial security

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Siemens' products and solutions constitute one element of such a concept.

Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to an enterprise network or the Internet if and to the extent such a connection is necessary and only when appropriate security measures (e.g. firewalls and/or network segmentation) are in place.

For additional information on industrial security measures that may be implemented, please visit:

Industrial security (http://www.siemens.com/industrialsecurity)

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends that product updates are applied as soon as they are available and that the latest product versions are used. Use of product versions that are no longer supported, and failure to apply the latest updates may increase customer's exposure to cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed at:

Industrial security (http://www.siemens.com/industrialsecurity)

Further information is provided on the Internet:

Industrial Security Configuration Manual (https://support.industry.siemens.com/cs/ww/en/view/108862708)

WARNING

Unsafe operating states resulting from software manipulation

Software manipulations (e.g. viruses, trojans, malware or worms) can cause unsafe operating states in your system that may lead to death, serious injury, and property damage.

- Keep the software up to date.
- Incorporate the automation and drive components into a holistic, state-of-the-art industrial security concept for the installation or machine.
- Make sure that you include all installed products into the holistic industrial security concept.
- Protect files stored on exchangeable storage media from malicious software by with suitable protection measures, e.g. virus scanners.
- Protect the drive against unauthorized changes by activating the "know-how protection" drive function.

1.1.5 Residual risks of power drive systems

When assessing the machine- or system-related risk in accordance with the respective local regulations (e.g., EC Machinery Directive), the machine manufacturer or system installer must take into account the following residual risks emanating from the control and drive components of a drive system:

1. Unintentional movements of driven machine or system components during commissioning, operation, maintenance, and repairs caused by, for example,
   - Hardware and/or software errors in the sensors, control system, actuators, and cables and connections
   - Response times of the control system and of the drive
   - Operation and/or environmental conditions outside the specification
   - Condensation/conductive contamination
   - Parameterization, programming, cabling, and installation errors
   - Use of wireless devices/mobile phones in the immediate vicinity of electronic components
   - External influences/damage
   - X-ray, ionizing radiation and cosmic radiation
2. Unusually high temperatures, including open flames, as well as emissions of light, noise, particles, gases, etc., can occur inside and outside the components under fault conditions caused by, for example:
   - Component failure
   - Software errors
   - Operation and/or environmental conditions outside the specification
   - External influences/damage
3. Hazardous shock voltages caused by, for example:
   - Component failure
   - Influence during electrostatic charging
   - Induction of voltages in moving motors
   - Operation and/or environmental conditions outside the specification
   - Condensation/conductive contamination
   - External influences/damage
4. Electrical, magnetic and electromagnetic fields generated in operation that can pose a risk to people with a pacemaker, implants or metal replacement joints, etc., if they are too close
5. Release of environmental pollutants or emissions as a result of improper operation of the system and/or failure to dispose of components safely and correctly
6. Influence of network-connected communication systems, e.g. ripple-control transmitters or data communication via the network

For more information about the residual risks of the drive system components, see the relevant sections in the technical user documentation.

1.2 Carrying out of repairs

⚠ DANGER

Carrying out of repairs

Anywhere in the automation equipment where faults might cause physical injury or major material damage, in other words, where faults could be dangerous, additional external precautions must be taken, or facilities must be provided, that guarantee or enforce a safe operational state, even when there is a fault (e.g. using an independent limit value switch, mechanical locking mechanisms, EMERGENCY STOP/EMERGENCY OFF devices).

2 Preparation before commissioning

2.1 Scope of delivery

2.1.1 System overview

The SINUMERIK 808D ADVANCED control system is an economic numerical control system for milling or turning machines. The SINUMERIK 808D ADVANCED controller, coupled with the high performance SINAMICS V70 feed/spindle drive, SIMOTICS S-1FL6 feed motor, and SIMOTICS M-1PH1 main motor, is able to control up to five axes including analog/digital spindles.

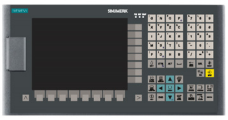
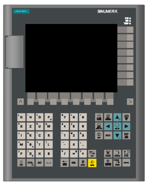
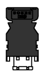
Control system versions

Control system		SINUMERIK 808D ADVANCED T				SINUMERIK 808D ADVANCED M			
Applicable machine tools		Turning machines				Milling machines			
PPU	Applicable software version	V4.91				V4.91			
	PPU variants	PPU161.3	PPU160.3	PPU151.3	PPU150.3	PPU161.3	PPU160.3	PPU151.3	PPU150.3
	Panel layout	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical
	Operator panel with English keys	√	√	√	√	√	√	√	√
	Operator panel with Chinese keys	√	√	√	√	√	√	√	√
MCP	Configurable MCPs are available in the following versions: • Horizontal MCP, with English keys and override switches • Horizontal MCP, with Chinese keys and override switches • Horizontal MCP, with Chinese keys and a reserved slot for the handwheel (applicable to turning machines only) • Vertical MCP, with English keys and a reserved slot for the handwheel • Vertical MCP, with Chinese keys and a reserved slot for the handwheel • Vertical MCP, with English keys and an override switch for the spindle • Vertical MCP, with Chinese keys and an override switch for the spindle								
Number of configurable axes	Total	Up to 6		Up to 4		Up to 6		Up to 4	
	Standard axes	3		3		4		4	
	Additional axes (license required)	3		1		2		-	
Communication with drive		Drive Bus interface							
Configurable drives		SINAMICS V70 feed/spindle drive							
Configurable motors		SIMOTICS S-1FL6/SIMOTICS M-1PH1							

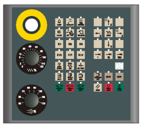
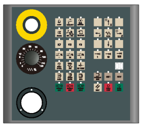
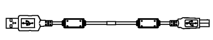
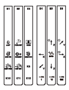
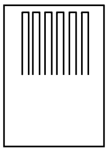
√: available

2.1.2 PPU and MCP

Components in the panel processing unit (PPU) package

<table>
<tr><th>Component</th><th>Quantity (pieces)</th><th colspan="2">Illustration</th><th colspan="2">Article number</th></tr>
<tr><td rowspan="16">PPU</td><td rowspan="16">1</td><td rowspan="4">Horizontal version (PPU161.3)</td><td rowspan="8"></td><td rowspan="2">Turning</td><td>6FC5370-2AT03-0AA0 (English)</td></tr>
<tr><td>6FC5370-2AT03-0CA0 (Chinese)</td></tr>
<tr><td rowspan="2">Milling</td><td>6FC5370-2AM03-0AA0 (English)</td></tr>
<tr><td>6FC5370-2AM03-0CA0 (Chinese)</td></tr>
<tr><td rowspan="4">Horizontal version (PPU151.3)</td><td rowspan="2">Turning</td><td>6FC5370-3AT03-0AA0 (English)</td></tr>
<tr><td>6FC5370-3AT03-0CA0 (Chinese)</td></tr>
<tr><td rowspan="2">Milling</td><td>6FC5370-3AM03-0AA0 (English)</td></tr>
<tr><td>6FC5370-3AM03-0CA0 (Chinese)</td></tr>
<tr><td rowspan="4">Vertical version (PPU160.3)</td><td rowspan="8"></td><td rowspan="2">Turning</td><td>6FC5370-2BT03-0AA0 (English)</td></tr>
<tr><td>6FC5370-2BT03-0CA0 (Chinese)</td></tr>
<tr><td rowspan="2">Milling</td><td>6FC5370-2BM03-0AA0 (English)</td></tr>
<tr><td>6FC5370-2BM03-0CA0 (Chinese)</td></tr>
<tr><td rowspan="4">Vertical version (PPU150.3)</td><td rowspan="2">Turning</td><td>6FC5370-3BT03-0AA0 (English)</td></tr>
<tr><td>6FC5370-3BT03-0CA0 (Chinese)</td></tr>
<tr><td rowspan="2">Milling</td><td>6FC5370-3BM03-0AA0 (English)</td></tr>
<tr><td>6FC5370-3BM03-0CA0 (Chinese)</td></tr>
<tr><td>Drive Bus terminator</td><td>1</td><td colspan="2"></td><td colspan="2">6FC5548-0BA21-0AA0</td></tr>
<tr><td>Mounting clamps with screws</td><td>• PPU161.3/ PPU151.3: 8
• PPU160.3/ PPU150.3: 10</td><td colspan="4"></td></tr>
<tr><td>Connectors</td><td>8</td><td colspan="4">Seven I/O connectors and one 24 V power input connector</td></tr>
<tr><td>Readme file</td><td>1</td><td colspan="4">Third-party software - Licensing terms and copyright information</td></tr>
</table>

Components in the machine control panel (MCP) package

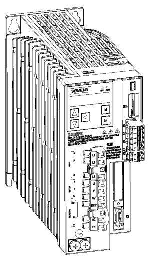
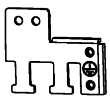
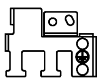
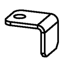
Component	Quantity (pieces)	Illustration		Article number
MCP	1	Horizontal MCP, with override switches		6FC5303-0AF35-0AA0 (English) 6FC5303-0AF35-0CA0 (Chinese)
		Horizontal MCP, with a reserved slot for the handwheel		6FC5303-0AF35-1CA0 (Chinese)
		Vertical MCP, with an override switch for the spindle		6FC5303-0AF35-2AA0 (English) 6FC5303-0AF35-2CA0 (Chinese)
		Vertical MCP, with a reserved slot for the handwheel		6FC5303-0AF35-3AA0 (English) 6FC5303-0AF35-3CA0 (Chinese)
MCP connecting cable	1 (for connecting the MCP to the PPU)			
Mounting clamps with screws	• Horizontal MCP: 6 • Vertical MCP: 8			
Pre-defined labeling strips for keys of the MCP, milling *	1			
Blank strip paper, A4 size *	1			

* Not provided in the package for the horizontal MCP with a reserved slot for the handwheel.

2.1.3 Drives and motors

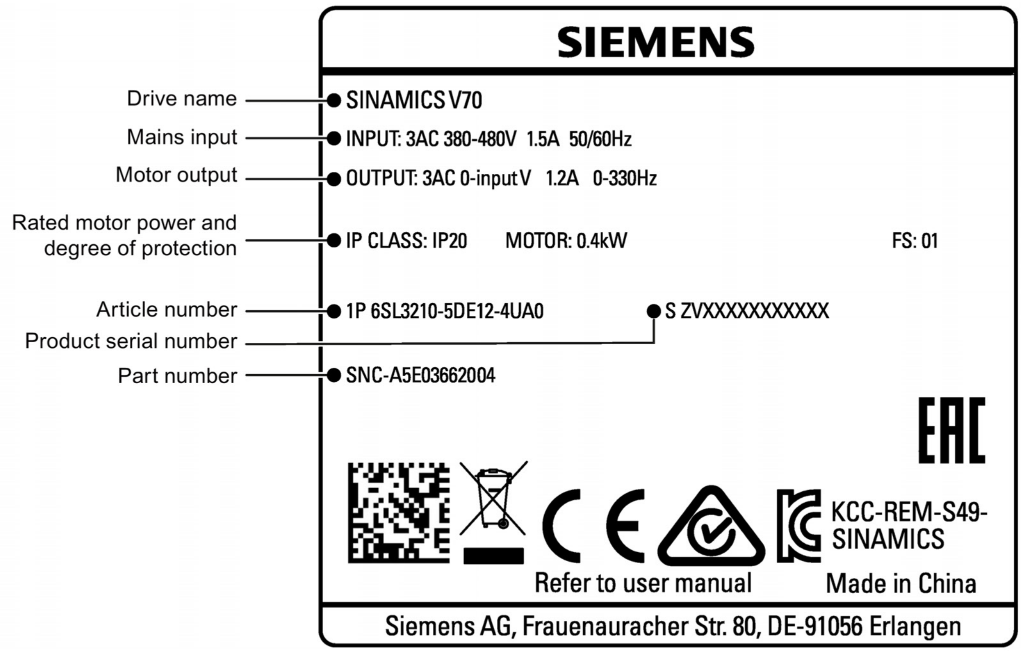
2.1.3.1 SINAMICS V70 feed servo system

Components in the SINAMICS V70 feed drive package

Component	Quantity (pieces)	Illustration	Outline dimension (Width × Height × Depth, mm)	Frame size [1]	Rated output current (A)	Article number
SINAMICS V70 feed drive	1		80 × 180 × 200	FSA	1.2	6SL3210-5DE12-4UA0
					3.0	6SL3210-5DE13-5UA0
			100 × 180 × 220	FSB	4.6	6SL3210-5DE16-0UA0
					5.3	6SL3210-5DE17-8UA0
					7.8	6SL3210-5DE21-0UA0
			140 × 260 × 240	FSC	11.0	6SL3210-5DE21-4UA0
					13.2	6SL3210-5DE21-8UA0
Shielding plate	1 (FSA)		For all shielded cables of the drive			
	2 (FSB/FSC)		For all shielded cables of the drive			
			For the line supply cable of the drive			
Connectors	4 (FSA)/2 (FSB/FSC)		Line supply connector (FSA only)			
			Motor power/braking resistor connector (FSA only)			
			Holding brake connector			
			STO/24 V power supply connector			
User documentation	1	Safety Instructions				

[1] For more information about different frame sizes, see Section "Drill patterns and outline dimensions (Page 56)".

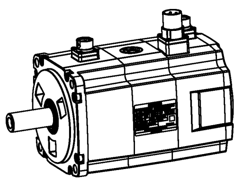
SINAMICS V70 feed drive rating plate



Explanation of SINAMICS V70 feed drive article numbers

Data position of the article number	1	2	3	4	5	6	7		8	9	10	11	12		13	14	15	16
Article number	6	S	L	3	2	1	0	-	5	D	•	❑	❑	-	❑	U	A	0
Mains voltage: 3 AC 380 V to 480 V											E							
Motor output power																		
0.4 kW												1	2		4			
0.75 kW/1 kW												1	3		5			
1.5 kW												1	6		0			
1.75 kW												1	7		8			
2 kW/2.5 kW												2	1		0			
3.5 kW												2	1		4			
5 kW/7 kW												2	1		8			

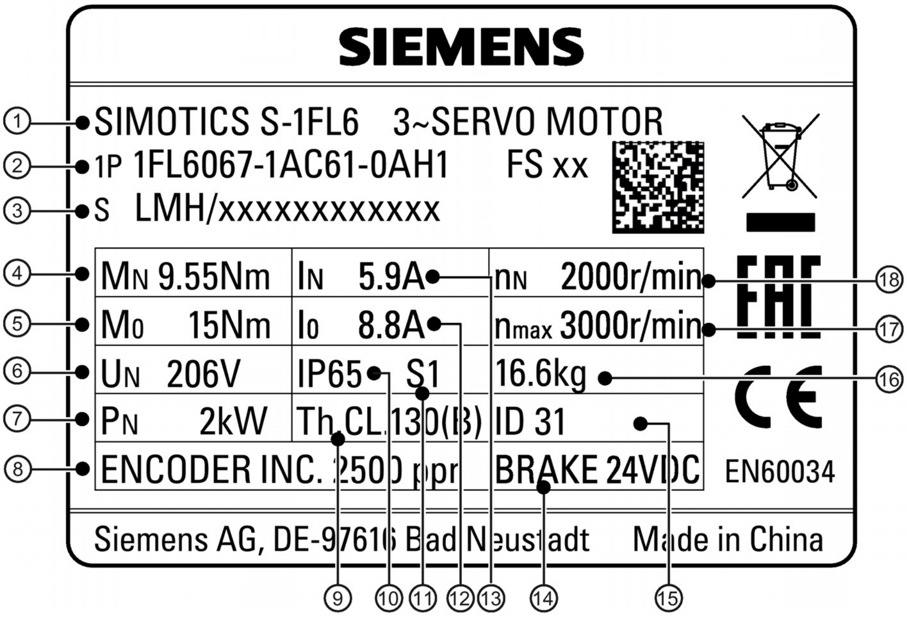
Components in the SIMOTICS S-1FL6 motor package

Component	Illustration	Shaft height (mm)	Stall torque (Nm)	Article number 1)
SIMOTICS S-1FL6 motor		45	1.9	1FL6042-1AF61-❑❑❑1
			3.5	1FL6044-1AF61-❑❑❑1
		65	4	1FL6061-1AC61-❑❑❑1
				1FL6061-1AC64-2L❑1 2)
			6	1FL6062-1AC61-❑❑❑1
				1FL6062-1AC64-2L❑1 2)
			8	1FL6064-1AC61-❑❑❑1
				1FL6064-1AC64-2L❑1 2)
			11	1FL6066-1AC61-❑❑❑1
				1FL6066-1AC64-2L❑1 2)
			15	1FL6067-1AC61-❑❑❑1
				1FL6067-1AC64-2L❑1 2)
		90	15	1FL6090-1AC61-❑❑❑1
			22	1FL6092-1AC61-❑❑❑1
			30	1FL6094-1AC61-❑❑❑1
			40	1FL6096-1AC61-❑❑❑1
User documentation	SIMOTICS S-1FL6 Servo Motors Installation Guide			

1) For more information about article numbers, see motor article number explanation described later in this section.

2) ❑ = G or H only.

SIMOTICS S-1FL6 motor rating plate



①	Motor type	⑩	Degree of protection
②	Article number	⑪	Motor operating mode
③	Serial number	⑫	Stall current
④	Rated torque	⑬	Rated current
⑤	Stall torque	⑭	Holding brake
⑥	Rated voltage	⑮	Motor ID
⑦	Rated power	⑯	Weight
⑧	Encoder type and resolution	⑰	Maximum speed
⑨	Thermal class	⑱	Rated speed

Explanation of SIMOTICS S-1FL6 feed motor article numbers

Data position of the article number	1	2	3	4	5	6	7		8	9	10	11	12		13	14	15	16
Article number	1	F	L	6	❑	❑	❑	-	●	●	❑	●	●	-	❑	❑	❑	●
Shaft height																		
45 mm					0	4												
65 mm					0	6												
90 mm					0	9												
Stall torque																		
15 Nm, SH90							0											
4 Nm, SH65							1											
1.9 Nm, SH45; 6 Nm, SH65; 22 Nm, SH90							2											
3.5 Nm, SH45; 8 Nm, SH65; 30 Nm, SH90							4											
11 Nm, SH65; 40 Nm, SH90							6											
15 Nm, SH65							7											
High inertia variant									1									
Natural cooling										A								
Rated speed																		
2000 rpm											C							
3000 rpm											F							
400 V supply voltage												6						
Type of construction																		
IM B5, flange mounting, Standard													1					
IM B5, flange mounting, Performance													4					
Straight connectors with a fixed outlet direction															0			
Angular connectors with a flexible outlet direction															2			
Encoder type																		
Incremental encoder, TTL 2500 ppr																A		
Absolute encoder, 20-bit + 12-bit multi-turn																L		
Mechanics																		
Plain shaft, without brake																	G	
Plain shaft, with brake																	H	
Shaft with key (half-key balancing), without brake																	A	
Shaft with key (half-key balancing), with brake																	B	
IP65, with a shaft oil seal																		1

Device combination of the SINAMICS V70 feed servo system

The table below lists ordering data of V70 feed drives and configurable motors. You can select the desired feed drive according to the motor configured:

SIMOTICS S-1FL6 feed motor					SINAMICS V70 feed drive	
Stall torque (Nm)	Rated power (kW)	Rated speed (rpm)	Shaft height (mm)	Article number	Article number	Frame size
1.9	0.40	3000	45	1FL6042-1AF61-❑❑❑1	6SL3210-5DE12-4UA0	FSA
3.5	0.75			1FL6044-1AF61-❑❑❑1	6SL3210-5DE13-5UA0	
4	0.75	2000	65	1FL6061-1AC61-❑❑❑1		
				1FL6061-1AC64-2L❑1 [1)]		
6	1.00			1FL6062-1AC61-❑❑❑1		
				1FL6062-1AC64-2L❑1 [1)]		
8	1.50			1FL6064-1AC61-❑❑❑1	6SL3210-5DE16-0UA0	FSB
				1FL6064-1AC64-2L❑1 [1)]		
11	1.75			1FL6066-1AC61-❑❑❑1	6SL3210-5DE17-8UA0	
				1FL6066-1AC64-2L❑1 [1)]		
15	2.00			1FL6067-1AC61-❑❑❑1	6SL3210-5DE21-0UA0	
				1FL6067-1AC64-2L❑1 [1)]		
15	2.50	2000	90	1FL6090-1AC61-❑❑❑1		
22	3.50			1FL6092-1AC61-❑❑❑1	6SL3210-5DE21-4UA0	FSC
30	5.00			1FL6094-1AC61-❑❑❑1	6SL3210-5DE21-8UA0	
40	7.00			1FL6096-1AC61-❑❑❑1		

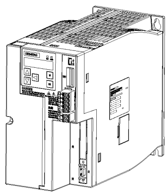
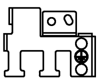
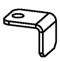
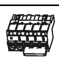
1) ❑ = G or H only.

Note

You can select a SINAMICS V70 feed drive for all the SIMOTICS S-1FL6 feed motors whose rated power values are equal to or smaller than that specified as matching with this feed drive in the table above.

2.1.3.2 SINAMICS V70 spindle servo system

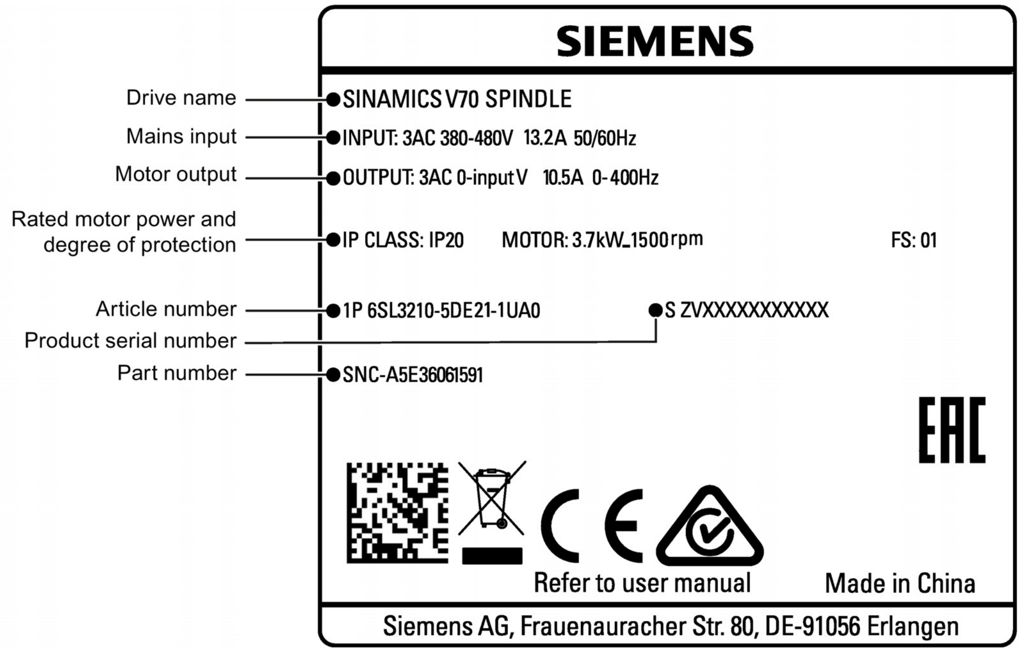
Components in the SINAMICS V70 spindle drive package

Component	Quantity (pieces)	Illustration	Outline dimension (Width × Height × Depth, mm)	Frame size[1)]	Rated output current (A)	Article number
SINAMICS V70 spindle drive	1		100 × 180 × 220	FSB	10.5	6SL3210-5DE21-1UA0
			140 × 260 × 240	FSC	12.9	6SL3210-5DE21-3UA0
					19.6	6SL3210-5DE22-0UA0
			190 × 350 × 185	FSD	29.8	6SL3210-5DE23-0UA0
					37.6	6SL3210-5DE24-0UA0
Shielding plate (FSB/FSC only [2)])	2		For all shielded cables of the drive			
			For the line supply cable of the drive			
Connector	1		STO/24 V power supply connector			
User documentation	1	Safety Instructions				

1) For more information about the different frame sizes, see Section "Drill patterns and outline dimensions (Page 56)".

2) The shielding plate for FSD is available as an option only.

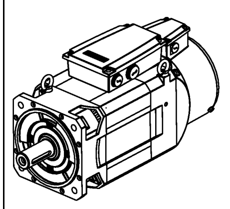
SINAMICS V70 spindle drive rating plate



Explanation of SINAMICS V70 spindle drive article numbers

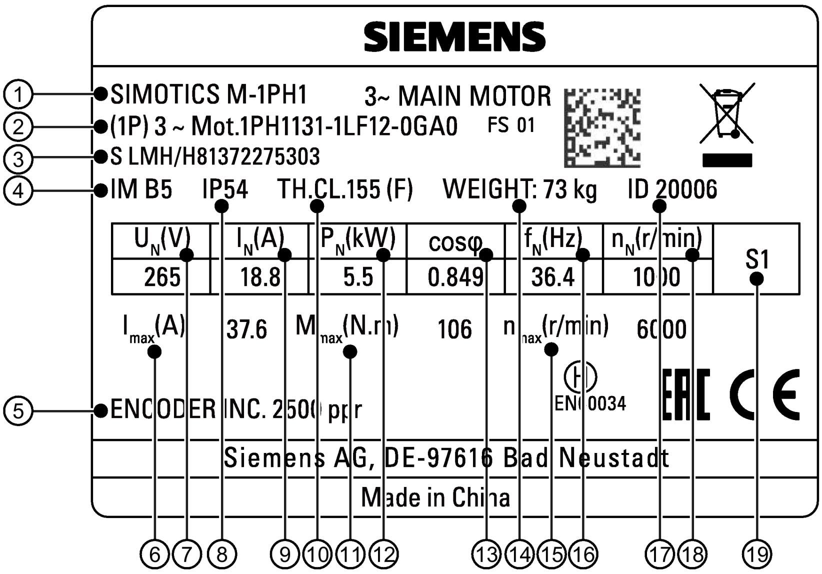
Data position of the article number		1	2	3	4	5	6	7		8	9	10	11	12		13	14	15	16
Article number		**6**	**S**	**L**	**3**	**2**	**1**	**0**	**-**	**5**	**D**	**•**	**❑**	**❑**	**-**	**❑**	**U**	**A**	**0**
Mains voltage: 3 AC 380 V to 480 V												**E**							
Frame size	**Motor output power**																		
FSB	3.7 kW												**2**	**1**		**1**			
FSC	3.7 kW												**2**	**1**		**3**			
	7.5 kW												**2**	**2**		**0**			
FSD	11 kW												**2**	**3**		**0**			
	15 kW												**2**	**4**		**0**			

Components in the SIMOTICS M-1PH1 main motor package

Component	Illustration	Shaft height (mm)	Rated power (kW)	Rated speed (rpm)	Article number[1)]
SIMOTICS M-1PH1 main motor		100	3.7	1500	1PH1101-1❑F1❑-❑GA0
			3.7	1000	1PH1103-1❑D1❑-❑GA0
			5.5	1500	1PH1103-1❑F1❑-❑GA0
			5.5	1000	1PH1105-1❑D1❑-❑GA0
			7.5	1500	1PH1105-1❑F1❑-❑GA0
		132	7.5	1000	1PH1131-1❑D1❑-❑GA0
			11	1500	1PH1131-1❑F1❑-❑GA0
			11	1000	1PH1133-1❑D1❑-❑GA0
			15	1500	1PH1133-1❑F1❑-❑GA0
User documentation	SIMOTICS M-1PH1 Main Motor Installation Guide				

[1)] For more information about the article numbers, see the motor article number explanation described later in this section.

SIMOTICS M-1PH1 main motor rating plate



①	Motor type	⑧	Degree of protection	⑮	Maximum speed
②	Article number	⑨	Rated current	⑯	Rated frequency
③	Serial number	⑩	Thermal class	⑰	Motor ID
④	Mounting orientation	⑪	Maximum torque	⑱	Rated speed
⑤	Encoder type and resolution	⑫	Rated power	⑲	Motor operating mode
⑥	Maximum current	⑬	Motor power factor		
⑦	Rated voltage	⑭	Weight		

Explanation of the SIMOTICS M-1PH1 main motor article numbers

Data position of the article number	1	2	3	4	5	6	7		8	9	10	11	12		13	14	15	16
Article number	1	P	H	1	❑	❑	❑	-	●	❑	❑	●	❑	-	❑	●	●	●
Shaft height																		
100 mm					1	0												
132 mm					1	3												
Rated power and speed (SH100)																		
3.7 kW, 1500 rpm							1											
3.7 kW, 1000 rpm; 5.5 kW, 1500 rpm							3											
5.5 kW, 1000 rpm; 7.5 kW, 1500 rpm							5											
Rated power and speed (SH132)																		
7.5 kW, 1000 rpm; 11 kW, 1500 rpm							1											
11 kW, 1000 rpm; 15 kW, 1500 rpm							3											
Asynchronous variant									1									

Encoder type																		
Incremental encoder, TTL 2500 ppr										L								
Absolute encoder, single-turn 20-bit										H								
Rated speed																		
1000 rpm											D							
1500 rpm											F							
Forced cooling (non-drive end to drive end)												1						
Type of construction																		
IM B3/IM V5, foot mounting													0					
IM B5/IM V1, flange mounting													2					
Shaft extension																		
Plain shaft															0			
Fitted key, full-key balancing															1			
Fitted key, half-key balancing															2			
Standard bearing																G		
Mechanics																	A	
Version																		0

Device combination of the SINAMICS V70 spindle servo system

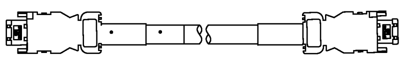
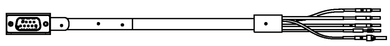
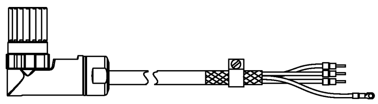
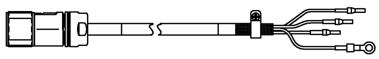
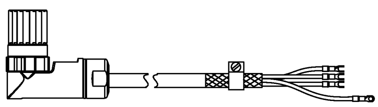
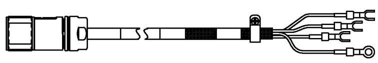
The table below lists ordering data of V70 spindle drives and configurable motors. You can select the desired spindle drive according to the motor configured:

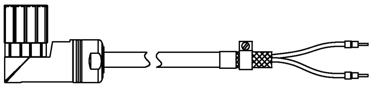
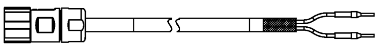
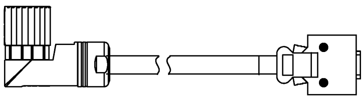
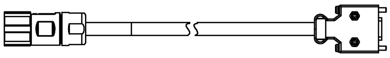
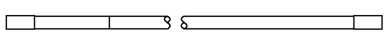
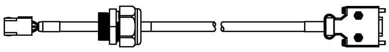
SIMOTICS M-1PH1 main motor					Power cable [1]	SINAMICS V70 spindle drive		
Rated power (kW)	Rated current (A)	Rated speed (rpm)	Shaft height (mm)	Article number	Cross section (mm^2)	Article number	Frame size	Rated current (A)
3.7	10.3	1500	100	1PH1101-1❑F1❑-❑GA0	4 × 2.5	6SL3210-5DE21-1UA0	FSB	10.5
3.7	12.9	1000		1PH1103-1❑D1❑-❑GA0		6SL3210-5DE21-3UA0	FSC	12.9
5.5	16.9	1500		1PH1103-1❑F1❑-❑GA0	4 × 4	6SL3210-5DE22-0UA0		19.6
5.5	18.8	1000		1PH1105-1❑D1❑-❑GA0				
7.5	19.6	1500		1PH1105-1❑F1❑-❑GA0				
7.5	26.6	1000	132	1PH1131-1❑D1❑-❑GA0		6SL3210-5DE23-0UA0	FSD	29.8
11	28.8	1500		1PH1131-1❑F1❑-❑GA0	4 × 10			
11	28.3	1000		1PH1133-1❑D1❑-❑GA0				
15	36.7	1500		1PH1133-1❑F1❑-❑GA0	4 × 16	6SL3210-5DE24-0UA0		37.6

[1] For more information about the ordering data of the power cables between the spindle drive and the main motor, see Section "Cables and connectors (Page 28)".

2.1.4 Cables and connectors

Cables

Component	Illustration	Article number	Length (m)
PPU to SINAMICS V70 feed/spindle drive			
Drive Bus cable		6FC5548-0BA20-1AA2	0.25
		6FC5548-0BA20-1AA3	0.35
		6FC5548-0BA20-1AB0	1
		6FC5548-0BA20-1AD0	3
		6FC5548-0BA20-1AF0	5
		6FC5548-0BA20-1AH0	7
		6FC5548-0BA20-1BA0	10
		6FC5548-0BA20-1BF0	15
		6FC5548-0BA20-1CA0	20
PPU (analog spindle interface) to Siemens inverter or third-party drive (with analog input)			
Spindle setpoint cable		6FC5548-0BA05-1AD0	3
		6FC5548-0BA05-1AE0	4
		6FC5548-0BA05-1AF0	5
		6FC5548-0BA05-1AH0	7
		6FC5548-0BA05-1BA0	10
		6FC5548-0BA05-1BF0	15
		6FC5548-0BA05-1CA0	20
SINAMICS V70 feed drive to 1FL6 motor			
MOTION-CONNECT 300 power cable (V70 FSA to 1FL6 motor with straight connectors)		6FX3002-5CL01-1AD0	3
		6FX3002-5CL01-1AF0	5
		6FX3002-5CL01-1AH0	7
		6FX3002-5CL01-1BA0	10
		6FX3002-5CL01-1BF0	15
		6FX3002-5CL01-1CA0	20
MOTION-CONNECT 300 power cable (V70 FSA to 1FL6 motor with angular connectors)		6FX3002-5CL02-1AD0	3
		6FX3002-5CL02-1AF0	5
		6FX3002-5CL02-1AH0	7
		6FX3002-5CL02-1BA0	10
		6FX3002-5CL02-1BF0	15
		6FX3002-5CL02-1CA0	20
MOTION-CONNECT 300 power cable (V70 FSB/FSC to 1FL6 motor with straight connectors)		6FX3002-5CL11-1AD0	3
		6FX3002-5CL11-1AF0	5
		6FX3002-5CL11-1AH0	7
		6FX3002-5CL11-1BA0	10
		6FX3002-5CL11-1BF0	15
		6FX3002-5CL11-1CA0	20
MOTION-CONNECT 300 power cable (V70 FSB/FSC to 1FL6 motor with angular connectors)		6FX3002-5CL12-1AD0	3
		6FX3002-5CL12-1AF0	5
		6FX3002-5CL12-1AH0	7
		6FX3002-5CL12-1BA0	10
		6FX3002-5CL12-1BF0	15
		6FX3002-5CL12-1CA0	20

Component	Illustration	Article number	Length (m)
MOTION-CONNECT 300 brake cable (V70 to 1FL6 motor with straight connectors)		6FX3002-5BL02-1AD0	3
		6FX3002-5BL02-1AF0	5
		6FX3002-5BL02-1AH0	7
		6FX3002-5BL02-1BA0	10
		6FX3002-5BL02-1BF0	15
		6FX3002-5BL02-1CA0	20
MOTION-CONNECT 300 brake cable (V70 to 1FL6 motor with angular connectors)		6FX3002-5BL03-1AD0	3
		6FX3002-5BL03-1AF0	5
		6FX3002-5BL03-1AH0	7
		6FX3002-5BL03-1BA0	10
		6FX3002-5BL03-1BF0	15
		6FX3002-5BL03-1CA0	20
MOTION-CONNECT 300 incremental encoder cable (V70 to 1FL6 motor with straight connectors)		6FX3002-2CT10-1AD0	3
		6FX3002-2CT10-1AF0	5
		6FX3002-2CT10-1AH0	7
		6FX3002-2CT10-1BA0	10
		6FX3002-2CT10-1BF0	15
		6FX3002-2CT10-1CA0	20
MOTION-CONNECT 300 absolute encoder cable (V70 to 1FL6 motor with straight/angular connectors)		6FX3002-2DB10-1AD0	3
		6FX3002-2DB10-1AF0	5
		6FX3002-2DB10-1AH0	7
		6FX3002-2DB10-1BA0	10
		6FX3002-2DB10-1BF0	15
		6FX3002-2DB10-1CA0	20
MOTION-CONNECT 300 incremental encoder cable (V70 to 1FL6 motor with angular connectors)		6FX3002-2CT12-1AD0	3
		6FX3002-2CT12-1AF0	5
		6FX3002-2CT12-1AH0	7
		6FX3002-2CT12-1BA0	10
		6FX3002-2CT12-1BF0	15
		6FX3002-2CT12-1CA0	20
SINAMICS V70 spindle drive to 1PH1 motor			
MOTION-CONNECT 500 power cable (4 × 2.5 mm^2, raw cable), for 1PH1 3.7 kW motor		6FX5008-1BB21-1DA0	30
MOTION-CONNECT 500 power cable (4 × 4 mm^2, raw cable), for 1PH1 5.5 kW to 7.5 kW motor		6FX5008-1BB31-1DA0	
MOTION-CONNECT 500 power cable (4 × 10 mm^2, raw cable), for 1PH1 11 kW motor		6FX5008-1BB51-1DA0	
MOTION-CONNECT 500 power cable (4 × 16 mm^2, raw cable), for 1PH1 15 kW motor		6FX5008-1BB61-1DA0	
MOTION-CONNECT 300 incremental encoder cable		6FX3002-2CT30-1AD0	3
		6FX3002-2CT30-1AF0	5
		6FX3002-2CT30-1AH0	7
		6FX3002-2CT30-1BA0	10
		6FX3002-2CT30-1BF0	15
		6FX3002-2CT30-1CA0	20

Component	Illustration	Article number	Length (m)
MOTION-CONNECT 300 absolute encoder cable		6FX3002-2DB30-1AD0	3
		6FX3002-2DB30-1AF0	5
		6FX3002-2DB30-1AH0	7
		6FX3002-2DB30-1BA0	10
		6FX3002-2DB30-1BF0	15
		6FX3002-2DB30-1CA0	20

Note

- The MOTION-CONNECT 300 cables, MOTION-CONNECT 500 cables, and spindle setpoint cables given above are suitable for use in drag chains. For more information on how to lay cables properly in drag chains, see Section "Notes on the laying of cables in drag chains (Page 72)".
- No additional MOTION-CONNECT 300 power cables are available for 1PH1 motors. The 30 m MOTION-CONNECT 500 power cables (raw cables) listed above could be selected for using with 1PH1 motors. You must assemble the power cable with connectors by yourself. For more information about how to assemble the power cable, see Section "Assembling the power cable for the 1PH1 motor (Page 457)".

Recommended connectors for 1PH1 motor power cables

Power cable	Motor side					Drive side				
Cross-section	Supplier	Article number	Picture	Quantity (pieces)	Used for	Sup-plier	Article number	Picture	Quantity (pieces)	Used for
4 × 2.5 mm²	KST	RNYL 2-5		3	U/V/W	KST	SNYL2-4		3	U/V/W
	KST	RNYL 2-6		1	PE	KST	RNYL 2-5		1	PE
	-	-	-	-	-	IDEAL	6204		1	Cable shielding
4 × 4 mm²	KST	RNYL 5-5		3	U/V/W	KST	SNYL5-5		3	U/V/W
	KST	RNY 5-6		1	PE	KST	RNY 5-5		1	PE
	-	-	-	-	-	IDEAL	6204		1	Cable shielding
4 × 10 mm²	KST	TLK 10-5		3	U/V/W	KST	TLK 10-5		4	U/V/W/PE
	KST	TLK 10-6		1	PE	-	-	-	-	-
	-	-	-	-	-	IDEAL	62P08		1	Cable shielding
4 × 16 mm²	KST	TLK 16-5		3	U/V/W	KST	TLK 16-5		4	U/V/W/PE
	KST	TLK 16-6		1	PE	-	-	-	-	-
	-	-	-	-	-	IDEAL	62P08		1	Cable shielding

2.1.5 Options

2.1.5.1 External 24 VDC power supply

A 24 VDC power supply is used to supply the 808D ADVANCED and V70 servo drive. Consider the following technical specification requirements when selecting a 24 VDC power supply:

- 24 VDC supplying the SINUMERIK 808D ADVANCED:
  - Rated input voltage: 24 V
  - Max. input voltage: 28.8 V
  - Min. input voltage without output derating: 20.4 V
  - Rated input current: 2.25 A
- 24 VDC supplying the SINAMICS V70 drive:

Without a holding brake		With a holding brake	
Rated voltage (V)	**Maximum current (A)**	**Rated voltage (V)**	**Maximum current (A)**
24 (-15% to +20%)	1	24 (-10% to +10%) [1)]	3

1) The minimum voltage of 24 VDC -10% must be available at the connector on the motor side in order to guarantee that the brake reliably opens. If the maximum voltage of 24 VDC +10% is exceeded, then the brake could re-close. The voltage drop along the brake feeder cable must be taken into consideration. The voltage drop ΔU for copper cables can be approximately calculated as follows:

ΔU [V] = 0.042 • (l/q) • I_{Brake}

Where: l = Cable length [m], q = Brake core cross section [mm²], I_{Brake} = DC current of brake [A]

2.1.5.2 Fuse/Type E combination motor controllers and circuit breakers

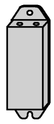
The fuse/Type E combination motor controller or circuit breaker is used to protect the control system.

<table>
<tr><th colspan="3">SINAMICS V70</th><th colspan="2">Standard fuse</th><th colspan="3">Type E combination motor controller (for all feed drives and spindle drive FSB)
Circuit breakers (for spindle drives FSC and FSD only)</th></tr>
<tr><th colspan="2">Frame size</th><th>Article number</th><th>Rated current (A)</th><th>Article number</th><th>Rated current (A)</th><th>Rated voltage (VAC)</th><th>Article number</th></tr>
<tr><td rowspan="7">Feed drive</td><td rowspan="2">FSA</td><td>6SL3210-5DE12-4UA0</td><td>6</td><td>3NA3801</td><td>2.8 to 4</td><td>690</td><td>3RV2021-1EA10</td></tr>
<tr><td>6SL3210-5DE13-5UA0</td><td>10</td><td>3NA3803</td><td>3.5 to 5</td><td>690</td><td>3RV2021-1FA10</td></tr>
<tr><td rowspan="3">FSB</td><td>6SL3210-5DE16-0UA0</td><td>10</td><td>3NA3803</td><td>5.5 to 8</td><td>690</td><td>3RV2021-1HA10</td></tr>
<tr><td>6SL3210-5DE17-8UA0</td><td>16</td><td>3NA3805</td><td>11 to 16</td><td>690</td><td>3RV2021-4AA10</td></tr>
<tr><td>6SL3210-5DE21-0UA0</td><td>16</td><td>3NA3805</td><td rowspan="2">14 to 20</td><td rowspan="2">690</td><td rowspan="2">3RV2021-4BA10</td></tr>
<tr><td rowspan="2">FSC</td><td>6SL3210-5DE21-4UA0</td><td>20</td><td>3NA3807</td></tr>
<tr><td>6SL3210-5DE21-8UA0</td><td>25</td><td>3NA3810</td><td rowspan="2">20 to 25</td><td rowspan="2">690</td><td rowspan="2">3RV2021-4DA10</td></tr>
<tr><td rowspan="5">Spindle drive</td><td>FSB</td><td>6SL3210-5DE21-1UA0</td><td>25</td><td>3NA3810</td></tr>
<tr><td rowspan="2">FSC</td><td>6SL3210-5DE21-3UA0</td><td>32</td><td>3NA3812</td><td>30</td><td>690</td><td>3VL1103-1KM30-0AA0</td></tr>
<tr><td>6SL3210-5DE22-0UA0</td><td>40</td><td>3NA3817</td><td>40</td><td>690</td><td>3VL1104-1KM30-0AA0</td></tr>
<tr><td rowspan="2">FSD</td><td>6SL3210-5DE23-0UA0</td><td>63</td><td>3NA3822</td><td>60</td><td>600</td><td>3VL1106-1KM30-0AA0</td></tr>
<tr><td>6SL3210-5DE24-0UA0</td><td>80</td><td>3NA3824</td><td>80</td><td>600</td><td>3VL1108-1KM30-0AA0</td></tr>
</table>

Note: The above types of fuses and Type E combination motor controllers are compliant with the CE standard.

2.1.5.3 Braking resistors

A braking resistor is used for the SINAMICS V70 drive. For the feed drive, when the internal braking resistor cannot meet the braking requirements, an external braking resistor can be used to "dump" the regenerative energy produced by the motor, thus giving greatly improved braking and deceleration capabilities. For the spindle drive, an external braking resistor must be configured. Select a standard braking resistor according to the table below:

Drive frame size	Braking resistor				
	Illustration	Minimum resistance (Ω)	Max. power (kW)	Rated power (W)	Max. energy (kJ)
FSA		160	4	100	8
FSB		70	9.1	229	18.3
FSC		27	23.7	1185	189.6
FSD		18	37.4	1870	299.2

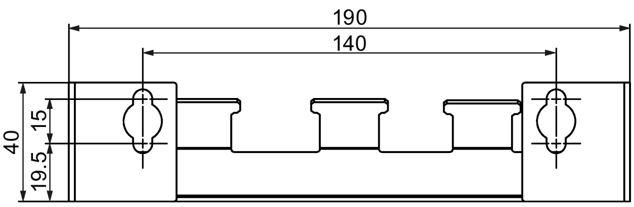
Note: When selecting a braking resistor, you must take into account the factors such as braking inertia, deceleration time, speed variation, and braking period according to your specific application and technology. The resistance of the selected braking resistor must not be lower than the minimum resistance listed above.

2.1.5.4 Shielding plate

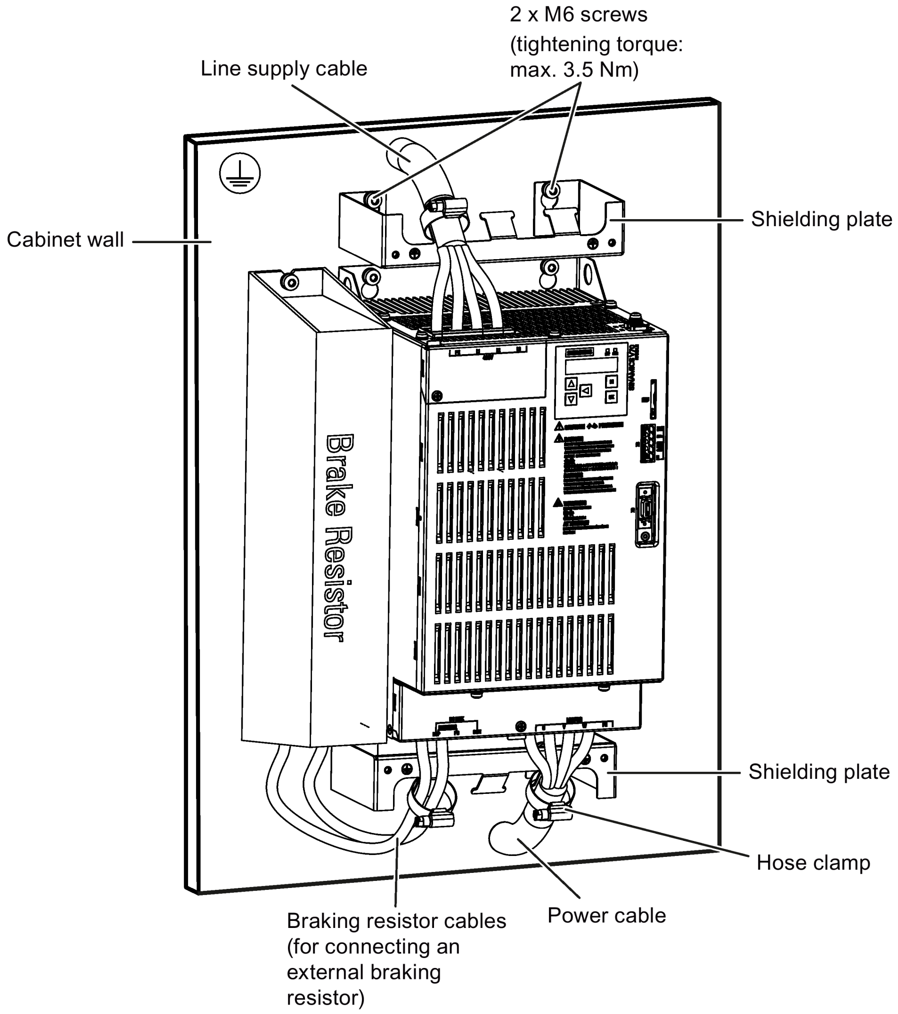
To achieve EMC-compliant installation of the drive, use shielding plates to connect the cable shields. The shielding plate for V70 spindle drive FSD is provided as an option. While for V70 drives of other frame sizes, the shielding plates are provided at delivery.

Drive variant	Article number	Component	Quantity
V70 FSD	6SL3266-1ED00-0VA0	Shielding plate	2
		M6 screws	4

Mounting dimensions (mm)



Connecting



2.1.5.5 Line filters

Siemens recommends you to use a filter to protect the system from high frequency noise.

The table below lists all filters recommended by Siemens:

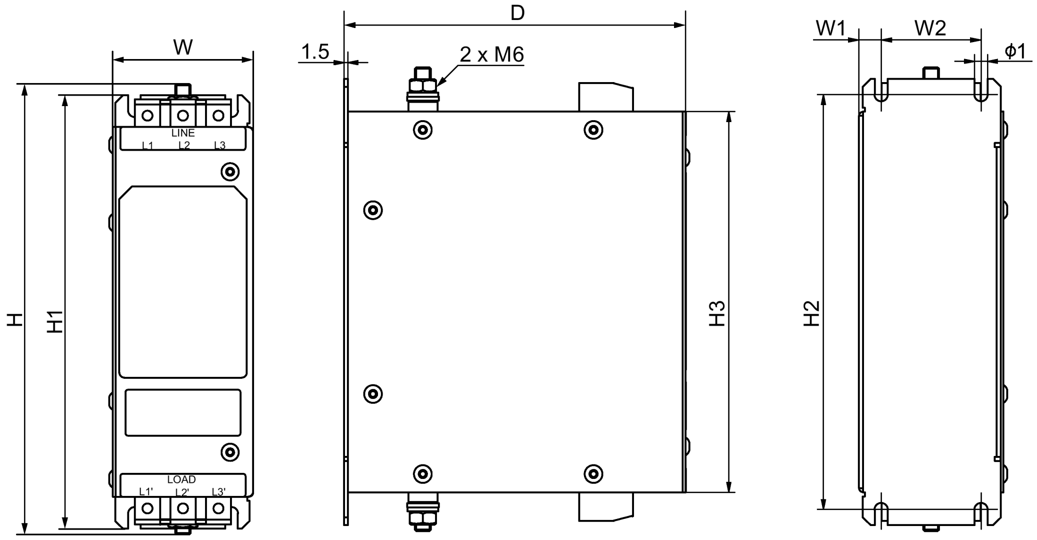
SINAMICS V70			Recommended filter			
Drive variant	**Frame size**	**Rated input current (A)**	**Rated current (A)**	**Wire gauge (AWG)**	**Degree of protection**	**Article number**
Feed drive	FSA	1.5	5	15 to 13	IP20	6SL3203-0BE15-0VA0
	FSA	3.8	5		IP20	
	FSB	5.8	12	15 to 14	IP20	6SL3203-0BE21-2VA0
	FSB	6.6	12		IP20	
	FSB	9.8	12		IP20	
	FSC	13.8	20	11 to 10	IP20	6SL3203-0BE22-0VA0
	FSC	16.5	20		IP20	
Spindle drive	FSB	13.2	12	15 to 14	IP20	6SL3203-0BE21-2VA0
	FSC	16.2	24	11 to 10	IP20	6SL3000-0HE21-0AA0
	FSC	24.5	24	10 to 9	IP20	
	FSD	37.3	36	7 to 6	IP20	6SL3000-0BE21-6DA0
	FSD	47	74	5 to 4	IP20	6SL3000-0BE23-6DA1

Basic technical data

Rated current	5 A	12 A	20 A	24 A	36 A	74 A
Rated voltage	3-phase 200 VAC to 480 VAC (-15% to +15%)		3-phase 380 VAC to 480 VAC (-15% to +15%)	3-phase 380 VAC to 480 VAC (-15% to +10%)		
Line frequency	50/60 Hz (-10% to +10%)					
Product standard	IEC 61800-5-1					
Power loss	< 2 W	< 3 W	< 7 W	-		
Weight	0.68 kg	1.01 kg	1.33 kg	-		
Package size (H × W × D)	140 mm × 200 mm × 260 mm		140 mm × 200 mm × 330 mm	-		

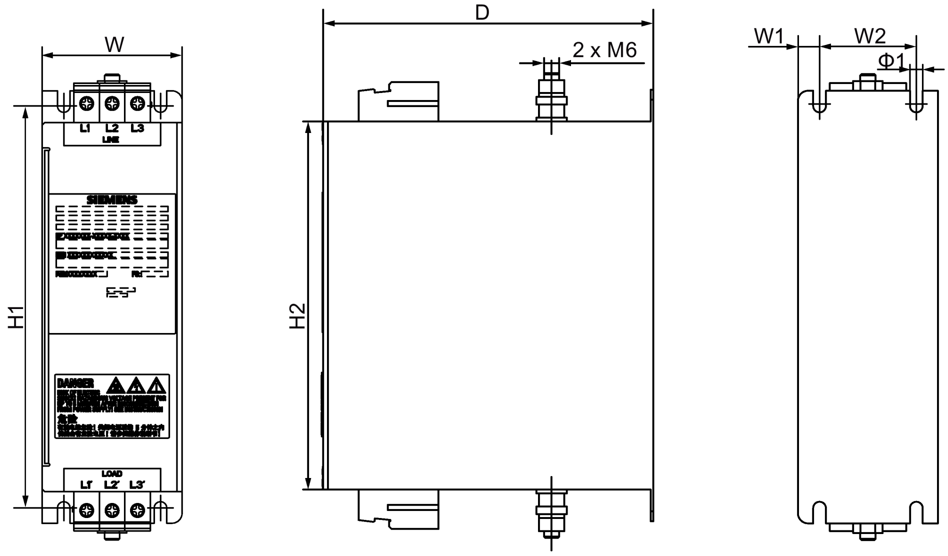
Outline dimensions (unit: mm)

- Filter used for SINAMICS V70 feed drives and SINAMICS V70 spindle drives FSB:



Rated current (A)	W	D	W2	H	H2	H1	H3	W1	Ø1
5	55	130	38	176.7	158	170	145	8.5	5
12	75	140	58	176.7	158	170	145	8.5	5
20	60	130	40	251.7	240	250	220	10	5.5

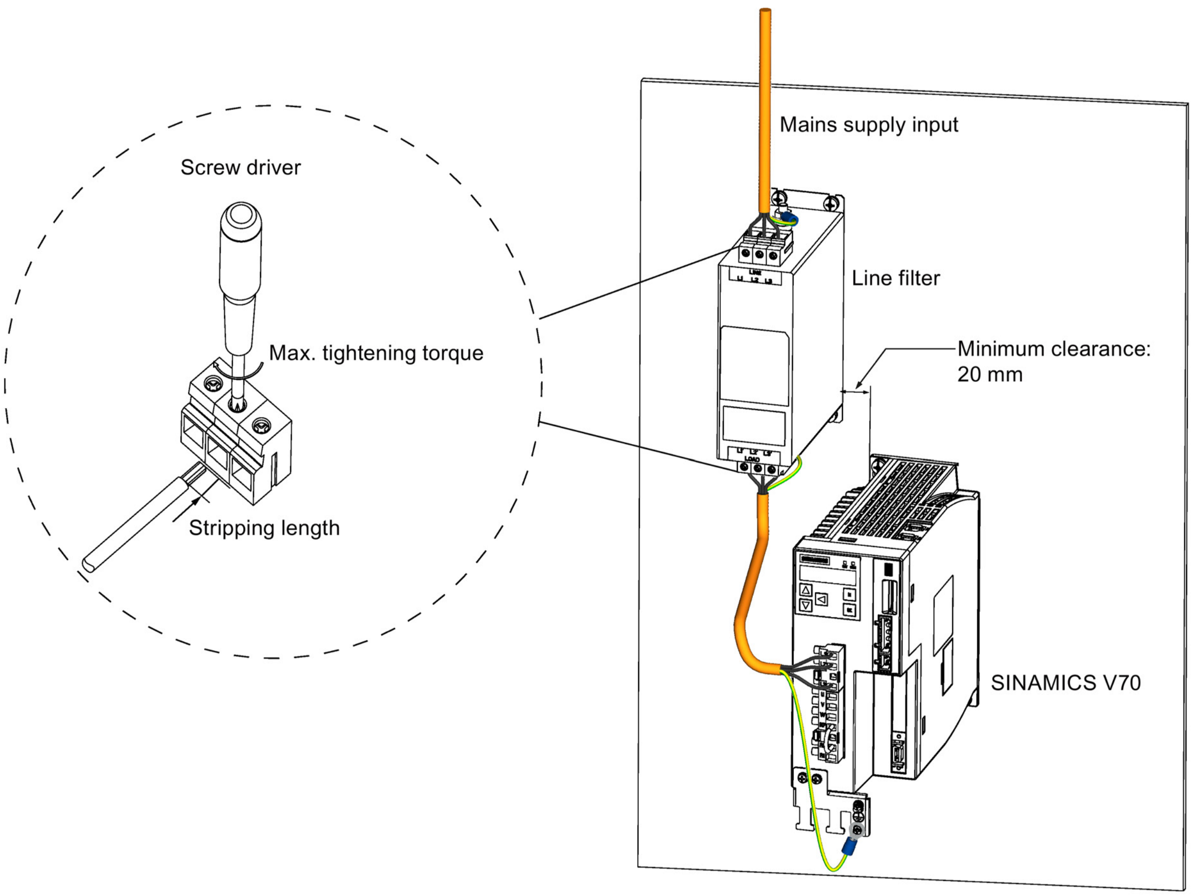
- Filter used for SINAMICS V70 spindle drives:



Rated current (A)	W	D	W2	H2	H1	H3	W1	Ø1
24	58	121.5	35	255	265	200	11.5	5.5
36	50	226	25	395	415	380	12.5	6.5
74	75	226	50	395	415	380	12.5	6.5

Connecting

The figure below provides a connection example. It shows how to connect a line filter to a SINAMICS V70 drive.



Filter rated current (A)	Screw driver	Max. tightening torque (Nm)	Stripping length (mm)
5	Slot head (M3 screw)	0.8	8
12			
20			
24	Slot head (M4 screw)	1.5	10
36		2.4	11
74	Inside hexagon (M6 screw)	3.7	18

2.1.5.6 SD card

An SD card can be used to copy drive parameters or perform a firmware update. Siemens recommends you to use the Siemens SD card (article number: 6SL3054-4AG00-2AA0).

You can also select other high quality SD cards with a maximum capacity of 2 GB from manufacturers such as KINGMAX, Kingston or SanDisk.

2.1.5.7 Toolbox DVD

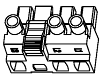
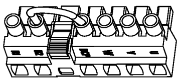
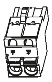
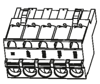
The Toolbox DVD (article number: 6FC5811-0CY00-0YA8) provides necessary software tools to integrate the control system into a machine tool. Under the Toolbox DVD root directory, it contains a file "setup.exe". After starting this file the program guides you through installing the following software on the computer:

- Access MyMachine
  - Access MyMachine (AMM) is a tool that allows the commissioning engineer to exchange files between the computer and the control very easily through the Ethernet interface. For data transmission, the control can be connected to the computer directly or via the local network.
- PLC Programming Tool
  - PLC Programming Tool makes a connection between the programming tool and the control system. The commissioning engineer can program and debug the PLC inside the control system.
- Config DATA
  - Config_DATA contains the configuration data setup. The setup will install the configuration data for the control system to your computer. The configuration data consist of the Siemens examples, and the user documents.

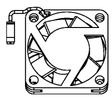
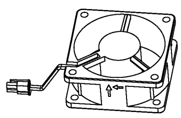
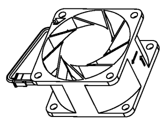
2.1.6 Spare parts

Connectors for V70 drives

You can order a connector kit (article number: 6SL3200-0WT01-0AA0) from Siemens which consists of the following connectors for the V70 drive. Alternatively, you can also purchase the individual connectors from the suppliers with the corresponding supplier article numbers when necessary.

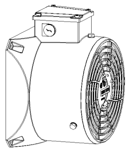
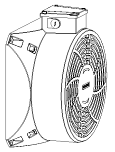
Components	Quantity	Illustration	Supplier	Article number	Applicable drive variants
Line supply connector	1		DINKLE	0183-01S2264904T02	V70 feed drive FSA
Motor power/braking resistor connector (with a short-circuit stick pre-assembled)	1		DINKLE	0183-01S2265107T03	
Holding brake connector	1		DEGSON	2EDGKDF-5.08-02P-1Y-32 AH	V70 feed drive FSA/FSB/FSC
STO/24 V power supply connector	1		DEGSON	2EDGKDF-5.08-05P-1Y-31 AH	All V70 drives
STO short-circuit stick	1		Phoenix	1733172	

Replacement fans for V70 drives

Drive frame size	Fan components	
	Illustration	Article number
FSB		6SL3200-0WF00-0AA0
FSC		6SL3200-0WF01-0AA0
FSD		6SL3200-0WF03-0AA0

For more information about fan replacement, see Section "Replacing the fan for the V70 drive (Page 454)".

Replacement fans for 1PH1 motors

Motor shaft height	Fan components	
	Illustration	Article number
SH100		1PH1902-0AB00-0AA0
SH132		1PH1902-0AC00-0AA0

For more information about fan replacement, see Section "Replacing the fan for the 1PH1 motor (Page 457)".

2.2 Commissioning software tools

Compliance with the General Data Protection Regulation

Siemens respects the principles of data protection, in particular the data minimization rules (privacy by design).

For this product, this means:
The product does not process neither store any person-related data, only technical function data (e.g. time stamps). If the user links these data with other data (e.g. shift plans) or if he stores person-related data on the same data medium (e.g. hard disk), thus personalizing these data, he has to ensure compliance with the applicable data protection stipulations.

2.2.1 Installing the software tools

Software components

In order to integrate the control system into a machine tool, software tools are required. These tools, including service tools are supplied on a DVD.

The following software tools are included on the Toolbox DVD:

Software	Description	See-also
PLC Programming Tool	The tool provides a user-friendly environment for commissioning the PLC. With this tool, you can develop, edit, and observe the logic to control your applications.	PLC Programming Tool (Page 182)
AccessMyMachine (AMM)	AMM is a multifunctional tool used for data transfer, service, commissioning tasks and remote control.	AMM communication tool (Page 475)

Supported operating systems

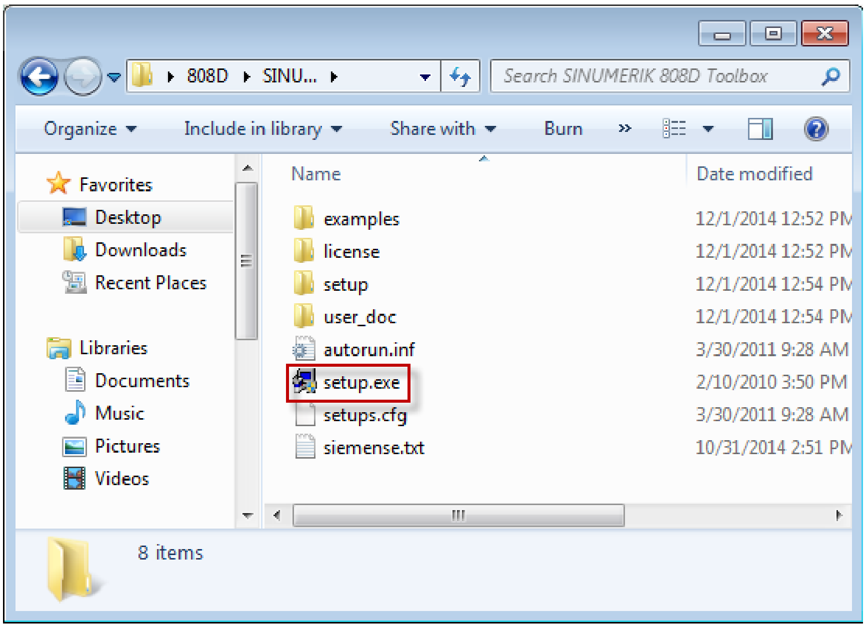
The software tools above support the following operating systems:

- Windows Vista (both 32-bit and 64-bit versions)
- Windows 7 (both 32-bit and 64-bit versions)

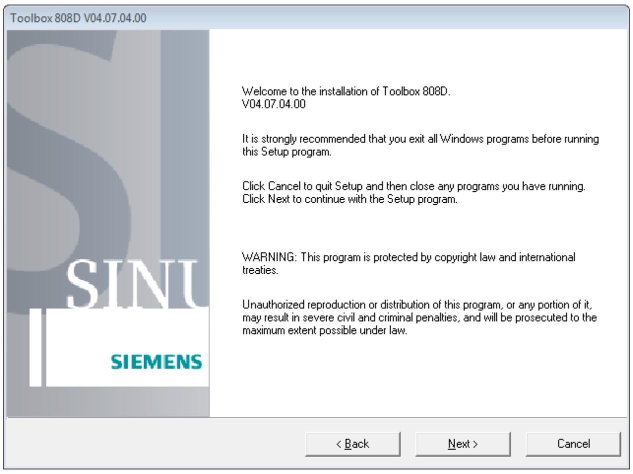
Installing the software

To install the software on your PC, proceed through the following steps:

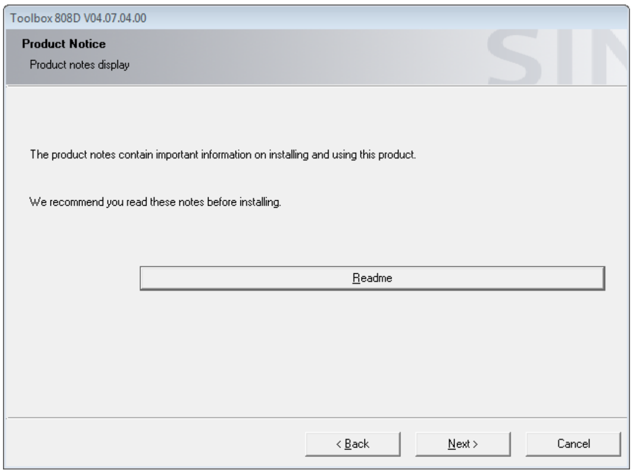
1. Double-click the "Setup.exe" in the folder.



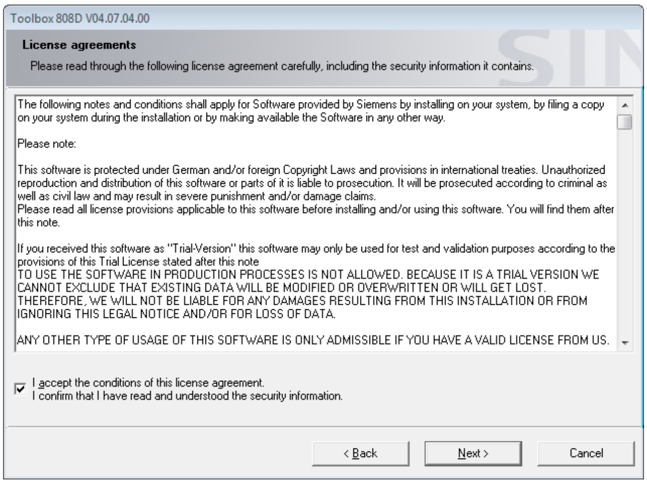
2. Read the welcome information and continue with "Next".



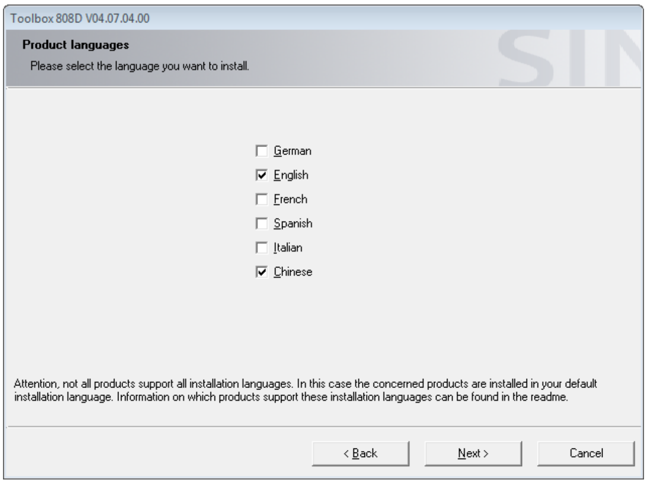
3. You can click the "Readme" button to read the indication information then close it and continue with "Next" or you can skip the reading and click "Next" directly.



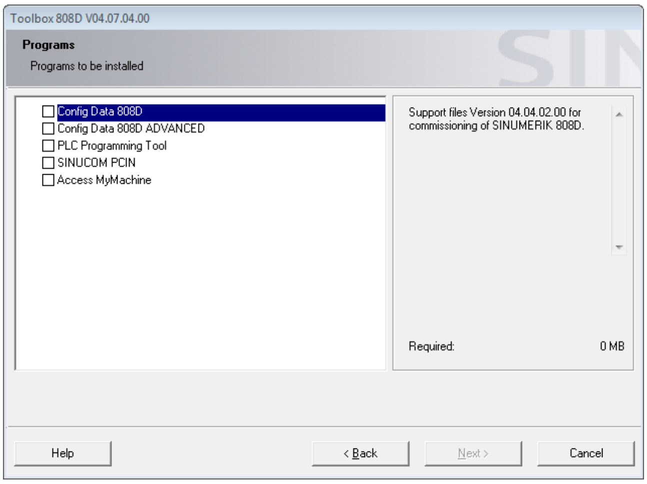
4. Accept the software license agreement and continue with "Next".



5. Select desired languages you want to install.



6. If you have installed an earlier version of a program, un-install the program first, then start the installation again and select the required software from the list.



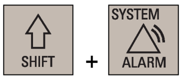
7. During the installation, various dialog boxes will appear. Acknowledge the dialog boxes and enter and confirm the installation information where necessary. Installing all the software packages will take approximately 30 minutes. When the installation finishes, shortcuts will be created on the desktop.

2.2.2 Establishing a connection with the software tools

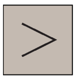
2.2.2.1 Configuring the firewall

Secure access and communication is achieved through the security function of the integrated firewall. To connect the software tools successfully, you must first enable the corresponding communication ports in the firewall configuration.

Operating sequence



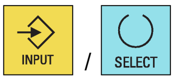
1. Select the system data operating area on the PPU.



2. Press this key to view the extended softkeys.

3. Open the window for firewall configuration through the following softkey operations:
   Serv. displ. → Service control → Service firewall
   The window below shows three configurable ports which are disabled by default:

Open	Port no.	Log	Description
☐	22	tcp	Secure Shell (SSH), for AMM connection
☐	102	tcp	S7 protocol, for PLC Prog Tool connect.
☐	5900	tcp	HMI RFB commu., for AMM remote control



4. Select the desired communication port with cursor keys and press either of these keys to enable it.

5. Press this softkey to confirm your settings.

WARNING

Network security risks due to improper firewall configuration

Improper firewall configuration may cause network security risks, for example, data leakage, virus invasion, and hacker attack. This may lead to incorrect parameterization or machine malfunction, which in turn can result in death, severe injuries and/or property damage.

- Do not use the control system inside a network infrastructure without an additional security product.
- You must make sure you disable all ports not needed in the firewall configuration.

Note

After you disable a communication port, the existing connection established earlier via this port will not be disabled until you manually disconnect it or the control system restarts/powers off. Therefore, it is recommended that you disconnect the established connections or restart the control system after disabling the ports.

2.2.2.2 Connecting with PLC Programming Tool

Note

Before connecting PLC Programming Tool, make sure you enable the communication port 102 on the HMI. For more information about enabling the communication ports, see Section "Configuring the firewall (Page 41)".

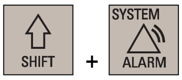
You can establish a connection between the control system and a computer installed with PLC Programming Tool via the Ethernet interface (X130). The following Ethernet connections are possible:

- Direct connection: connecting the control system directly to a computer
- Network connection: integrating the control system into an existing Ethernet network

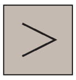
Establishing a direct connection

Proceed through the following steps to establish a direct connection:

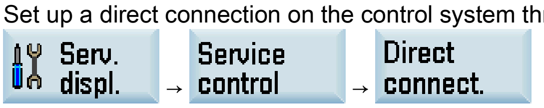
1. Connect the control system with the computer using an Ethernet cable.



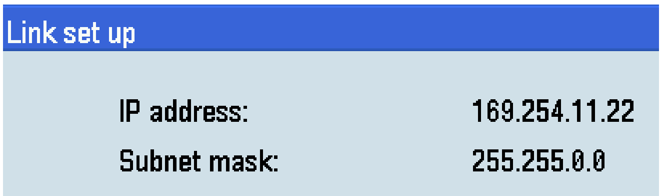
2. Select the system data operating area on the PPU.



3. Press this key to view the extended softkeys.
4. Set up a direct connection on the control system through the following softkey operations:

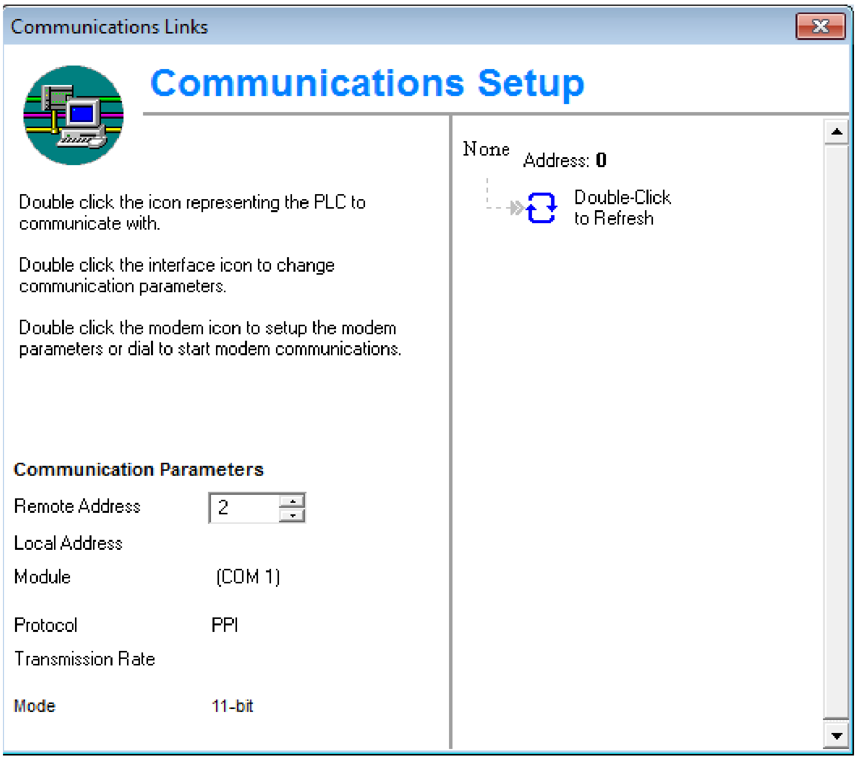


The following dialog box appears on the screen:

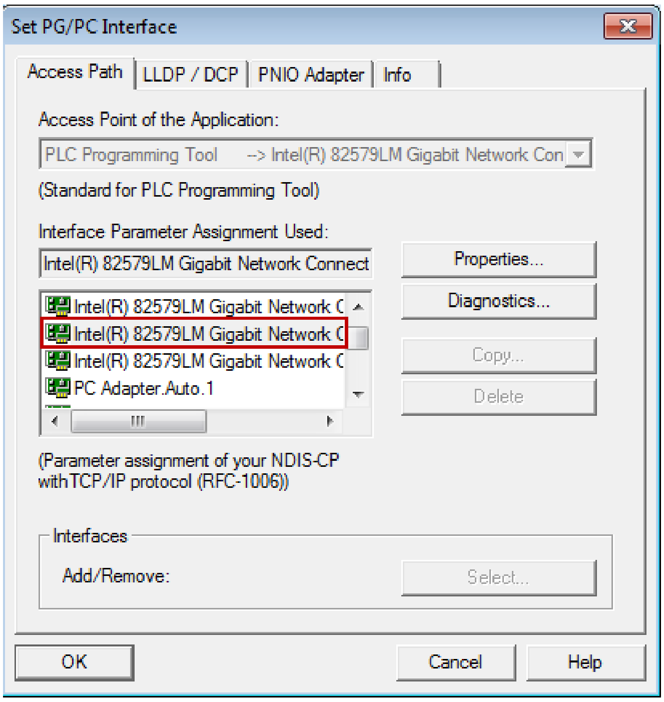


None Address: 0

5. Start PLC Programming Tool on your computer, and click the button in the toolbar to open the following dialog box:



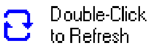
6. Double-click the access point symbol, and the following "Set PG/PC Interface" dialog box is displayed.



Select "TCP/IP" with the Ethernet card name of your computer and click the "OK" button.

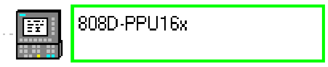
Note: You can find the name of your Ethernet card in the local area connection status under Control Panel on your computer.

7. Enter the IP address for the control system that displays in the above link setup dialog box in the communication settings dialog box.



8. Double-click this symbol in the communication setting window to establish a connection to the specified IP address.

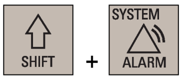
Wait until the information of the connected control system is identified as follows, and then the connection is ready.



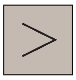
Establishing a network connection

Proceed through the following steps to establish a network connection:

1. Connect the control system with the local network using an Ethernet cable.

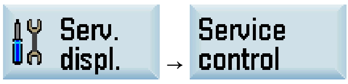


2. Select the system data operating area on the PPU.



3. Press this key to view the extended softkeys.

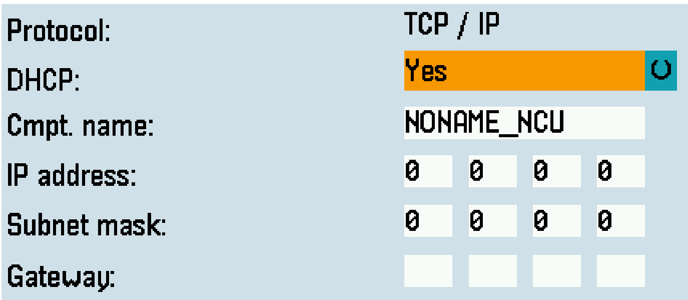
4. Enter the main screen of the service control options through the following softkey operations:



5. Press this softkey to enter the window for the network configuration.

Note: Make sure the following vertical softkey is deactivated:

6. Configure the network as required in the following window:

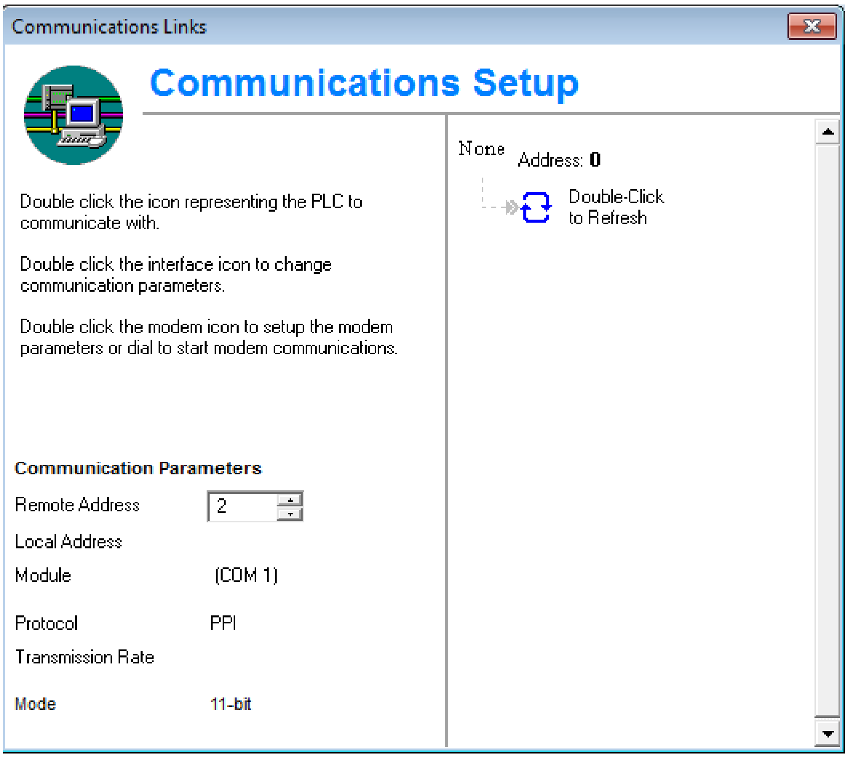


You can configure DHCP with the following key:

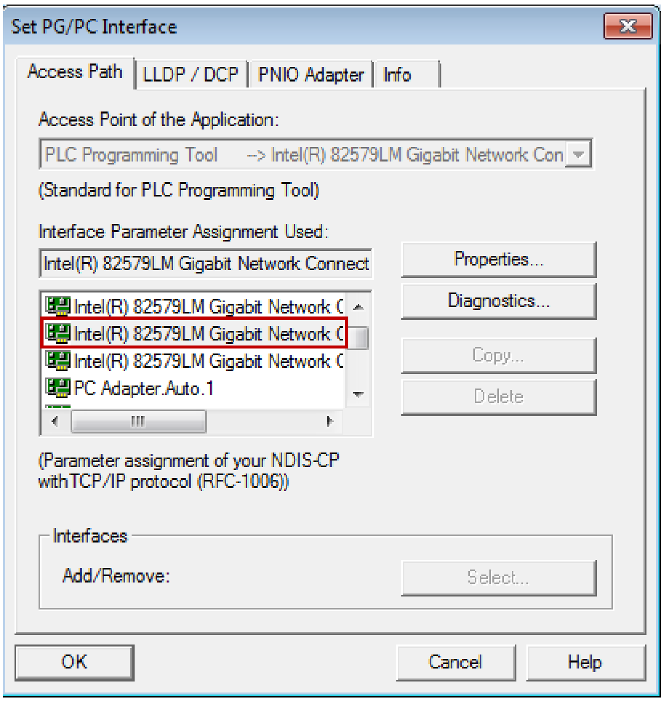
Note: If you select "No" for DHCP, you must enter the IP address (which must belong to the same network as that of your computer) and subnet mask manually.

7. Press this softkey to save the configuration. If you select "Yes" for DHCP, you also need to restart the control system to activate the network configuration.

8. Start PLC Programming Tool on your computer, and click the button in the toolbar to open the following dialog box:



9. Double-click the access point symbol, and the following "Set PG/PC Interface" dialog box is displayed.

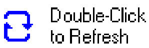


Select "TCP/IP" with the Ethernet card name of your computer and click the "OK" button.

Note: You can find the name of your Ethernet card in the local area connection status under Control Panel on your computer.

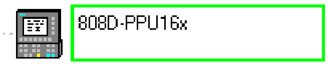
10. Enter the IP address for the control system in the communication setting window, for example:

Note that the IP address entered here must be the same as that you have set on the PPU.



11. Double-click this symbol in the communication setting window to establish a connection to the specified IP address.

Wait until the information of the connected control system is identified as follows, and then the connection is ready.



2.2.2.3 Connecting with AMM

Note

Before connecting the AMM tool, make sure you enable the communication port 22 on the HMI. For more information about enabling the communication ports, see Section "Configuring the firewall (Page 41)".

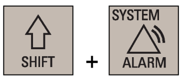
You can establish a connection between the control system and a computer installed with AMM via the Ethernet interface (X130). The following Ethernet connections are possible:

- Direct connection: connecting the control system directly to a computer
- Network connection: integrating the control system into an existing Ethernet network

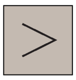
Establishing a direct connection

Proceed as follows to establish a direct connection between the control system and a computer (AMM tool):

1. Connect the control system with the computer using an Ethernet cable.

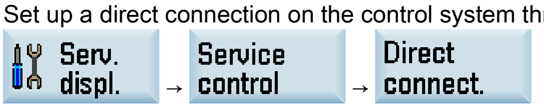


2. Select the system data operating area on the PPU.

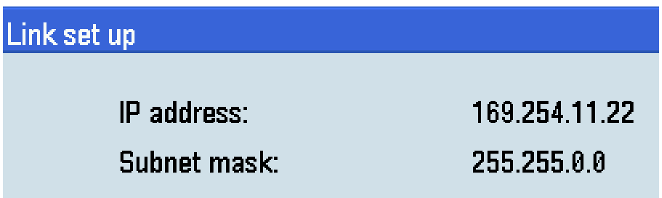


3. Press this key to view the extended softkeys.

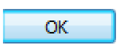
4. Set up a direct connection on the control system through the following softkey operations:



The following dialog box displays on the screen:



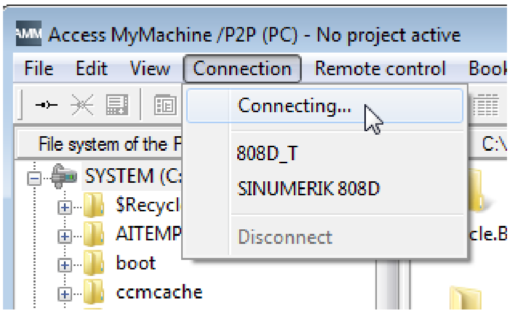
5. Start Access MyMachine on your computer. A password setting dialog box appears when the tool is started for the first time.



6. Enter a desired password in the input fields and then click this button to save.

This password ensures that all the connection data for AMM is encrypted. The password can be subsequently changed at any time from the menu bar.

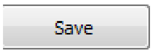
7. Click the button in the toolbar or select from the main window menu as follows to call the connection dialog box:



8. Select the direct connection option for SINUMERIK 808D in the connection dialog box, and then click this button to make the connection settings changeable.

9. Assign the connection parameters. Note that the access level and password must be specified according to those set on the HMI.

   Note: To avoid unauthorized access of the controller, change the Siemens default passwords to your own ones. For more information about changing a password, see Section "Setting the password (Page 123)".



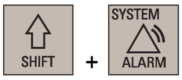
10. After you finish the editing, click this button to save the settings.

11. Click the following button or simply double-click the connection option to establish the connection.

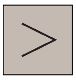
Establishing a network connection

Proceed as follows to establish a network connection:

1. Connect the control system with the local network using an Ethernet cable.

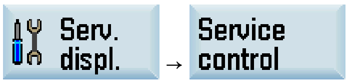


2. Select the system data operating area on the PPU.



3. Press this key to view the extended softkeys.

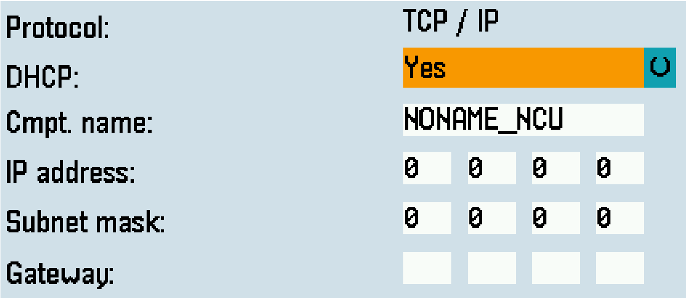
4. Enter the main screen of the service control options through the following softkey operations:



5. Press this softkey to enter the window for the network configuration.

   Note: make sure the following vertical softkey is not selected:

6. Configure the network as required in the following window:



You can configure DHCP with the following key:

Note: If you select "No" for DHCP, you must enter the IP address (which must belong to the same network as that of your computer) and subnet mask manually.

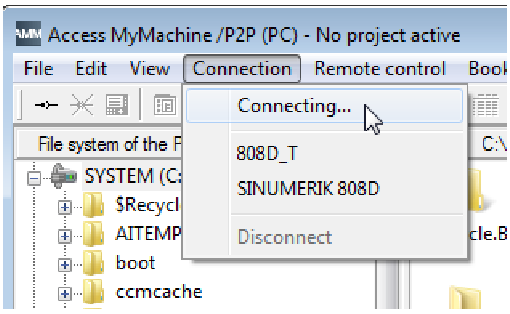
7. Press this softkey to save the configuration. If you select "Yes" for DHCP, you also need to restart the control system to activate the network configuration.

8. Start AMM on your computer. A password setting dialog box appears when the tool is started for the first time.

9. Enter a desired password in the input fields and then click this button to save.

This password ensures that all the connection data for AMM is encrypted. The password can be subsequently changed at any time from the menu bar.

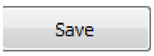
10. Click the button in the toolbar or select from the main window menu as follows to call the connection dialog box:



11. Select the network connections option and click this button to create new connection.

12. Assign the parameters for a new network connection in the dialog box. Note that the access level and password must be specified according to those set on the HMI.

Note: To avoid unauthorized access of the controller, change the Siemens default passwords to your own ones. For more information about changing a password, see Section "Setting the password (Page 123)".



13. After you finish the editing, click this button to save the settings.

14. Click the following button or simply double-click the connection option to establish the connection.

2.3 Personal computer

A personal computer with the following basic configuration is necessary for commissioning:

- Operating system: Windows Vista (both 32-bit and 64-bit versions)/Windows 7 (both 32-bit and 64-bit versions)
- Hard drive capacity: > 40 GB
- Memory capacity: > 1 GB
- Ethernet interface: for NC, PLC, and drive commissioning
- RJ45 Ethernet cable

3 Mounting

WARNING

Electric shock and danger to life when live parts are touched

Death or serious injury can result when live parts are touched.

- Only work on electrical devices when you are qualified for this job.
- Always observe the country-specific safety rules.

Before installing or removing the components of the control system, make sure that the system is disconnected from the mains.

WARNING

Fire or electric shock due to inadequate protection class

If the equipment operates in an area subject to inflammables or combustibles, water or corrosion hazards, it contains high risk of fire or electric shock.

The fire or electric shock may lead to death or serious injury.

Make sure that the control system is installed in a control cabinet with an adequate protection class.

Note

When dimensioning the control cabinet, make sure that the installed components do not exceed the permissible surrounding air temperature, even if the outside temperature is high.

Note

Fault of the wireless services caused by high-frequency faults in residential environments

This product can cause high-frequency interferences in a residential environment that can require radio interference suppression measures.

- Have the installation and commissioning with appropriate radio interference suppression measures performed by qualified personnel.

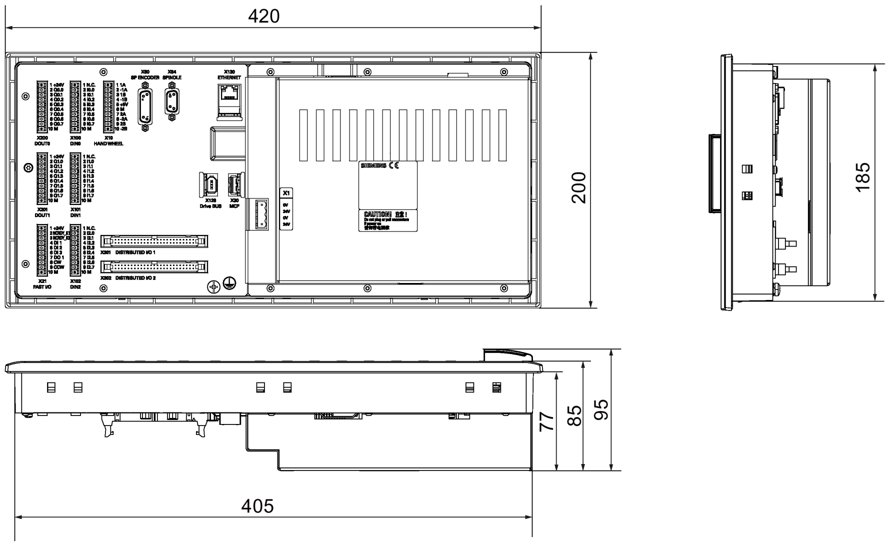
3.1 Mounting the PPU and MCP

3.1.1 Outline dimensions (unit: mm)

PPU161.3/PPU151.3

Note

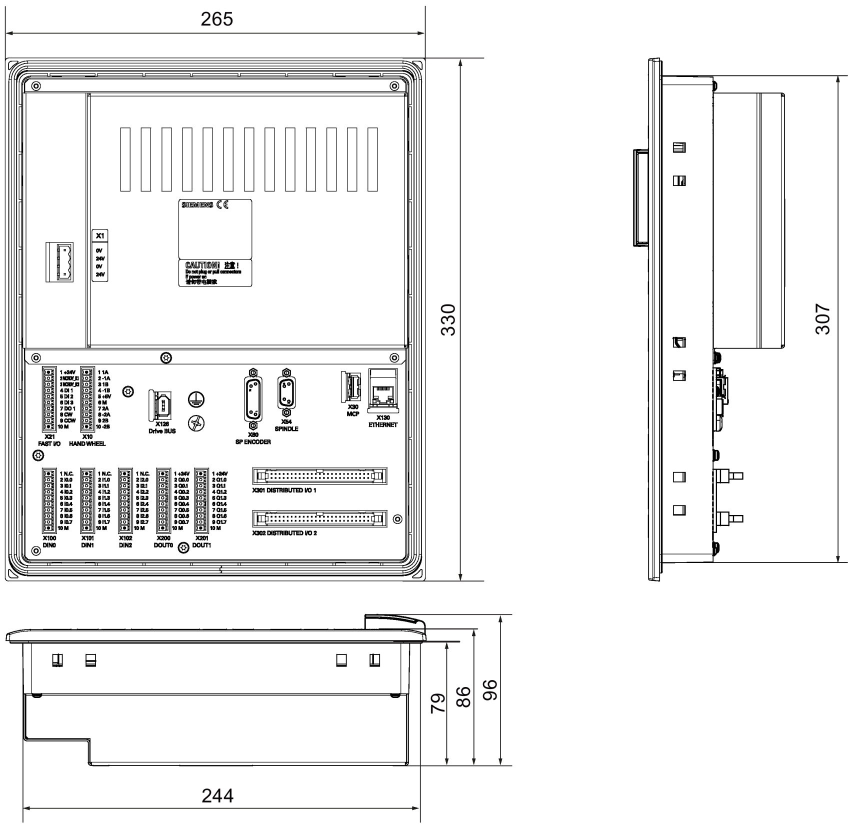
PPU161.3 and PPU151.3 have the same outline dimensions. The illustration below uses PPU161.3 as an example.



PPU160.3/PPU150.3

Note

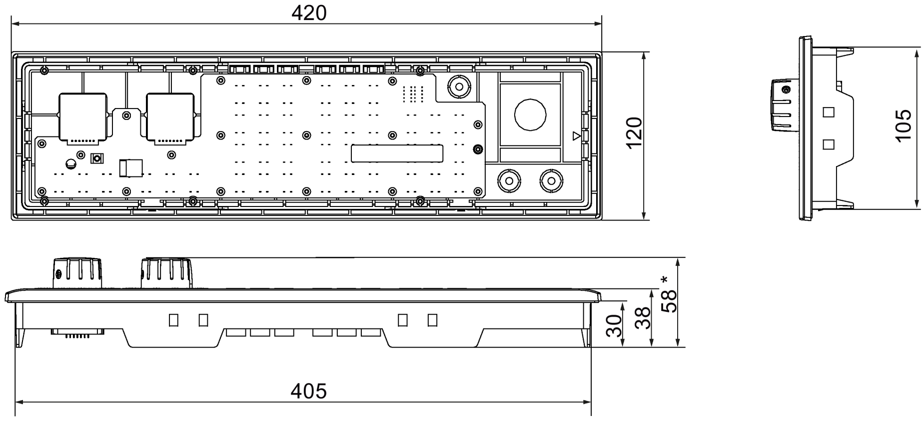
PPU160.3 and PPU150.3 have the same outline dimensions. The illustration below uses PPU160.3 as an example.



Horizontal MCP

Note

All horizontal MCP versions have the same outline dimensions. The illustration below uses the variant with override switches as an example.

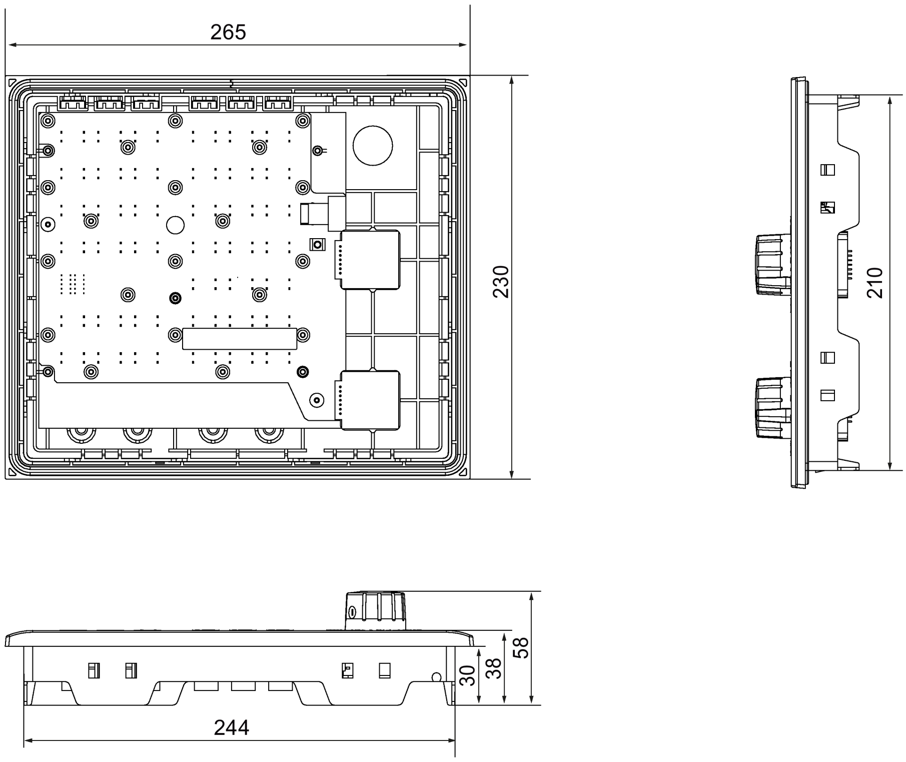


* Not available on the horizontal MCP with a reserved slot for the handwheel

Vertical MCP

Note

All vertical MCP versions have the same outline dimensions. The illustration below uses the variant with an override switch for the spindle as an example.



3.1.2 Cut-out dimensions and mounting clearance

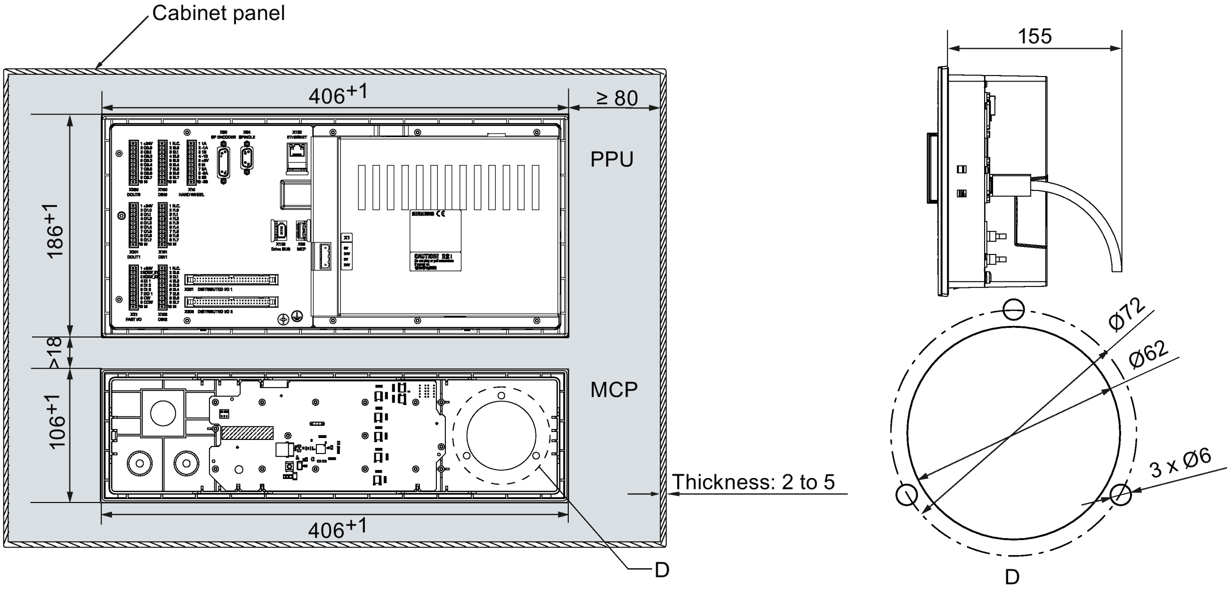
Note

Make sure there is enough space around the PPU and the MCP for tightening the screws in the control cabinet.

Horizontal PPU and MCP (unit: mm)

Note

The illustration below uses PPU161.3 and the horizontal MCP with a reserved slot for the handwheel as an example.
All horizontal PPU/MCP versions share the same requirements for cut-out dimensions and mounting clearance.

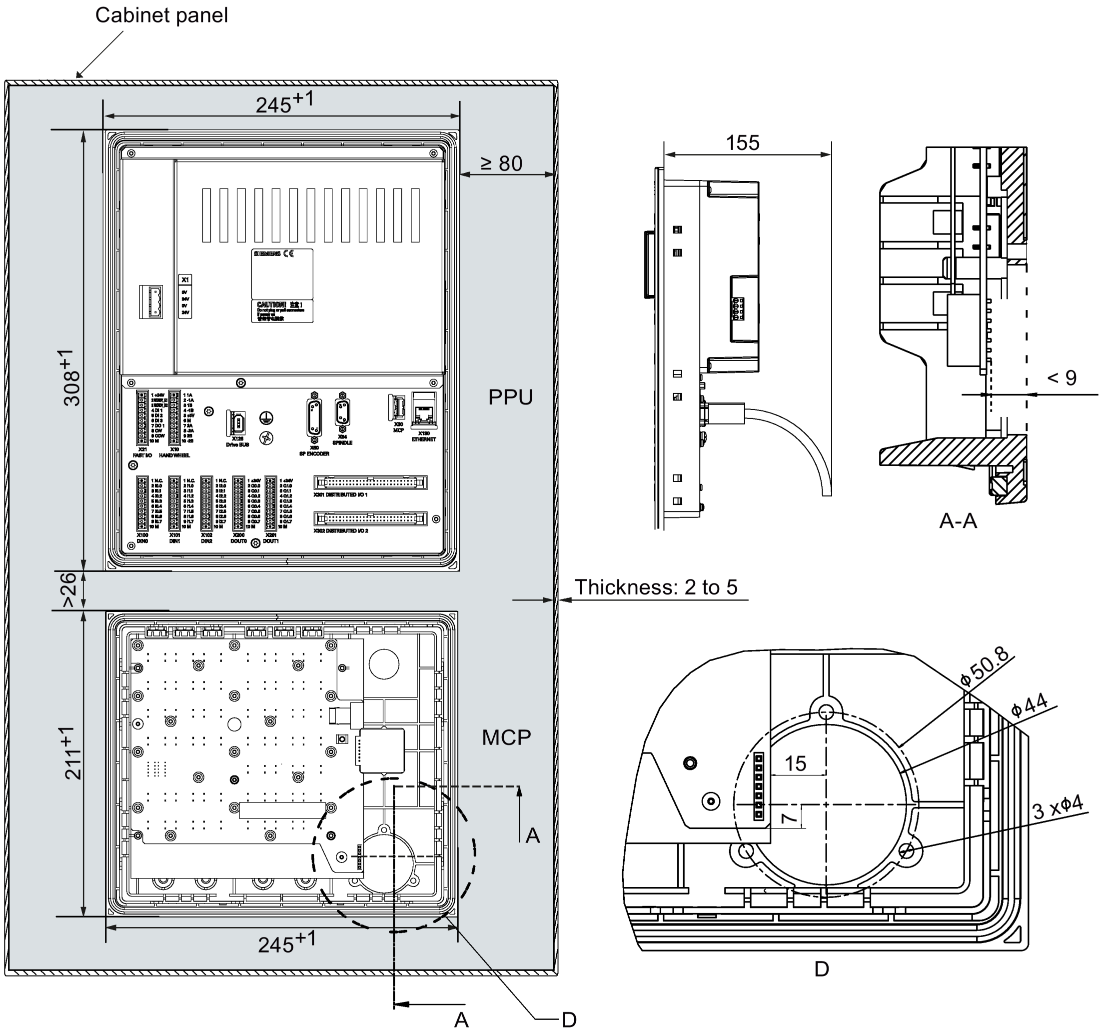


To make maintenance easy, keep sufficient clearance (≥ 80 mm) between the system CF card slot and the cabinet wall. The recommended depth of the cabinet is greater than 155 mm.

Vertical PPU and MCP (unit: mm)

Note

All vertical MCP versions share the same requirements for cut-out dimensions and mounting clearance. The illustration below uses the vertical MCP with a reserved slot for the handwheel as an example.

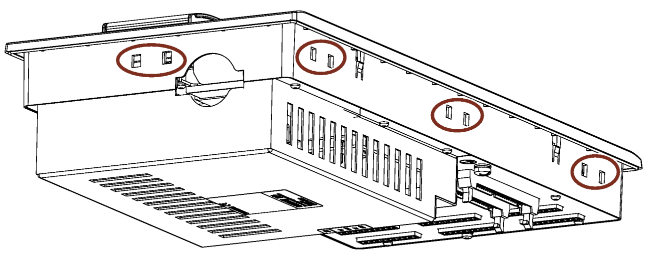


Note

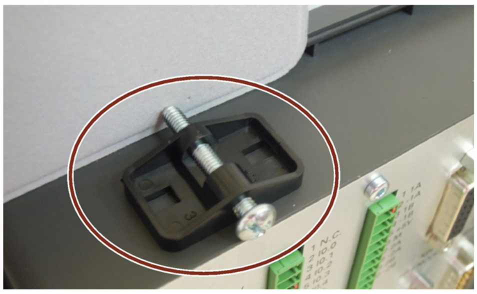
When mounting a horizontal PPU together with a vertical MCP or vice versa, follow the requirement for the clearance between a vertical PPU and a vertical MCP shown above.

3.1.3 Mounting the PPU and MCP with the companion clamps

Use the companion clamps (8 for PPU161.3/PPU151.3, 10 for PPU160.3/PPU150.3, 6 for the horizontal MCP, and 8 for the vertical MCP) to fix the PPU and MCP to the cabinet panel. You can find the mounting positions (circled) on the PPU and MCP. The distance between two mounting holes of each mounting position is 21 mm.

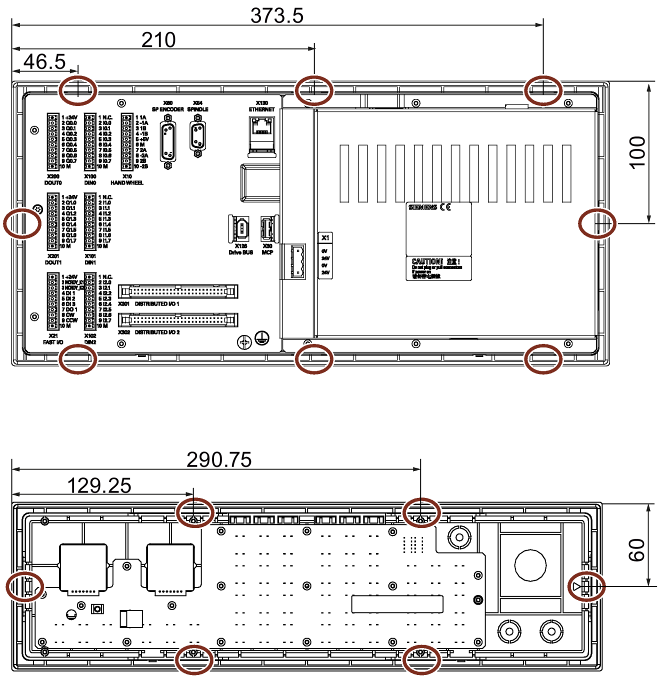


See the mounting illustration as follows (screw tightening torque: ≤ 0.2 Nm):

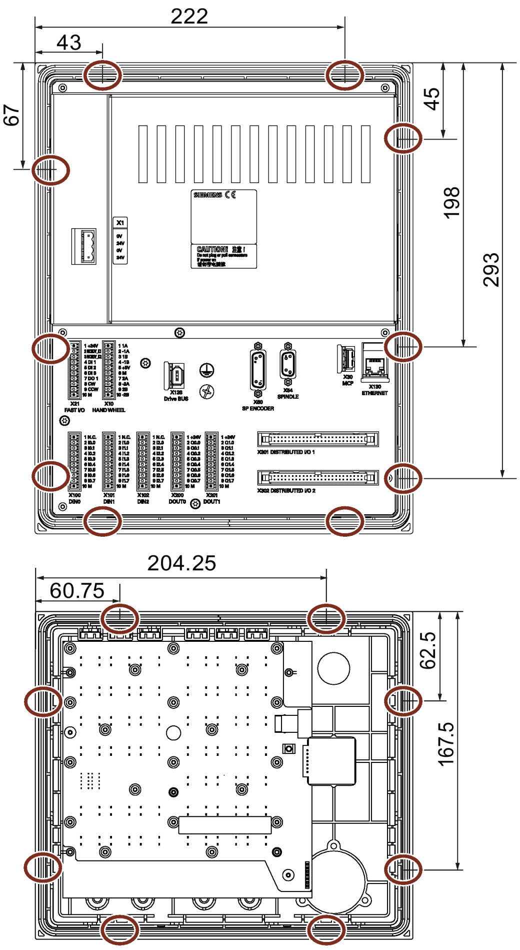


The following figures show all mounting positions on the PPU and MCP (unit: mm):

Horizontal PPU and MCP



Vertical PPU and MCP



3.2 Mounting the drive

Protection against the spread of fire

The device may be operated only in closed housings or in control cabinets with protective covers that are closed, and when all of the protective devices are used. The installation of the device in a metal control cabinet or the protection with another equivalent measure must prevent the spread of fire and emissions outside the control cabinet.

Protection against condensation or electrically conductive contamination

Protect the device, e.g. by installing it in a control cabinet with degree of protection IP54 according to IEC 60529 or NEMA 12. Further measures may be necessary for particularly critical operating conditions.

If condensation or conductive pollution can be excluded at the installation site, a lower degree of control cabinet protection may be permitted.

WARNING

Death or severe personal injury from harsh installation environment

A harsh installation environment will jeopardize personal safety and equipment. Therefore,

- Do not install the drive and the motor in an area subject to inflammables or combustibles, water or corrosion hazards.
- Do not install the drive and the motor in an area where it is likely to be exposed to constant vibrations or physical shocks.
- Do not keep the drive exposed to strong electro-magnetic interference.

CAUTION

Burn injuries caused by hot surfaces

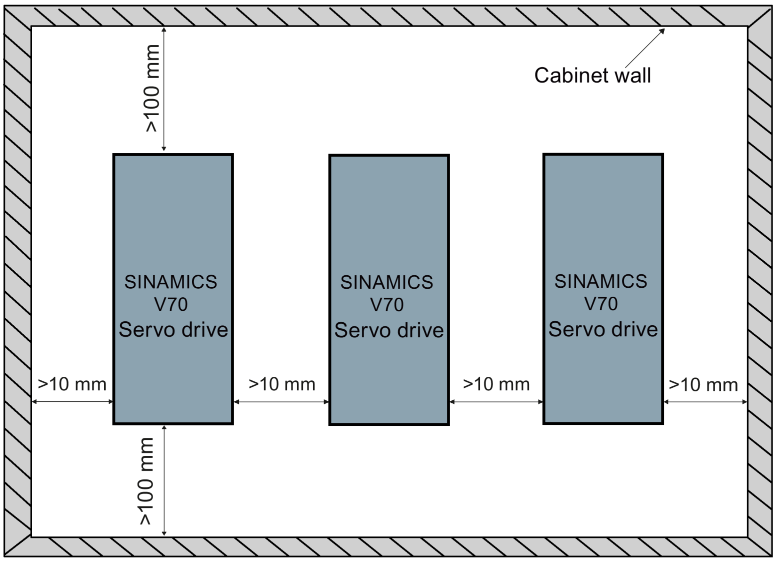
During operation and for a short time after switching-off the drive, the surfaces of the drive can reach a high temperature. Avoid coming into direct contact with the drive surface.

Note

For detailed information about mounting conditions, see Section "Servo drives (Page 376)".

3.2.1 Mounting orientation and clearance

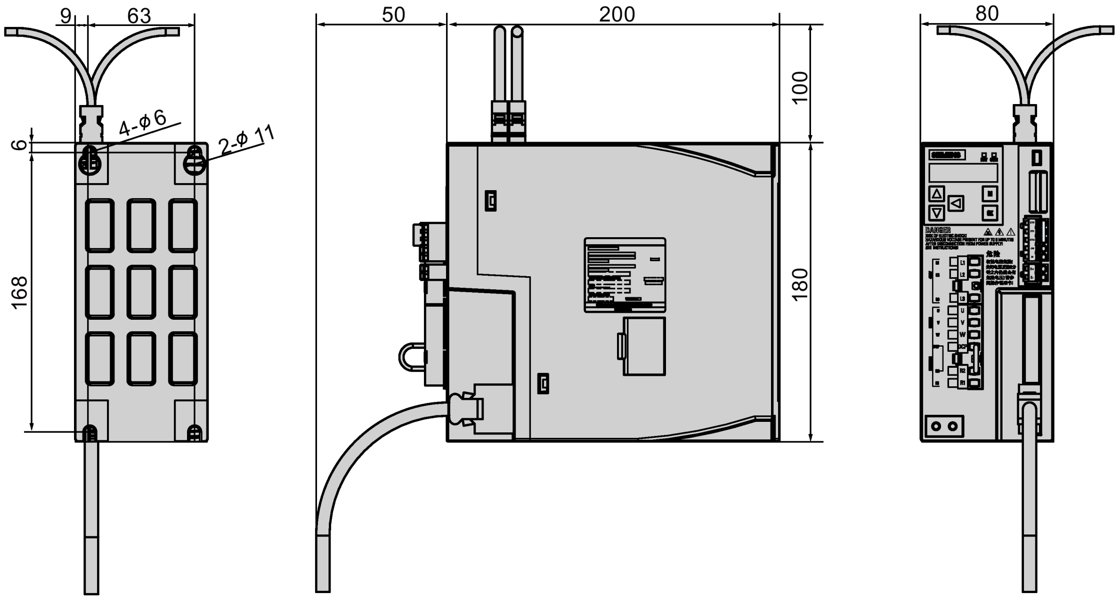
Mount the drive vertically to the back plate of a shielded cabinet (non-painted) and observe the mounting clearances specified in the illustration below:



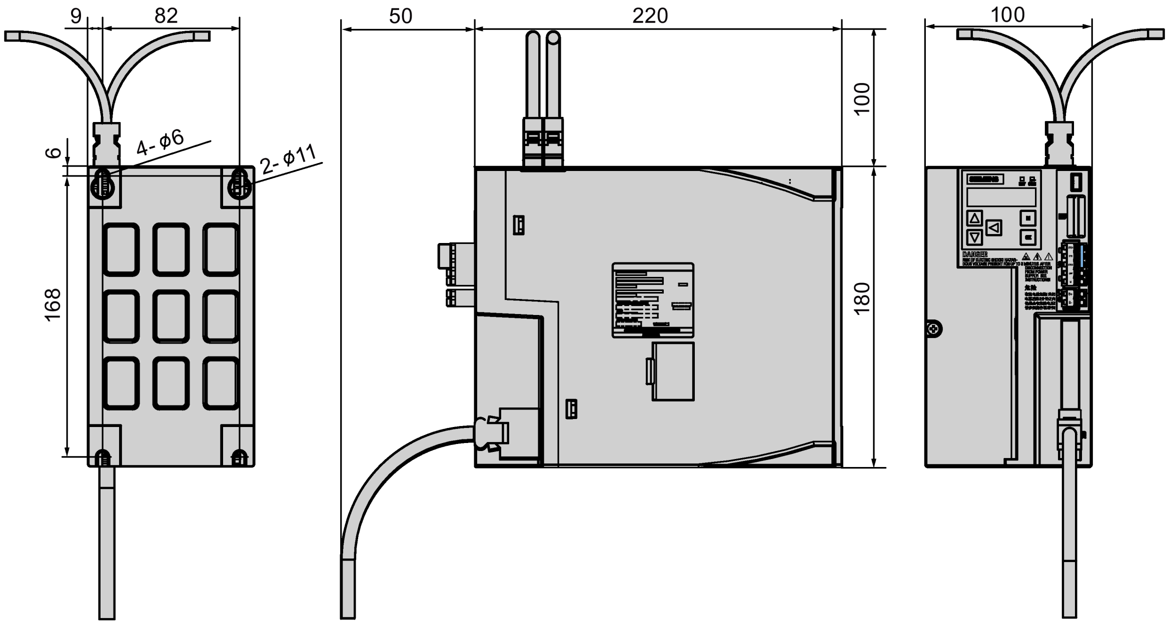
3.2.2 Drill patterns and outline dimensions

All dimensional data is specified in millimeters.

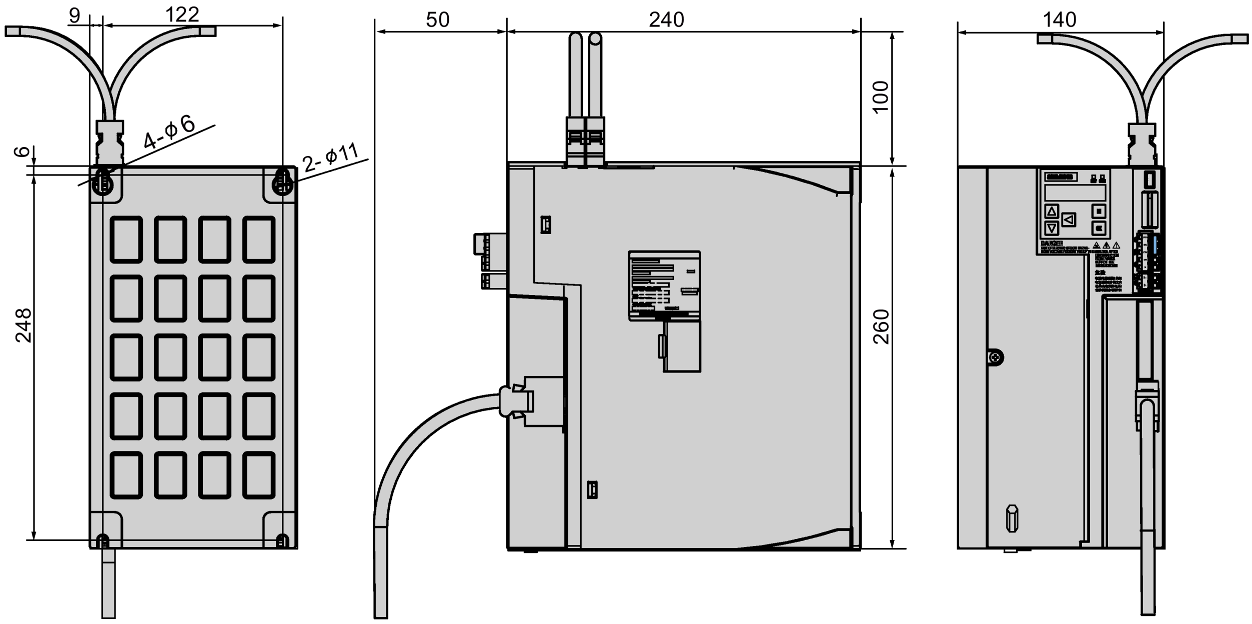
SINAMICS V70 feed drive FSA



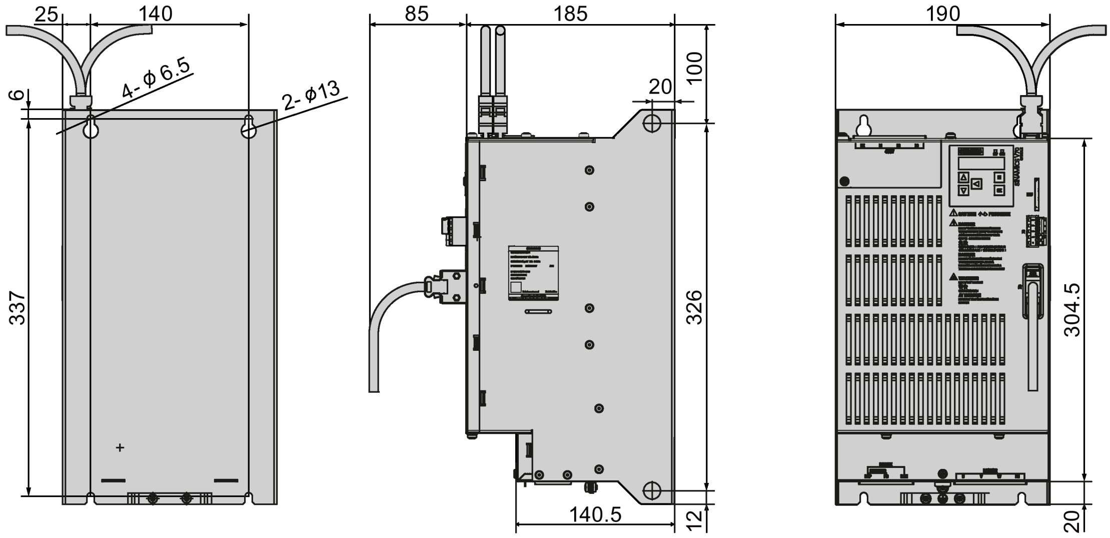
SINAMICS V70 feed/spindle drive FSB



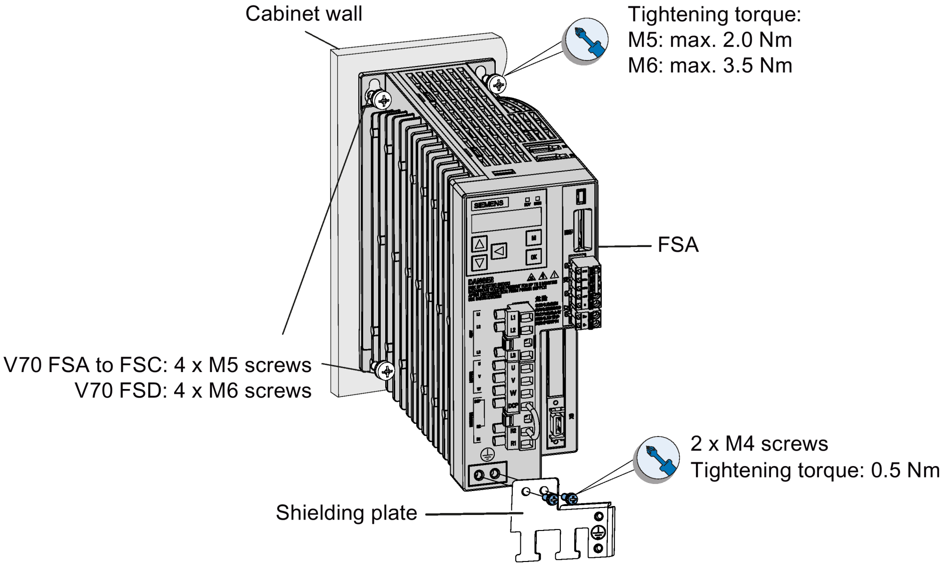
SINAMICS V70 feed/spindle drive FSC



SINAMICS V70 spindle drive FSD



3.2.3 Mounting the drive



Note

EMC instructions

- The SINAMICS V70 drives have been tested in accordance with the emission requirements of the category of C2 (residential) environment for FSA/FSB/FSC, and C3 (industrial) environment for FSD. The conducted emissions and radiated emissions are in compliance with the standard of EN 55011 and reached Class A for FSA/FSB/FSC and Class A2 for FSD.
- In a residential environment, this product can cause high-frequency interferences that may necessitate suppression measures.
- For a radiated emission test, an external AC filter (between the 380 VAC power supply and the drive) will be used to meet the EMC requirement and the drive will be installed inside the shielded metallic chamber, other parts of the motion control system (including the PLC, DC power supply, spindle drive, motor) will be put inside the shielded chamber.
- For a conductive emission test, an external AC filter (between the 380 VAC power supply and the drive) will be used to meet the EMC requirement.
- For the radiated emission and conductive emission test, the length of the line supply cable between the line filter and the drive must be shorter than 1 m.

Note

Screw tightening

After the drive installation is complete, make sure that you tighten the screw on the terminal door of the drive.

3.3 Mounting the motor

NOTICE
Damage to the motor If the liquid enters the motor, the motor may be damaged. During motor installation or operation, make sure that no liquid (water, oil, etc.) can penetrate into the motor. Besides, when installing the motor horizontally, make sure that the cable outlet faces downward to protect the motor from ingress of oil or water.

NOTICE
Risk of damage to bearing and bearing grease Liquid collecting in the flange can have a negative impact on the bearing and bearing grease. Make sure that the flange is free of liquid, both in the vertical and horizontal mounting positions.

NOTICE

Damage to the encoder


Do not exert any shock at the shaft end; otherwise, the encoder may be damaged.

Note

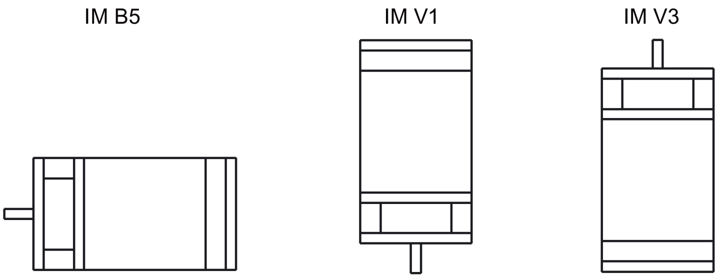
For detailed information about the motor mounting conditions, see Section "Servo motors (Page 380)".

3.3.1 Mounting the SIMOTICS S-1FL6 motor

3.3.1.1 Mounting orientation and outline dimensions

Mounting orientation

The SIMOTICIS S-1FL6 motor supports flange mounting only and it can be used in the following three types of construction:

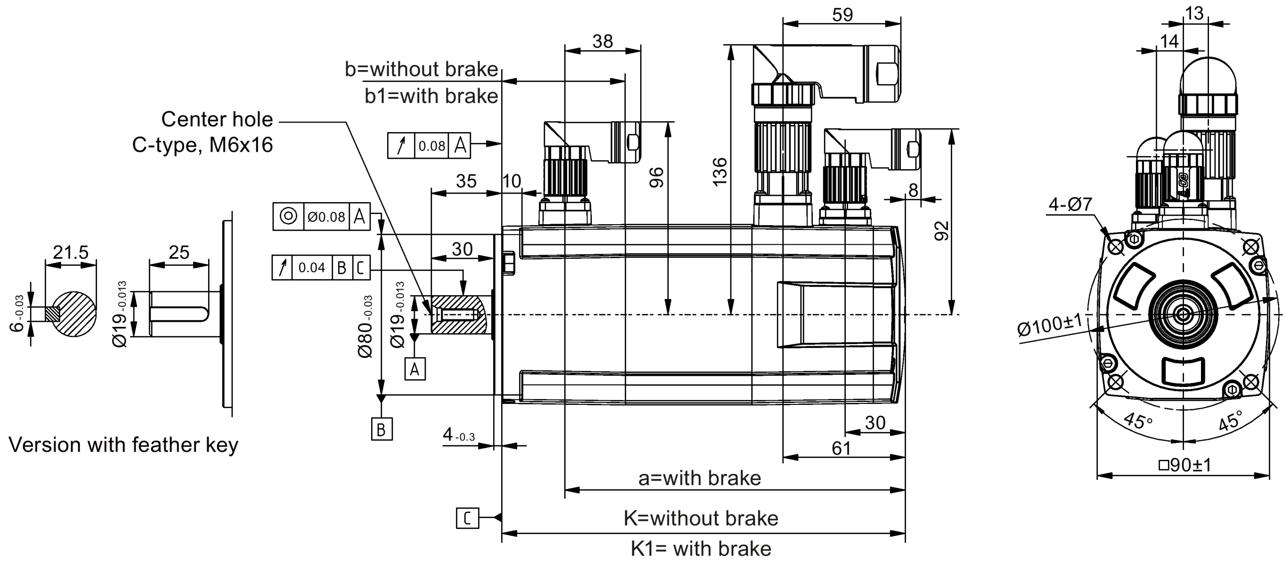


Note

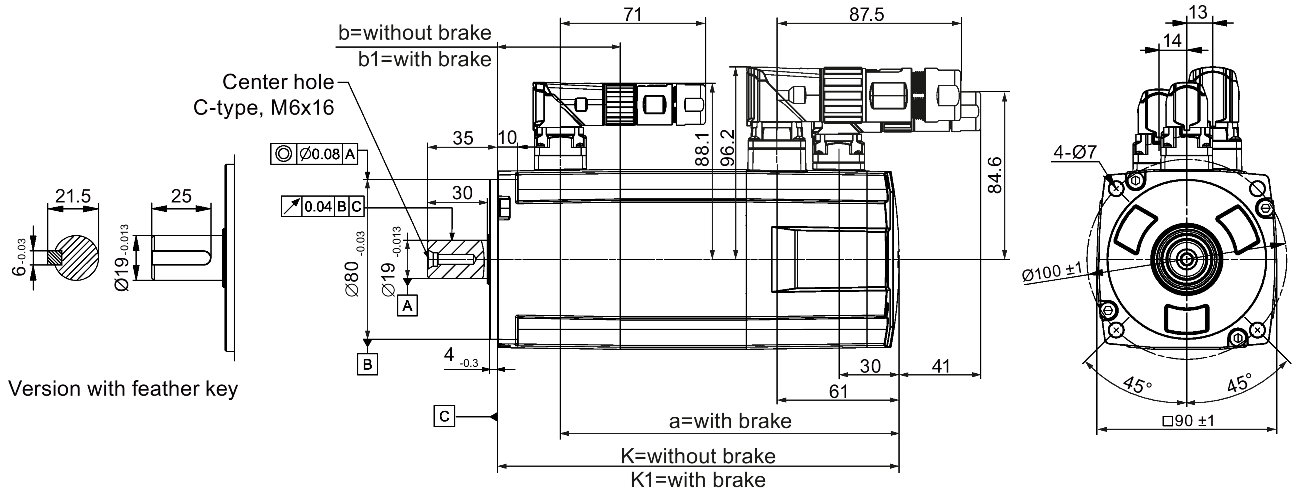
When configuring the IM V3 type of construction, pay particular attention to the permissible axial force (weight force of the drive elements) and the necessary degree of protection.

Motor dimensions (unit: mm)

Shaft height 45 mm, with straight connectors and the incremental encoder

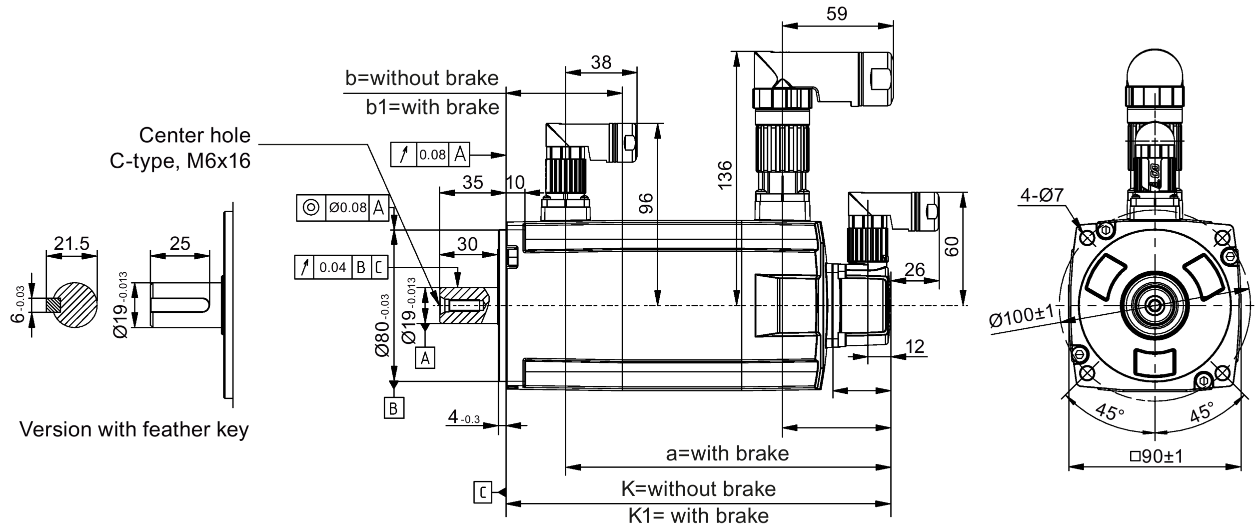


Shaft height 45 mm, with angular connectors and the incremental encoder

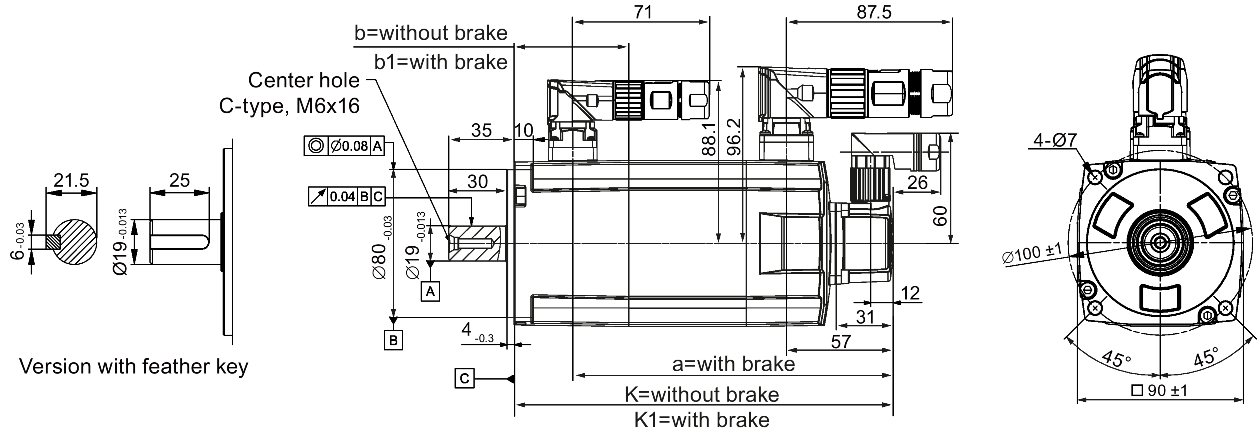


Stall torque	k	k1	a	b	b1
1.9 Nm	154.5	201	169.5	15	61.5
3.5 Nm	201.5	248	216.5		

Shaft height 45 mm, with straight connectors and the absolute encoder

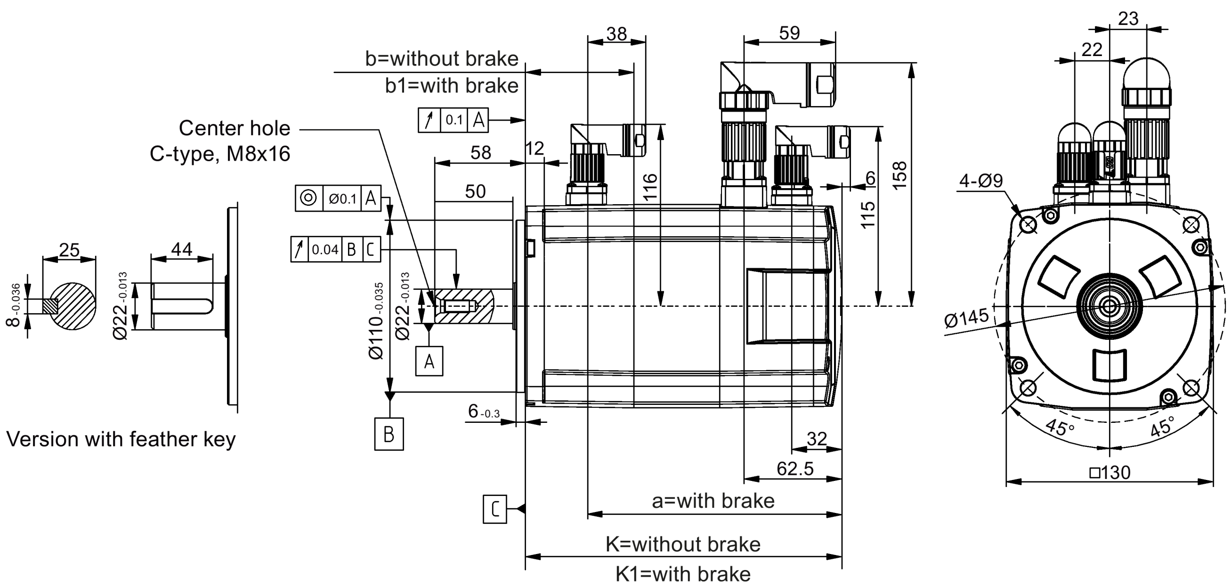


Shaft height 45 mm, with angular connectors and the absolute encoder

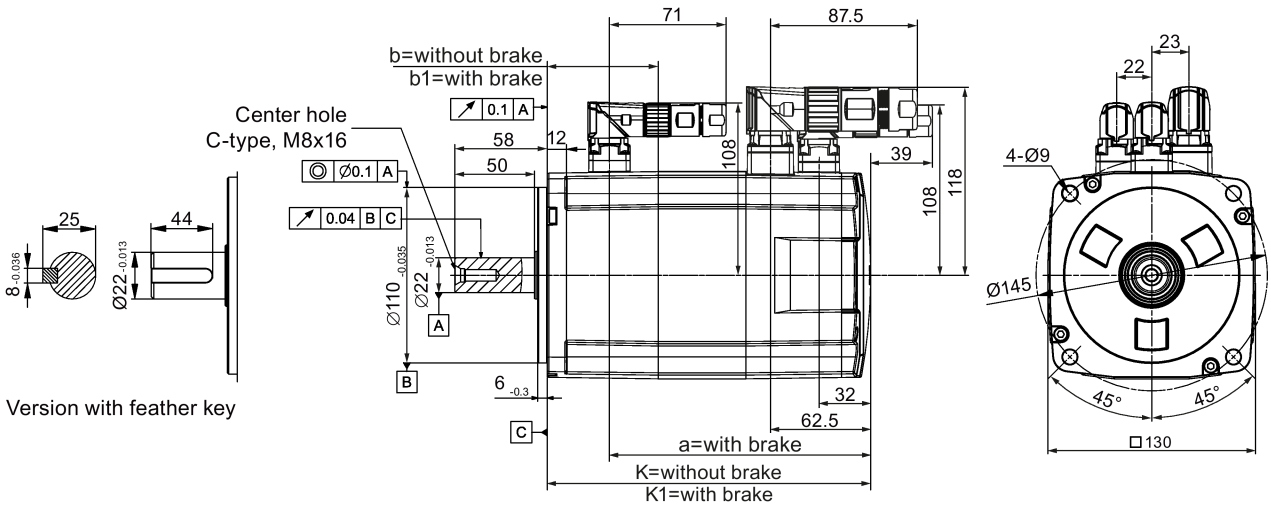


Stall torque	k	k1	a	b	b1
1.9 Nm	157	203.5	172	15	61.5
3.5 Nm	204	250.5	219		

Shaft height 65 mm, with straight connectors and the incremental encoder



Shaft height 65 mm, with angular connectors and the incremental encoder

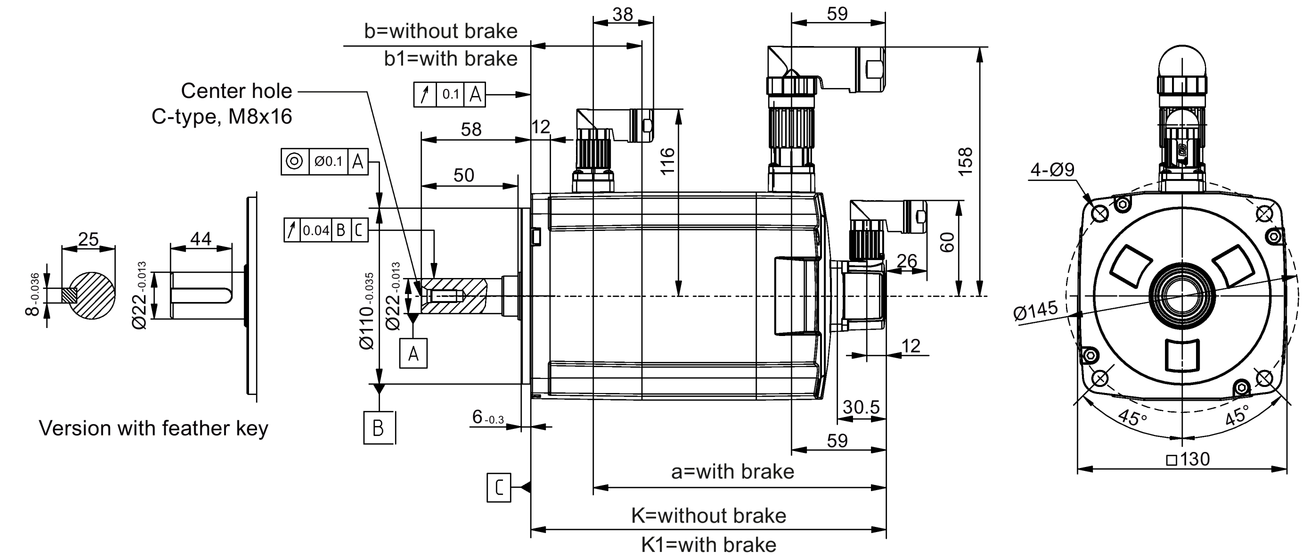


Stall torque	k	k1	a	b	b1
4 Nm	148	202.5	163	15	69.5
6 Nm	181 1)/164.5 2)	235.5 1)/219 2)	196 1)/179.5 2)		
8 Nm	181	235.5	196		
11 Nm	214	268.5	229		
15 Nm	247	301.5	262		

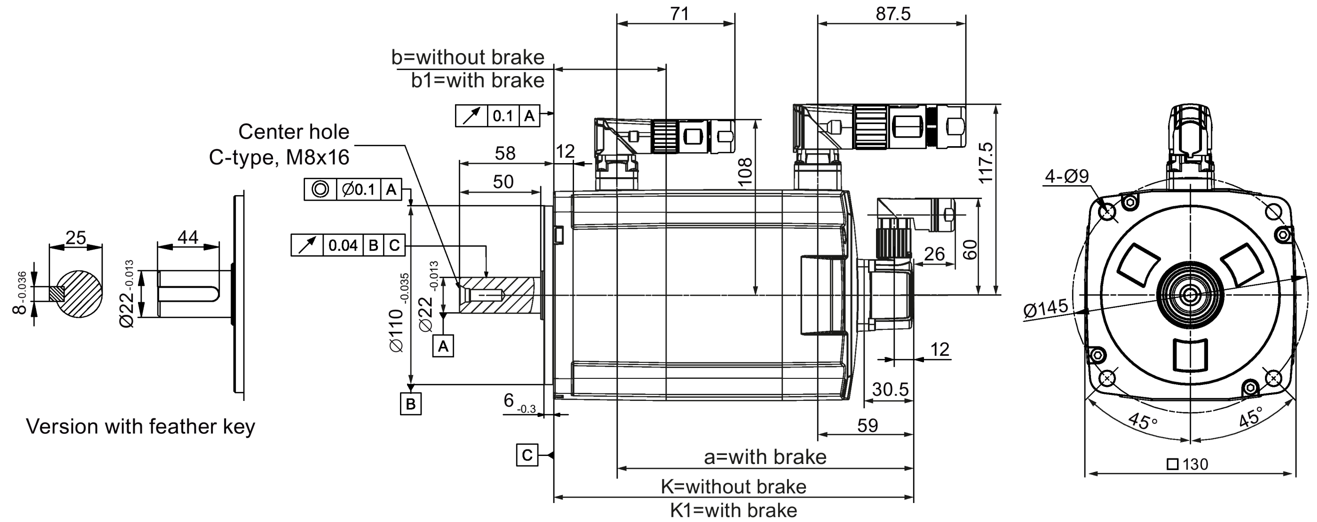
1) For the motor variants with straight connectors;

2) For the motor variants with angular connectors.

Shaft height 65 mm, with straight connectors and the absolute encoder



Shaft height 65 mm, with angular connectors and the absolute encoder

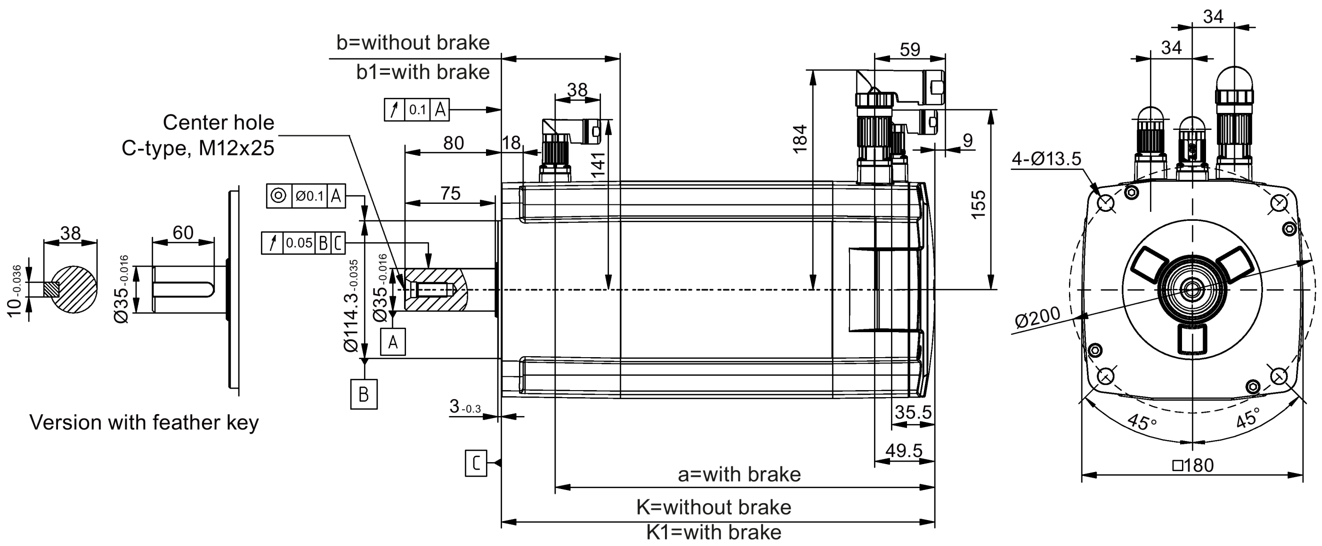


Stall torque	k	k1	a	b	b1
4 Nm	151	205.5	166	15	69.5
6 Nm	184 [1]/167.5 [2]	222 [1]/164.5 [2]	199 [1]/182.5 [2]		
8 Nm	184	238.5	199		
11 Nm	217	271.5	232		
15 Nm	250	304.5	265		

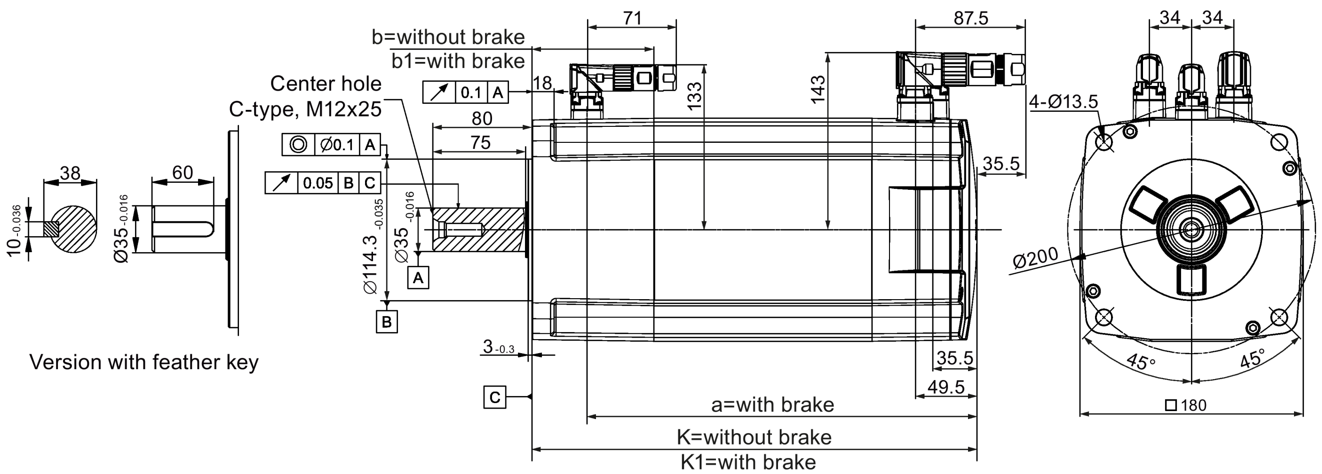
[1] For the motor variants with straight connectors;

[2] For the motor variants with angular connectors.

Shaft height 90 mm, with straight connectors and the incremental encoder

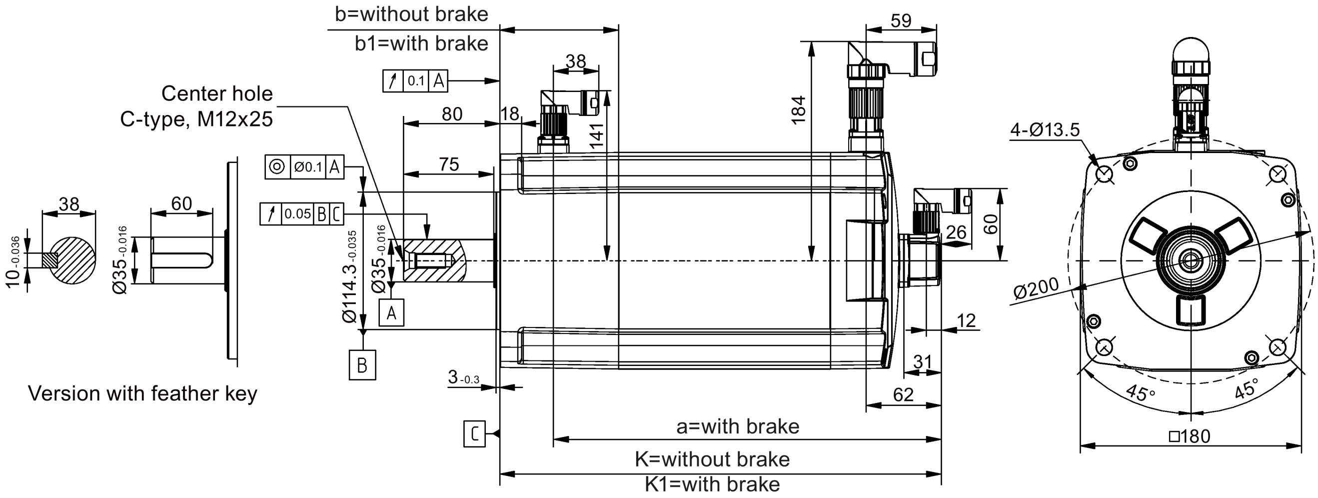


Shaft height 90 mm, with angular connectors and the incremental encoder

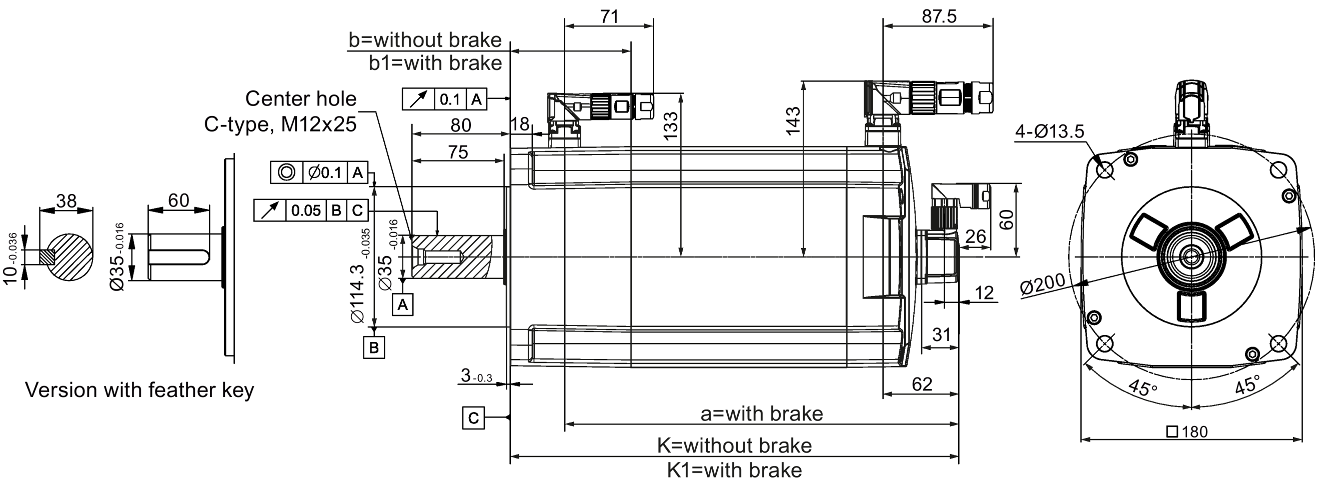


Stall torque	k	k1	a	b	b1
15 Nm	189.5	255	210.5	33	98.5
22 Nm	211.5	281	236.5		
30 Nm	237.5	307	262.5		
40 Nm	289.5	359	314.5		

Shaft height 90 mm, with straight connectors and the absolute encoder



Shaft height 90 mm, with angular connectors and the absolute encoder



Stall torque	k	k1	a	b	b1
15 Nm	197	263	218	33	98.5
22 Nm	223	289	244		
30 Nm	249	315	270		
40 Nm	301	367	322		

3.3.1.2 Mounting the motor

WARNING
Personal injury and material damage
Some motors, especially the 1FL609❑ are heavy. The excessive weight of the motor should be considered and any necessary assistance required for mounting should be sought.
Otherwise, the motor can fall down during mounting. This can result in serious personal injury or material damage.

NOTICE
Magnetic interference to the absolute encoder due to the magnetic field
To avoid magnetic interference to the absolute encoder, keep the servo motor with an absolute encoder at least 15 mm away from the devices that produce a magnetic field stronger than 10 mT.

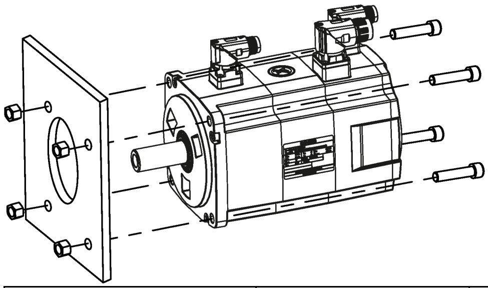
Note

Using the eyebolts

The 1FL609❑ motor (90 mm shaft height) has two M8 screw holes for screwing in two eyebolts. Lift the 1FL609❑ motor only at the eyebolts.

Eyebolts that have been screwed in must be either tightened or removed after mounting.

Install the motor onto a steel flange with four screws as shown in the following figure:



Motor	Screw	Recommended flange size (mm) *	Tightening torque (Nm)
1FL604❑	4 × M6	270 × 270 × 10	8
1FL606❑	4 × M8	390 × 390 × 15	20
1FL609❑	4 × M12	420 × 420 × 20	85

* Use a suitable flange according to the recommended flange size to ensure that the motor runs with rated specifications. For more information, see Section "Motor heating conditions (Page 71)".

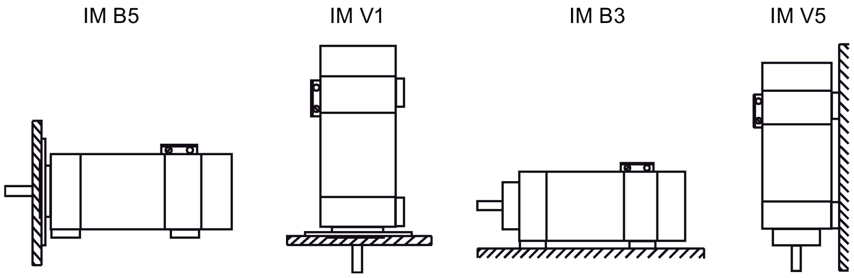
3.3.2 Mounting the SIMOTICS M-1PH1 main motor

3.3.2.1 Mounting orientation and outline dimensions

Mounting orientation

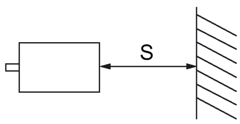
The SIMOTICS M-1PH1 main motor supports flange mounting and foot mounting as shown below:

Mounting method	Standard type of construction	Rotated type of construction
Foot mounting	IM B3	IM V5
Flange mounting	IM B5	IM V1



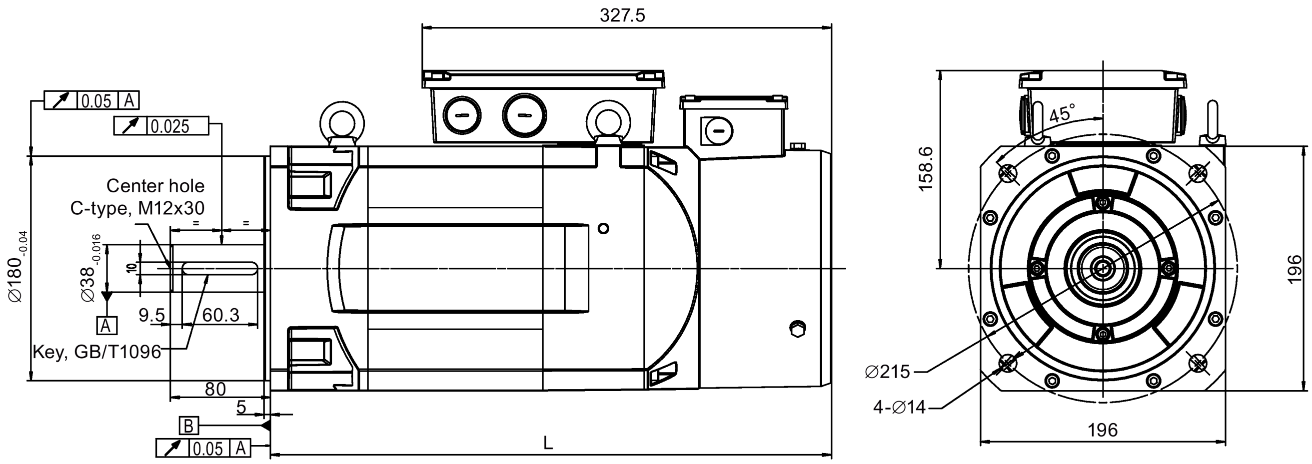
Minimum clearance between a fan and parts/components mounted by the customer

The minimum clearance between a fan and parts/components mounted by the customer or the air discharge opening, and the minimum clearance S between the air intake/air discharge opening and adjacent components must be maintained.

Shaft height (mm)	Fan mounting	Minimum clearance S (mm)	
100	Non-drive end axial, can be rotated through 180°	30	
132	Non-drive end radial, can be ordered differently from the mounting type	60	

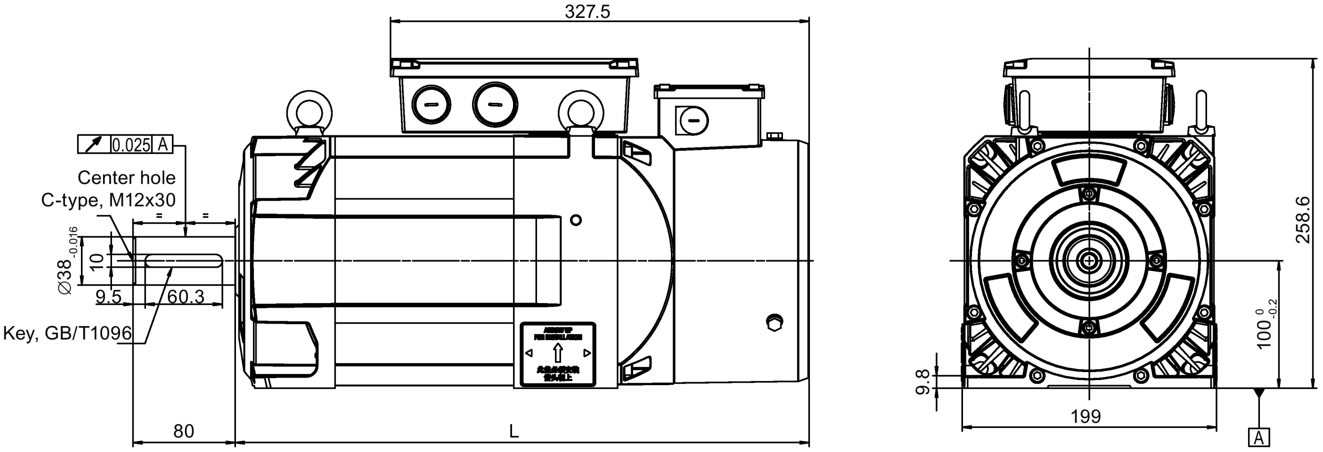
Motor dimensions

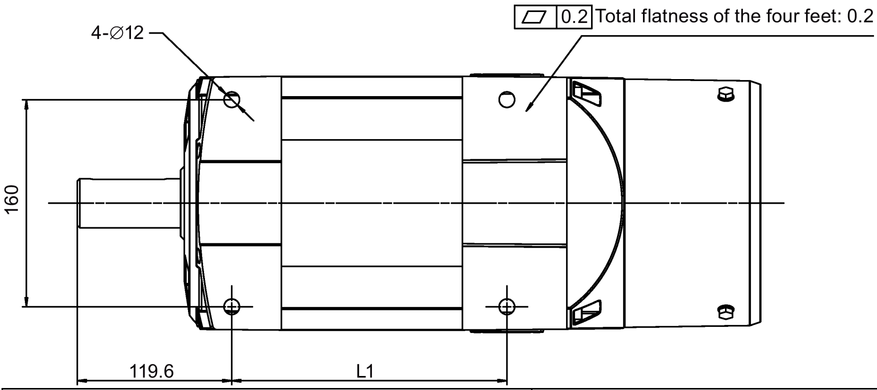
Shaft height 100 mm: flange mounting (unit: mm)



Motor	L
1PH1101-1❑F12-❑GA0	419
1PH1103-1❑F12-❑GA0	449
1PH1103-1❑D12-❑GA0	449
1PH1105-1❑F12-❑GA0	499
1PH1105-1❑D12-❑GA0	499

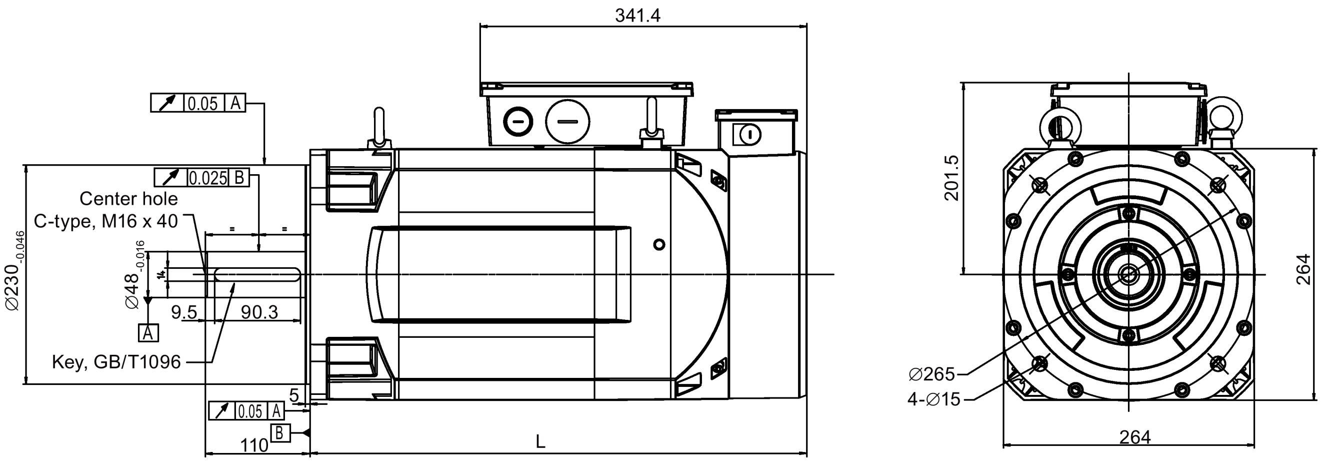
Shaft height 100 mm: foot mounting (unit: mm)





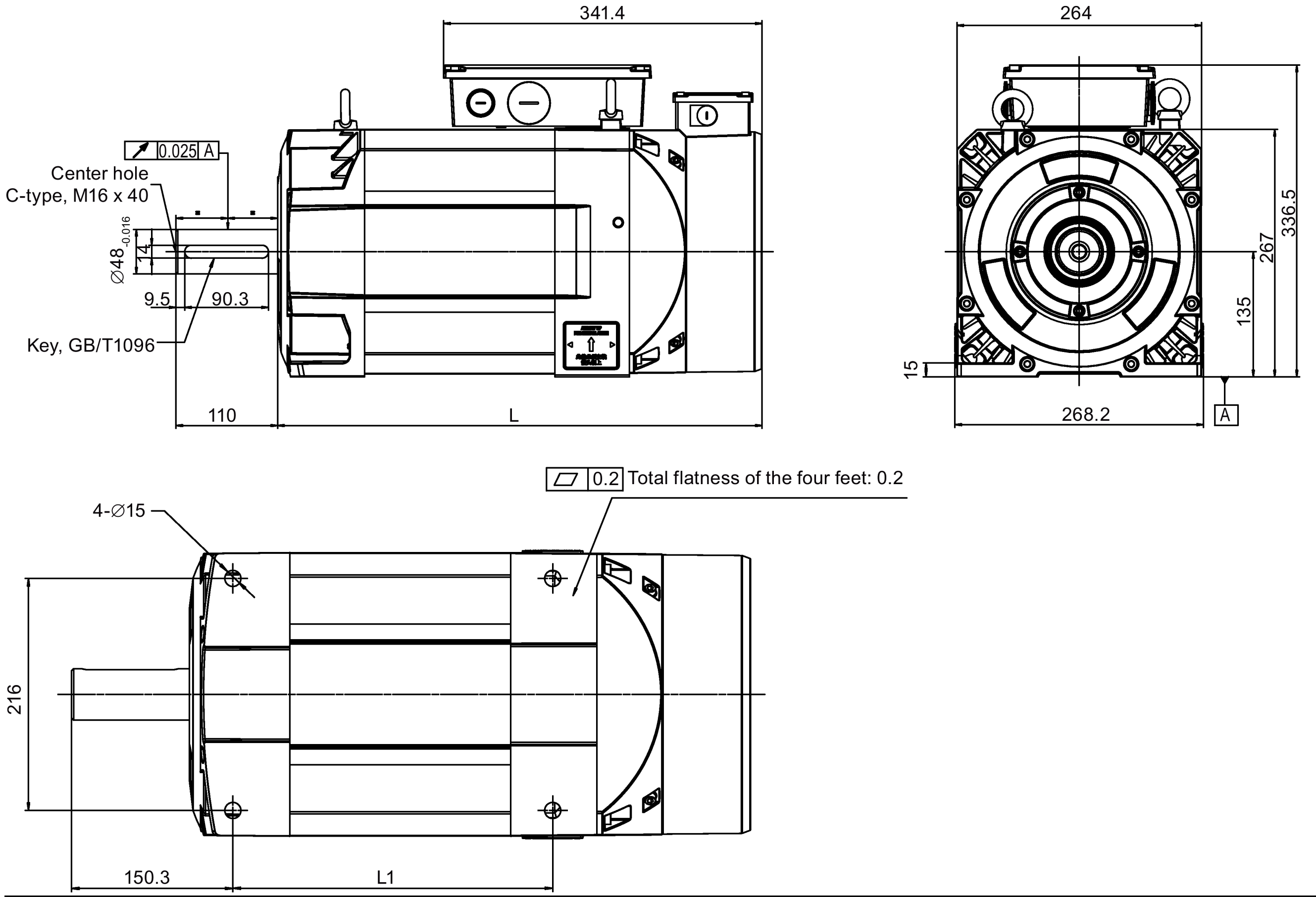
Motor	L	L1
1PH1101-1❑F10-❑GA0	419	183
1PH1103-1❑F10-❑GA0	449	213
1PH1103-1❑D10-❑GA0	449	213
1PH1105-1❑F10-❑GA0	499	263
1PH1105-1❑D10-❑GA0	499	263

Shaft height 132 mm: flange mounting (unit: mm)



Motor	L
1PH1131-1❑F12-❑GA0	475
1PH1131-1❑D12-❑GA0	465
1PH1133-1❑F12-❑GA0	525
1PH1133-1❑D12-❑GA0	525

Shaft height 132 mm: foot mounting (unit: mm)



Motor	L	L1
1PH1131-1❑F10-❑GA0	475	251.8
1PH1131-1❑D10-❑GA0	465	241.8
1PH1133-1❑F10-❑GA0	525	301.8
1PH1133-1❑D10-❑GA0	525	301.8

3.3.2.2 Mounting the motor

In order to ensure smooth, vibration-free motor operation, a stable foundation design is required, the motor must be precisely aligned, and the components that are to be mounted on the shaft extension must be correctly balanced.

The following mounting instructions must be carefully observed:

- For high-speed machines, the complete unit should be dynamically balanced after couplings or belt pulleys have been mounted.
- Use suitable equipment when mounting drive elements. Use the thread at the shaft extension.
- Do not apply any shocks or axial pressure to the shaft extension.
- Especially for high-speed motors with flange mounting, it is important that the mounting is stiff in order to locate any natural frequency as high as possible so that it remains above the maximum rotational frequency.
- Thin sheets (shims) can be placed under the motor mounting feet to align the motor and to avoid mechanically stressing the motor. The number of shims used should be kept to a minimum.
- In order to securely mount the motors and reliably and safely transfer the drive torque, bolts with strength class 8.8 according to ISO 898-1 should be used.

Note

All flange-mounted motors must have a stable motor suspension assembly and for high field weakening speeds must be supported using the appropriate feet at the bearing end shield. For more information on foot/flange mounting, see Section "Mounting orientation and outline dimensions (Page 67)".

Support using feet at the bearing end shield is not required if the following conditions are maintained:

- For flange-mounted motors, there is a stable motor suspension design.
- The permissible vibration values according to DIN ISO 10816 are maintained.
- The maximum speed is limited (see Section "SIMOTICS M-1PH1 main motors (Page 384)").

Motors that are mounted, as a result of their type of construction, to the wall using the motor feet, must be fixed in place through the use of an adequately dimensioned positive form fit (for example, studs or mounting rails).

When commissioning the motors, it must be ensured that the permissible vibration values according to DIN ISO 10816 are maintained.

Note

Using the eyebolts

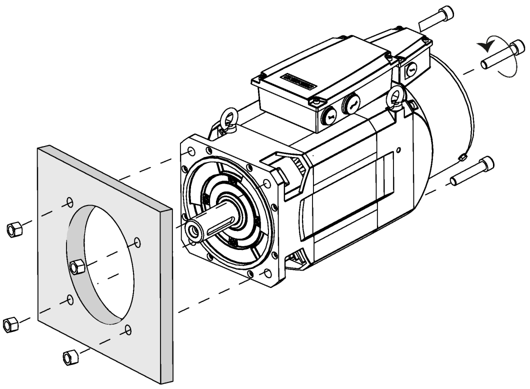
Lift the 1PH1 motor only at the eyebolts.

Note

Mount the motor so that the cooling air can enter and be discharged without any restrictions.

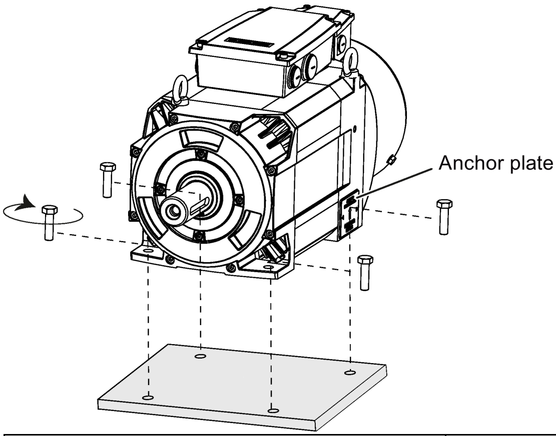
Flange mounting

Mount the motor through a mounting steel flange. Use four M12 screws with a tightening torque of 84 Nm.



Foot mounting

Remove the anchor plates with a wrench, fix the motor to the mounting plate with screws, and then reinstall the anchor plates. You can use four screws to fix the motor as shown in the following figure:



Motor variant	Screw	Tightening torque
1PH110❑	4 × M10	39 Nm
1PH113❑	4 × M12	84 Nm

3.3.3 Motor heating conditions

The rated motor specifications are continuous allowable values at a surrounding air temperature of 40 °C when the motor is installed with a steel flange. When the motor is mounted on a small surface, the motor temperature may rise considerably because of the limited heat radiating abilities of the surface. Make sure you use a suitable flange according to Siemens recommended flange sizes.

Note

The actual temperature rise depends on how the flange (motor mounting section) is fixed on the installation surface, what material is used for the motor mounting section, and motor speed. Always check the actual motor temperature.

3.4 Electrical cabinet design

It may be preferable to always use cooling units as this allows the cabinet to be sealed which is the best option for stopping the entry of contaminants. Within the cabinets it may also be necessary to install fans to ensure the air is circulated and prevent "hot spots" from forming.

The technical specifications of the individual hardware component will provide details of the power loss measured in Watts.

Calculations are made to see if the cabinet can dissipate the heat naturally.

The cabinet manufacturer can supply details of the heat-loss of the cabinet.

Natural heat dissipation occurs through the cabinet walls providing the wall is in free air and not against a wall for example.

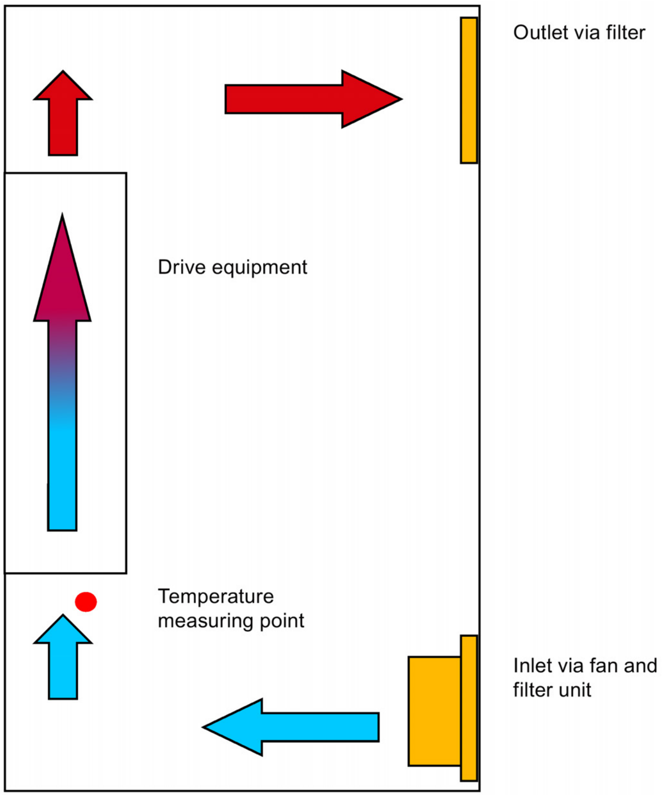
A general rule is that the energy dissipated is approximately 50 Watts/m² of free cabinet wall assuming a 10 °C temperature difference between the cabinet and the outside air.

3.4.1 Correct installation of fans

For cabinets it is possible that the cooling can be achieved with fans drawing air from the outside via a filter. Natural convection causes the warm air to exit via a filter.

The fact that air is being drawn directly from the outside means that this system can never be airtight. Having a fan for the inlet side only ensures that the cabinet is positively pressurized which helps keep contaminants from entering.

It is extremely important that the filters are service regularly to avoid ingress of contaminants and to maintain the efficiency of the cooling process.



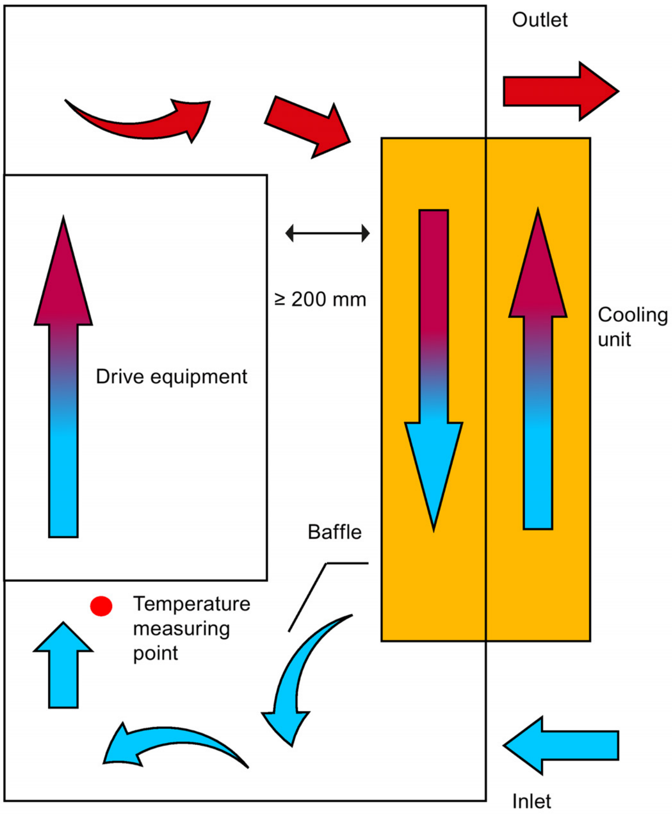
3.4.2 Correct installation of cooling units

The cool air should be directed to the bottom of the drive. The natural convection will draw the air through the drives.

The cool air from the cooling unit should not be directed straight onto/into the drives. It should be allowed to mix with the warmer air already in the cabinet, which can minimize the risk of condensation forming.

Cabinet top mounted cooling units require a method of directing the cool air from the cooling unit to the bottom of the drives.

In the case of a door mounted unit it may be necessary to direct the cool air with the use of a baffle.



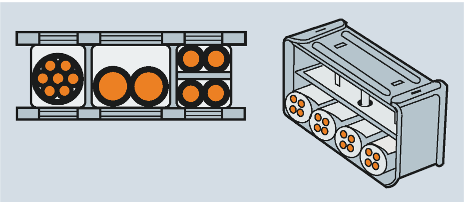
3.5 Notes on the laying of cables in drag chains

The MOTION-CONNECT cables between the drive and the motor, and setpoint cables between the drive and the controller satisfy requirements for use in drag chains.

Observe the following notes when laying these cables in drag chains:

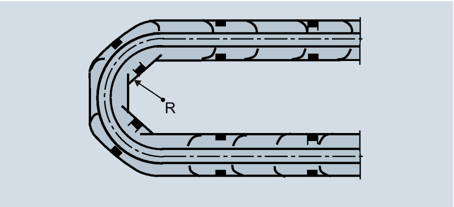
Laying cables separately in the drag chain

- To ensure a long service life of the drag chain and cable, lay cables made of different materials separately with separating webs in the drag chain.
- Fill the webs evenly to ensure that the position of cables does not change during operation.
- Distribute cables as symmetrically as possible according to their weights and dimensions.
- Use webs to separate cables with different outer diameters.
- Keep cables untwisted in the drag chain.



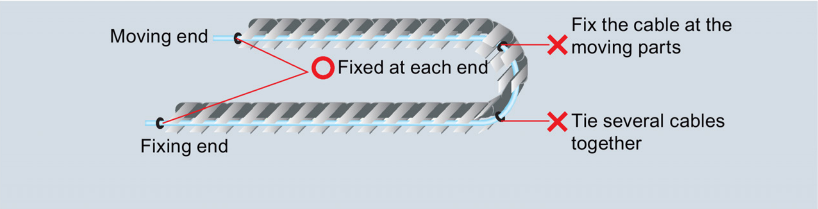
Observing minimum bending radius requirements

- Cables must be able to move without constraint, especially in the bending radii of the chain.
- Observe the specified minimum bending radii.



Fixing cables

- Make sure that cables in the drag chain are unattached and movable.
- Place the cable fixture in a "dead" zone at each end, suitably far away from each end point of the moving parts.



4 System connection

Third-party motors that can be operated

You can operate standard asynchronous motors from other manufacturers with the inverter:

NOTICE
Motor damage due to the use of an unsuitable third-party motor A higher load occurs on the motor insulation in inverter mode than with mains operation. Damage to the motor winding may occur as a result. • Please observe the notes in the System Manual "Requirements for third-party motors"

Additional information is provided on the Internet: Requirements for third-party motors (https://support.industry.siemens.com/cs/ww/en/view/79690594)

NOTICE
Damage to the control system The high-voltage components have strong interference on 24 VDC power supplies. If the 24 VDC power supply is not isolated from high-voltage components, the control system may be damaged. The 24 VDC protective extra-low voltage **must** be generated as a protective extra-low voltage with safe electrical isolation (according to IEC 204-1, Section 6.4, PELV), and grounded by with a PELV M signal connection to the central grounding point of the system.

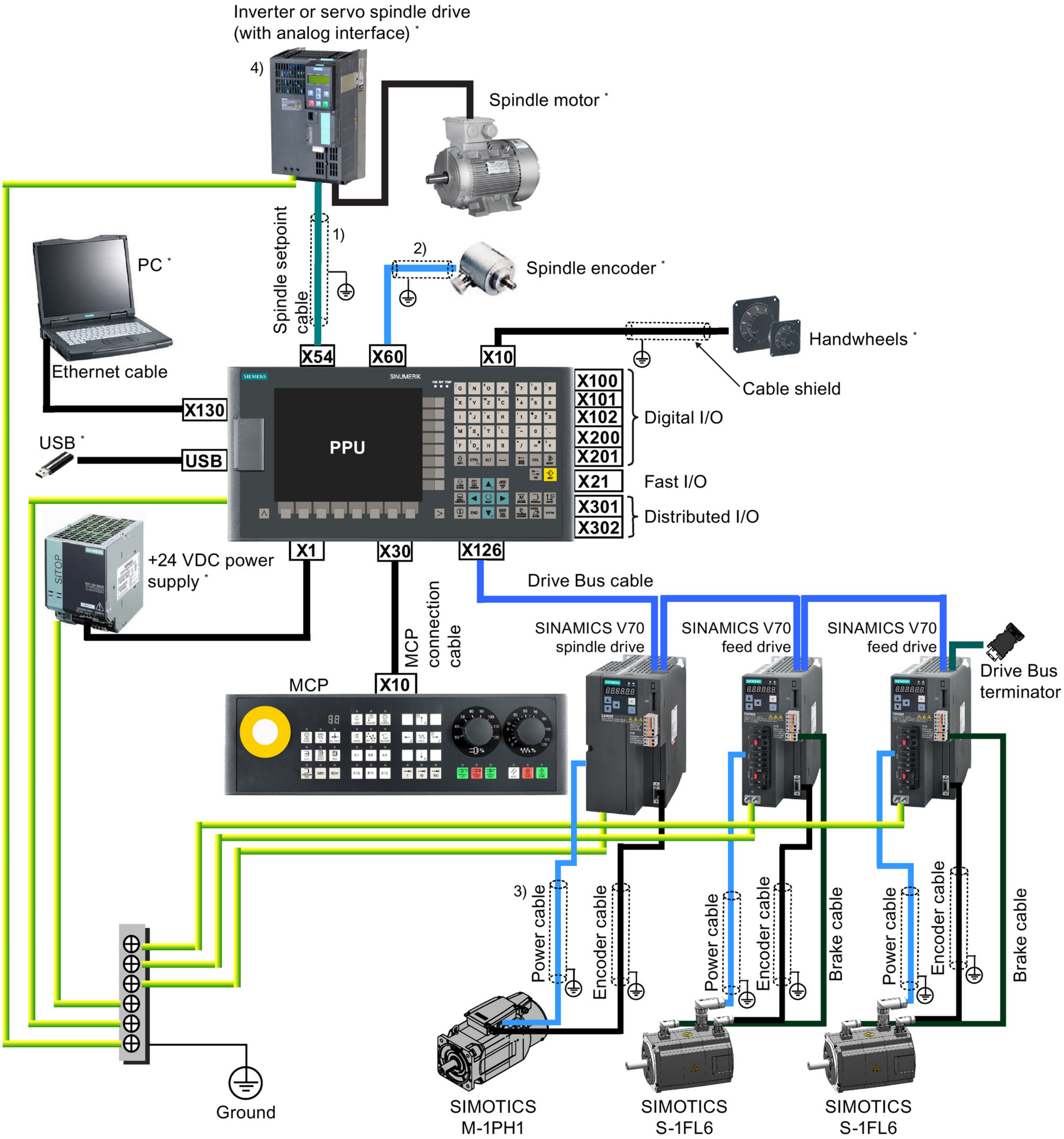
Note

By using an extra-low voltage, all interfaces have protective separation according to Class DVC A (SELV/PELV).

4.1 System connection overview

SINUMERIK 808D ADVANCED control system

The following configuration shows a typical example of the SINUMERIK 808D ADVANCED T controller (PPU161.3) with the SINAMICS V70 servo system, controlling two feed axes and one digital spindle. Note that the devices with an asterisk ("*") are not included in the scope of delivery.



1), 2) For more information about cable shield connection, see Section "Analog spindle interface - X54, spindle encoder interface - X60 (Page 89)".

3) For more information about cable shield connection, see Section "Connecting the drive to the motor (Page 110)".

4) For more information about configuring the analog spindle, see Section "Configuring the drives (Page 210)" or "Configuring an additional spindle (Page 238)".

Note

For more information about connecting the drive to a line filter or an external braking resistor, see Section "Connecting the drive to the motor (Page 110)".

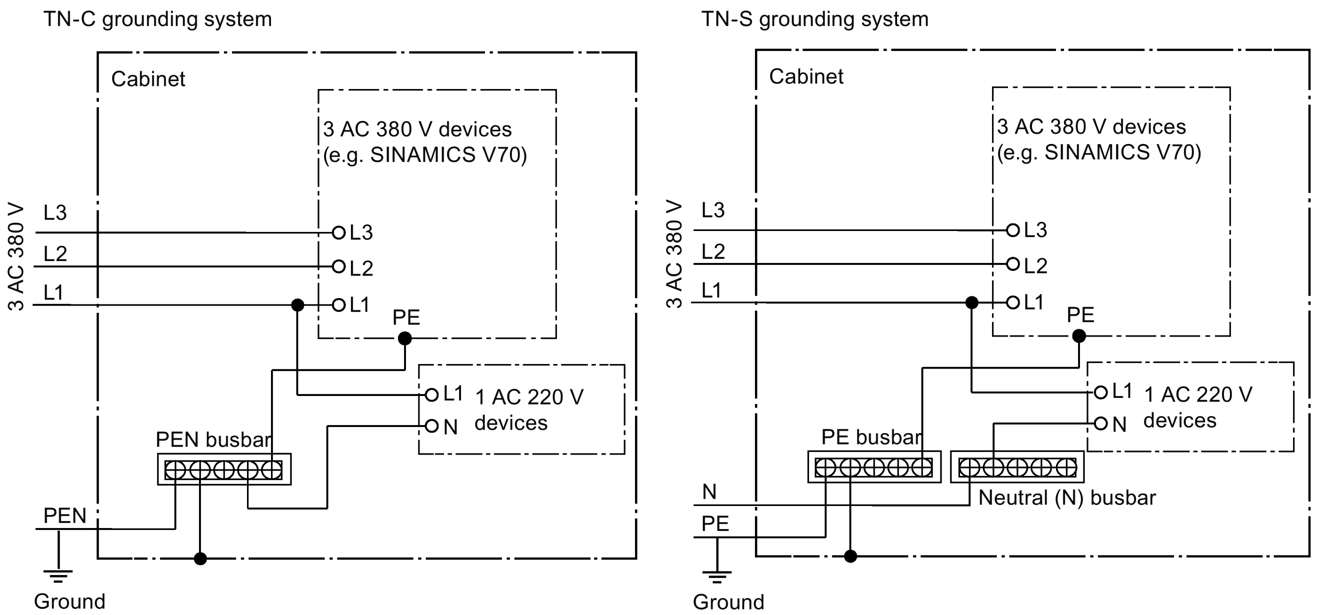
CAUTION

Personal injury and damage to property from inadequate protection

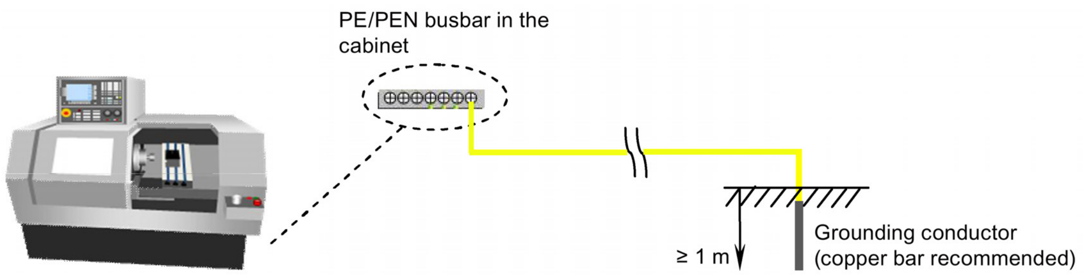
Inadequate protection may cause minor personal injury or damage to property.

- Using a copper protective earth conductor with a cross section of 10 mm² to connect the PE terminal of V70 to the protective earth. For the NC and 24 VDC power supply, there are no special requirements of the cross section of the copper protective earth conductor. For the inverter or servo spindle drive, it is recommended to refer to the relevant specifications to confirm the cross section of the copper protective earth conductor.
- Terminals for equipotential bondings that exist in addition to terminals for PE conductors must not be used for looping-through the PE conductors.

Cabinet grounding guide



Note that the PE/PEN busbar in the cabinet must connect to the ground through a grounding cable with a cross section ≥ 10 mm² as illustrated below:



Rules for routing cables

In order to achieve the greatest possible EMC compatibility for the complete system, the following EMC measures must be carefully observed:

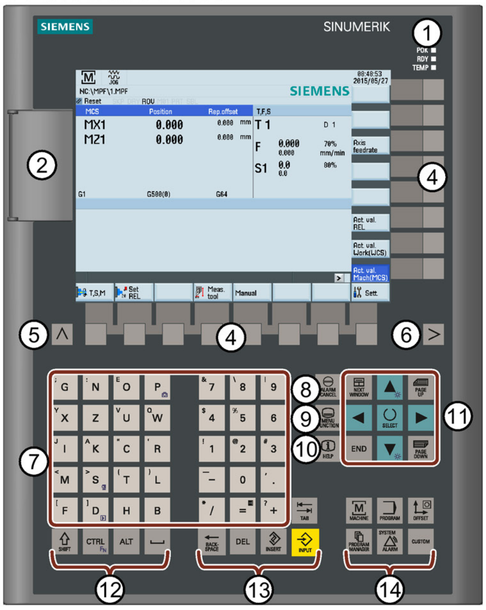
- Signal cables and power cables must be routed at the greatest possible distance from one another.
- If necessary, signal and power cables may cross one another (if possible at an angle of 90 °C), but must never be laid close or parallel to one another.
- Signal cables may not be routed close to strong external magnetic fields (e.g. motors and transformers).

- Pulse-loaded HC/HV lines must always be laid completely separately from all other lines.
- If signal lines cannot be routed a sufficient distance away from other cables, they must be installed in grounded cable ducts (metal).
- The clearance (interference injection area) between the following lines must be kept to a minimum:
  – Signal line and electrical circuit signal line (twisted)
  – Signal line and associated equipotential bonding conductor
  – Equipotential bonding conductor and protective conductor (routed together)

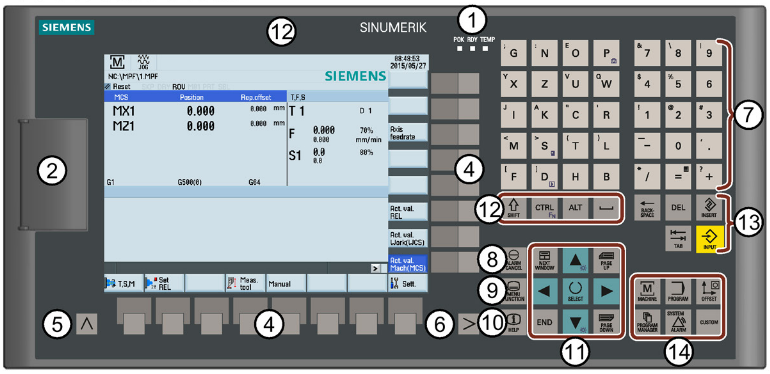
4.2 Interfaces on the PPU

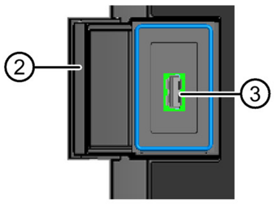
4.2.1 Control elements on the PPU

PPU160.3/PPU150.3



PPU161.3/PPU151.3





① **Status indicators**

② **Protective cover for USB interface**

③ **USB interface**

④ **Horizontal and vertical keys**
Call the corresponding vertical/horizontal softkeys on the screen

⑤ **Return key**
Returns to the next higher-level menu

⑥ **Menu extension key**
Calls the extended menu items

⑦ **Alphabetic and numeric keys**

⑧ **Alarm cancellation key**
Cancels alarms and messages that are marked with the symbol on this key

⑨ **Wizard key**
Guides you through performing basic commissioning and operation tasks

⑩ **Help key**
Calls help information

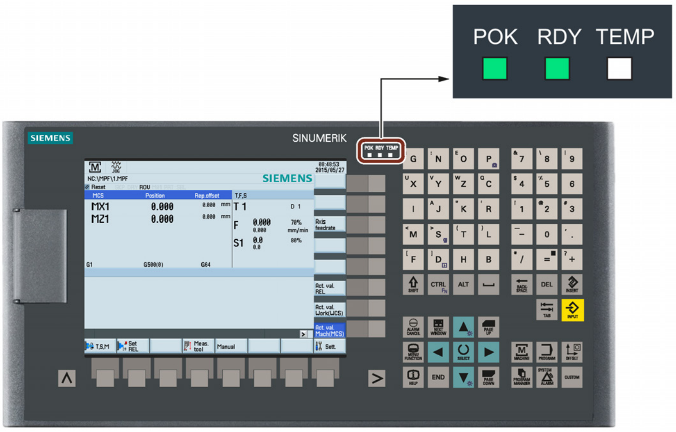
⑪ **Cursor keys**

⑫ **Modifier keys for use in key combinations**

⑬ **Edit control keys**

⑭ **Operating area keys**

4.2.2 Status LEDs on the PPU

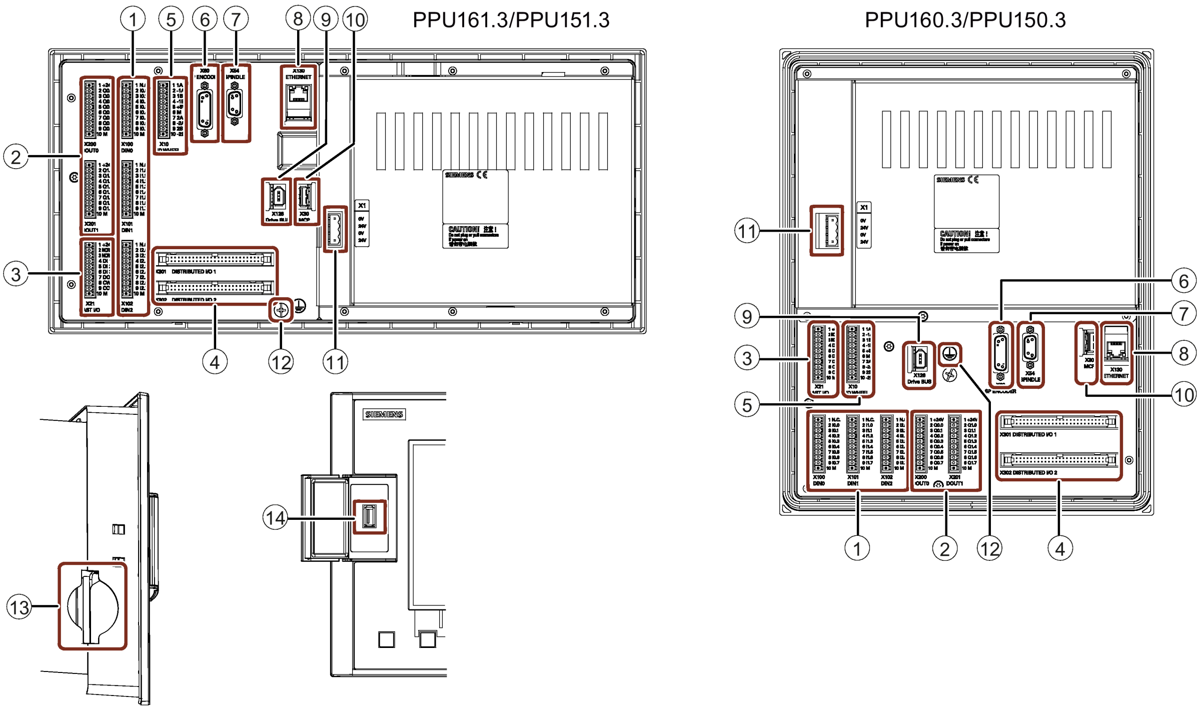


The individual LEDs and their functions are described in the table below:

LED	Color	Status	Description
POK	Green	Continuously lit	The power supply for the CNC is switched on.
RDY	Green	Continuously lit	The CNC is ready and the PLC is in run mode.
	Orange	Continuously lit	The PLC is in stop mode.
		Flashing	The PLC is in power-up mode.
	Red	Continuously lit	The CNC is in stop mode.
TEMP	Orange	Continuously lit	The CNC temperature is out of range.
	-	Off	The CNC temperature is within the specified range.

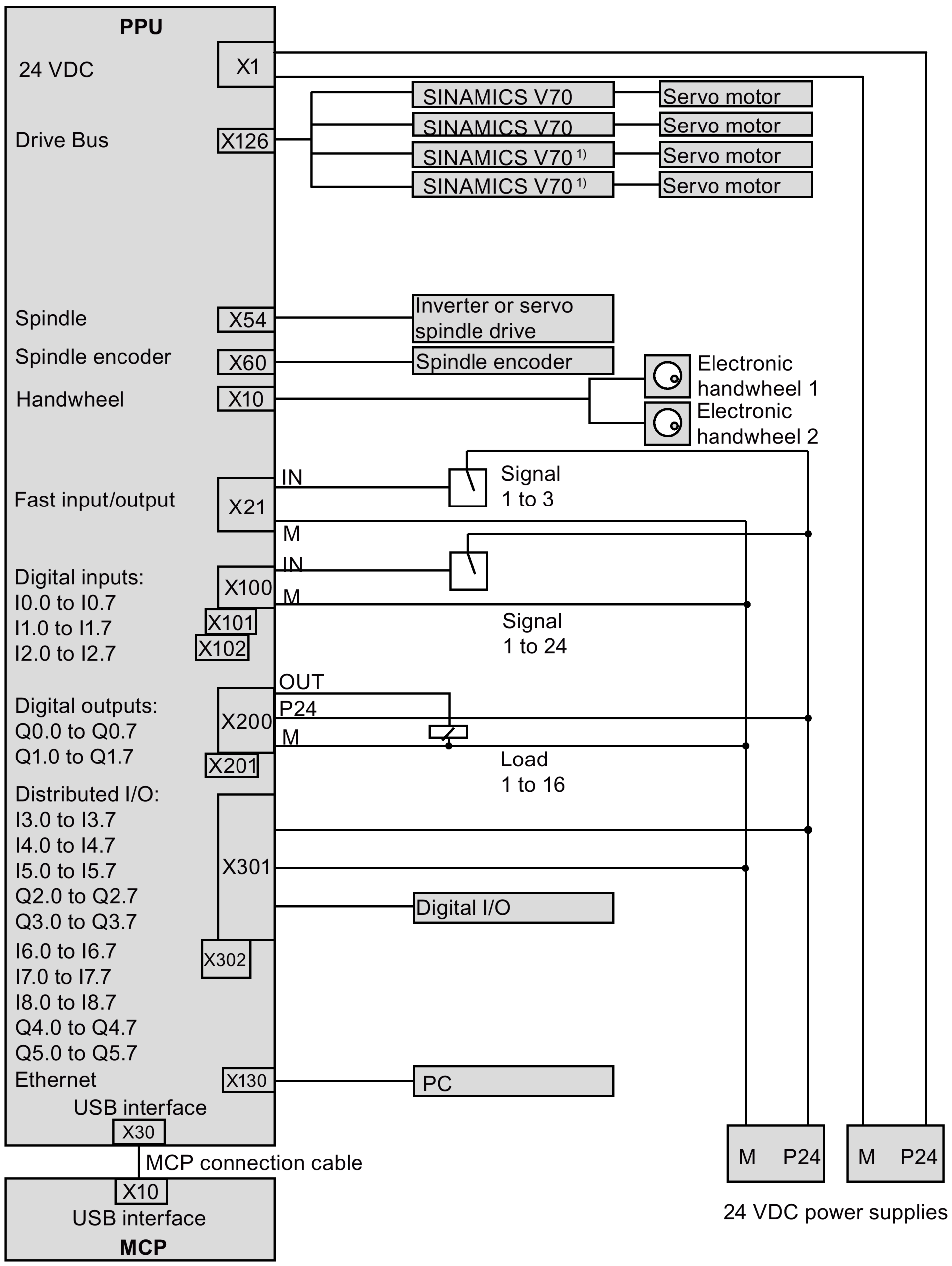
4.2.3 PPU interface overview

NOTICE
Failing to connect PE terminals to the ground will cause safety problems The PE terminals on the PPU must be connected to the ground; otherwise, it will cause safety problems and unexpected system conditions.



Legend	Interface	Description
PPU back		
①	X100, X101, X102	Digital inputs
②	X200, X201	Digital outputs
③	X21	FAST I/O
④	X301, X302	Distributed I/O
⑤	X10	Handwheel inputs
⑥	X60	Spindle encoder interface
⑦	X54	Analog spindle interface
⑧	X130	Ethernet interface
⑨	X126	Drive Bus interface
⑩	X30	USB interface, for connection with the MCP
⑪	X1	Power supply interface, +24 VDC power supply
⑫	-	PE terminal (M5 screw, tightening torque: 3 Nm), for connection with the ground
⑬	-	Slot for the system CF card
PPU front		
⑭	-	USB interface

4.2.4 Connecting the PPU



[1] For the SINUMERIK 808D ADVANCED T control system, connecting to the third and fourth drives is optional and depends upon whether you activate the software option "additional axis". For the SINUMERIK ADVANCED M control system, connecting to the fourth drive is optional and depends upon whether you activate the software option "additional axis".

4.2.5 Digital input interfaces - X100, X101, X102

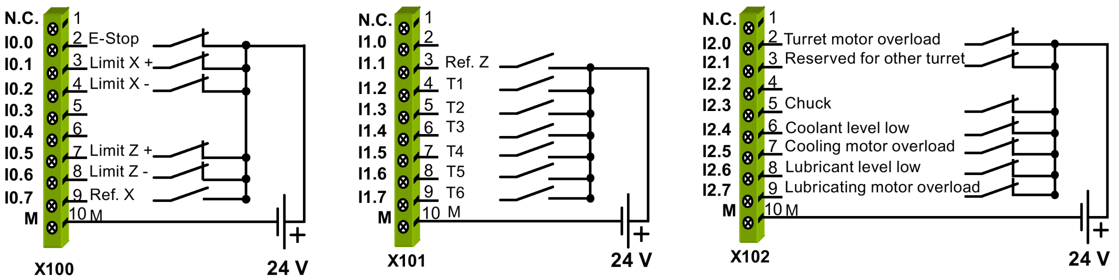
Pin assignment

Type	Mini Combicon 10-pin
Cable	Max. length: 10 m
	Max. cross-section: 1.5 mm² (when using one cable per connection)
Inputs	Permissible level (including ripple)
	High level: 20.4 V to 28.8 V Low level: -3 V to +5 V

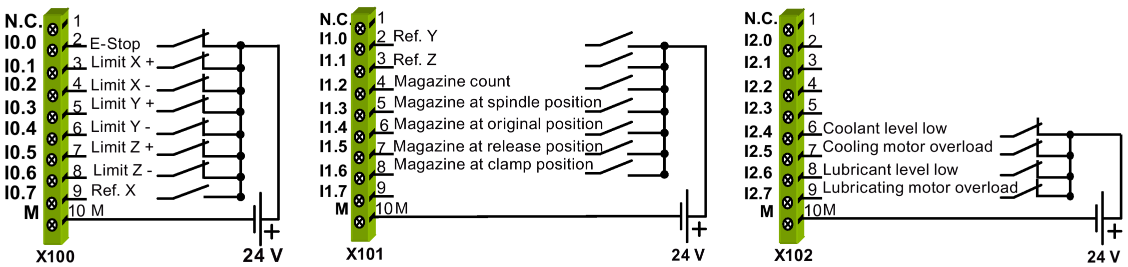
Pin	X100 (DIN0)	X101 (DIN1)	X102 (DIN2)	Remarks
1	N.C.	N.C.	N.C.	Not assigned
2	I0.0	I1.0	I2.0	Digital input
3	I0.1	I1.1	I2.1	Digital input
4	I0.2	I1.2	I2.2	Digital input
5	I0.3	I1.3	I2.3	Digital input
6	I0.4	I1.4	I2.4	Digital input
7	I0.5	I1.5	I2.5	Digital input
8	I0.6	I1.6	I2.6	Digital input
9	I0.7	I1.7	I2.7	Digital input
10	M	M	M	External ground

Connecting according to the default PLC program

Turning



Milling



Note

End sleeves are necessary if you use two cables per connection.

Fasten the cables to the screw terminals and plug the terminals into interfaces X100, X101 and X102 correctly.

4.2.6 Digital output interfaces - X200, X201

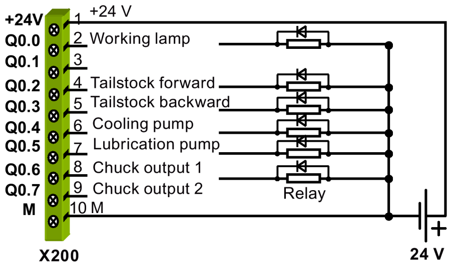
Pin assignment

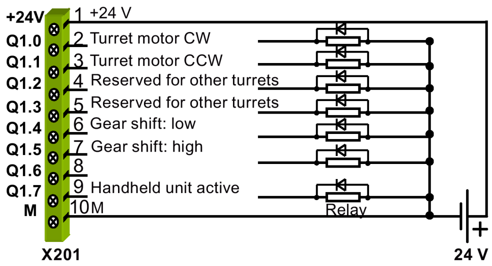
Type	Mini Combicon 10-pin
Cable	Max. length: 10 m
	Max. cross-section: 1.5 mm^2 (when using one cable per connection)
Outputs	Rated digital output current: 250 mA

Pin	X200 (DOUT0)	X201 (DOUT1)	Remarks
1	+24 V	+24 V	+24 V input (20.4 V to 28.8 V)
2	Q0.0	Q1.0	Digital output
3	Q0.1	Q1.1	Digital output
4	Q0.2	Q1.2	Digital output
5	Q0.3	Q1.3	Digital output
6	Q0.4	Q1.4	Digital output
7	Q0.5	Q1.5	Digital output
8	Q0.6	Q1.6	Digital output
9	Q0.7	Q1.7	Digital output
10	M	M	External ground

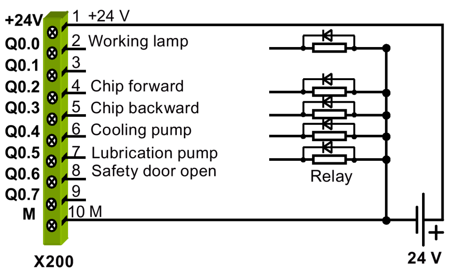
Connecting according to the default PLC program

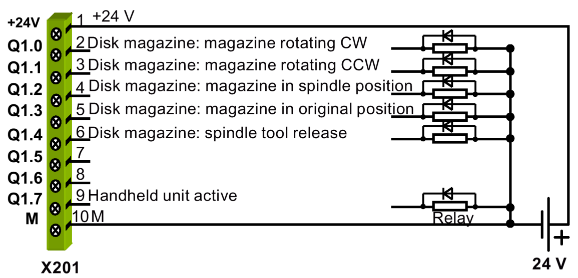
Turning





Milling





Note

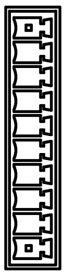
End sleeves are necessary if you use two cables per connection.

Fasten the cables to the screw terminals and plug the terminals into interfaces X200, X201 correctly.

4.2.7 Fast input/output - X21

Pin assignment

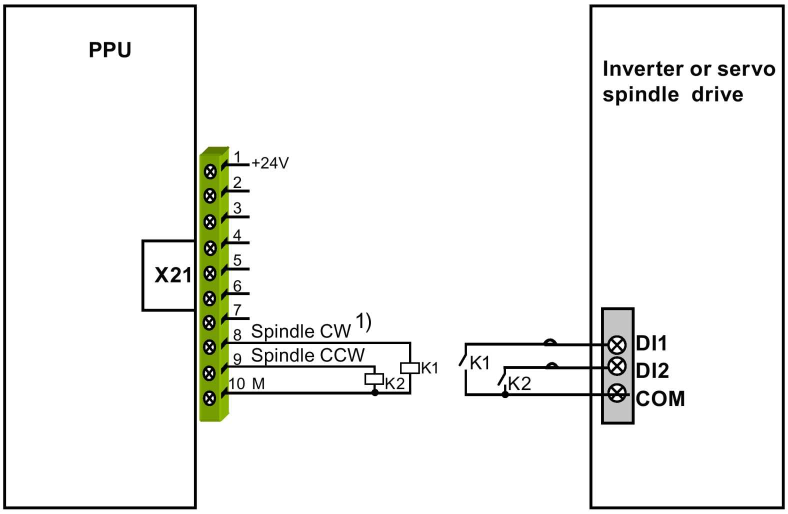
Type	Mini Combicon 10-pin
Cable	Shielded cable Max. length: 10 m Max. cross-section: 1.5 mm² (when use one cable per connection)
Inputs	Permissible level (including ripple) High level: 20.4 V to 28.8 V Low level: -3 V to +5 V

Illustration	Pin	Signal	Comment
 1 +24 V 2 NCRDY_K1 3 NCRDY_K2 4 DI 1 5 DI 2 6 DI 3 7 DO 1 8 CW 9 CCW 10 M X21 FAST I/O	1	+24 V	+24 V input (20.4 V to 28.8 V)
	2	NCRDY_1	NC ready signal contact 1
	3	NCRDY_2	NC ready signal contact 2
	4	DI1	Digital input, for connection to probe 1
	5	DI2	Digital input, for connection to probe 2
	6	BERO_SPINDLE or DI3 [1)]	Spindle bero or digital input
	7	DO1	Fast output
	8	CW	Spindle rotating clockwise
	9	CCW	Spindle rotating counter-clockwise
	10	M	Ground

1) A BERO proximity switch can be used only when an analog spindle drive is connected through the PPU interface X54 (no V70 spindle drive is connected) and a motor encoder is connected through the PPU interface X60.

Connecting

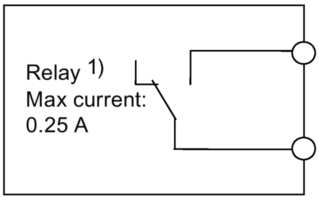
You can connect the fast I/O to the inverter to control the spindle rotating direction (unipolar):



1) See the following table for the enable status of pin 8 and pin 9 when the spindle rotates clockwise or counter-clockwise respectively for unipolar 1 and unipolar 2.

Setpoint output	Spindle CW		Spindle CCW	
	Pin 8	Pin 9	Pin 8	Pin 9
Unipolar 1	On	Off	On	On
Unipolar 2	On	Off	Off	On

NC readiness is in the form of a relay contact (NO). It must be integrated into an EMERGENCY STOP circuit. The connection diagram is shown as follows:



1) When the NC is not ready, the contact is open; otherwise, the contact is closed.

Connection cables

End sleeves are necessary if you use two cables per connection.

Fasten the cables to the screw terminals and plug the terminal into the interface X21.

You can buy the shielded cables from a third-party manufacturer.

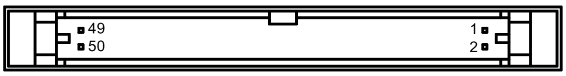
Note

To ensure optimum interference immunity, use only the shielded cable to connect the FAST I/O terminals (X21).

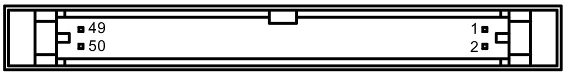
4.2.8 Distributed I/O - X301, X302

Pin assignment

Type	50-pin socket
Inputs	Permissible level (including ripple)
	High level: 20.4 V to 28.8 V
	Low level: -3 V to +5 V
Outputs	Rated digital output current: 250 mA

Pin	Signal	Comment	Pin	Signal	Comment
 X301 DISTRIBUTED I/O 1					
1	M	External ground	26	I5.7	Digital input
2	+24 V	+24 V output 1)	27	-	Not assigned
3	I3.0	Digital input	28	-	Not assigned
4	I3.1	Digital input	29	-	Not assigned
5	I3.2	Digital input	30	-	Not assigned
6	I3.3	Digital input	31	Q2.0	Digital output
7	I3.4	Digital input	32	Q2.1	Digital output
8	I3.5	Digital input	33	Q2.2	Digital output
9	I3.6	Digital input	34	Q2.3	Digital output
10	I3.7	Digital input	35	Q2.4	Digital output
11	I4.0	Digital input	36	Q2.5	Digital output
12	I4.1	Digital input	37	Q2.6	Digital output
13	I4.2	Digital input	38	Q2.7	Digital output
14	I4.3	Digital input	39	Q3.0	Digital output
15	I4.4	Digital input	40	Q3.1	Digital output

Pin	Signal	Comment	Pin	Signal	Comment
16	I4.5	Digital input	41	Q3.2	Digital output
17	I4.6	Digital input	42	Q3.3	Digital output
18	I4.7	Digital input	43	Q3.4	Digital output
19	I5.0	Digital input	44	Q3.5	Digital output
20	I5.1	Digital input	45	Q3.6	Digital output
21	I5.2	Digital input	46	Q3.7	Digital output
22	I5.3	Digital input	47	+24 V	+24 V input
23	I5.4	Digital input	48	+24 V	+24 V input
24	I5.5	Digital input	49	+24 V	+24 V input
25	I5.6	Digital input	50	+24 V	+24 V input



X302 DISTRIBUTED I/O 2

Pin	Signal	Comment	Pin	Signal	Comment
1	M	External ground	26	I8.7	Digital input
2	+24 V	+24 V output [1)]	27	-	Not assigned
3	I6.0	Digital input	28	-	Not assigned
4	I6.1	Digital input	29	-	Not assigned
5	I6.2	Digital input	30	-	Not assigned
6	I6.3	Digital input	31	Q4.0	Digital output
7	I6.4	Digital input	32	Q4.1	Digital output
8	I6.5	Digital input	33	Q4.2	Digital output
9	I6.6	Digital input	34	Q4.3	Digital output
10	I6.7	Digital input	35	Q4.4	Digital output
11	I7.0	Digital input	36	Q4.5	Digital output
12	I7.1	Digital input	37	Q4.6	Digital output
13	I7.2	Digital input	38	Q4.7	Digital output
14	I7.3	Digital input	39	Q5.0	Digital output
15	I7.4	Digital input	40	Q5.1	Digital output
16	I7.5	Digital input	41	Q5.2	Digital output
17	I7.6	Digital input	42	Q5.3	Digital output
18	I7.7	Digital input	43	Q5.4	Digital output
19	I8.0	Digital input	44	Q5.5	Digital output
20	I8.1	Digital input	45	Q5.6	Digital output
21	I8.2	Digital input	46	Q5.7	Digital output
22	I8.3	Digital input	47	+24 V	+24 V input
23	I8.4	Digital input	48	+24 V	+24 V input
24	I8.5	Digital input	49	+24 V	+24 V input
25	I8.6	Digital input	50	+24 V	+24 V input

[1)] Make sure that the current at pin 2 of X301 or X302 does not exceed the maximum current I_{out} = 0.25 A; otherwise, the controller could be damaged.

Connecting

⚠ WARNING
Electric shock due to connection to an unsuitable power supply
When equipment is connected to an unsuitable power supply, exposed components may carry a hazardous voltage that might result in serious injury or death.
• The 24 V power supply must be protective extra-low voltage in accordance with EN60204-1, Section 6.4, PELV (with M ground).

⚠ CAUTION
Damage to power supply due to incorrect grounding
Be sure not to connect pin 2 of X301/302 to ground; otherwise, the power supply of the control system could be damaged.

Note

The 24 V output of X301/302 pin 2 comes from pins 47 to 50.

Note

Addressing ranges

X301: IB3, IB4, IB5, QB2, QB3

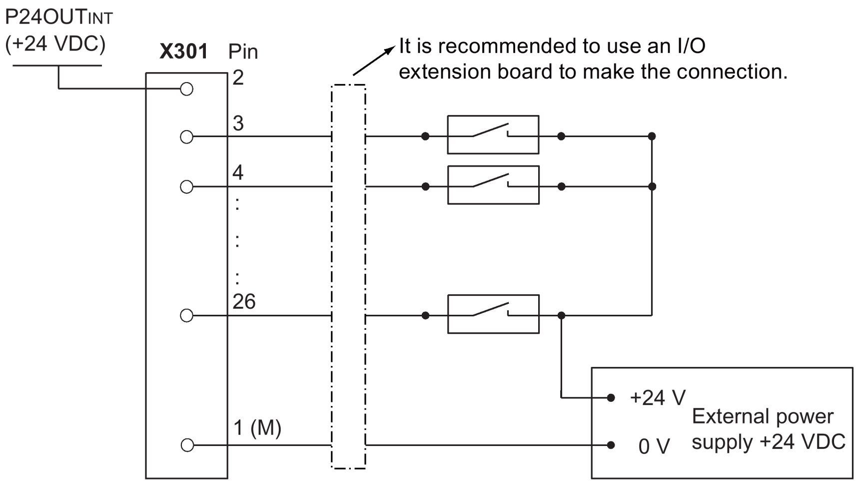
X302: IB6, IB7, IB8, QB4, QB5

Note

The connecting cable between the power source, load current supply connection, and associated reference potential M must **not** exceed the maximum permissible length of 10 m.

Digital inputs

The diagram below shows you how to connect the connector pins of the digital inputs at interface X301 (example). You can connect connector X302 in the same way.

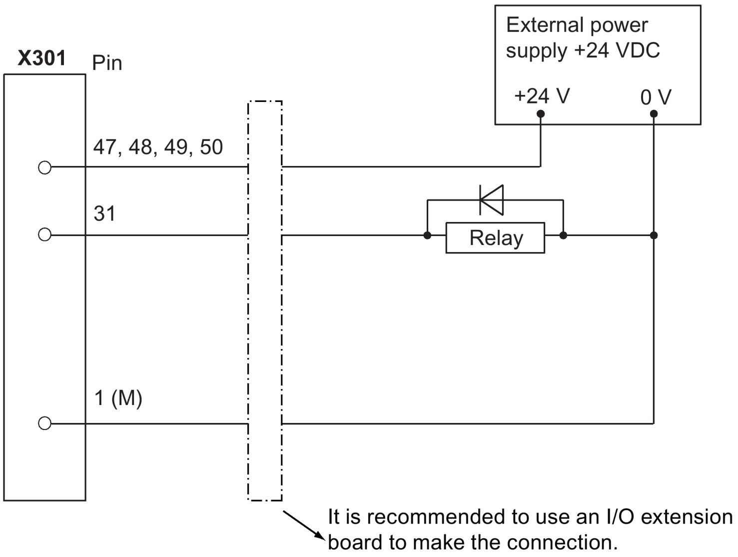


Note

When using an external power supply, you must connect the 24 V (permissible range: 20.4 V to 28.8 V) power supply for the digital outputs to **all the four power input pins** (X301, X302: **pins 47, 48, 49, 50**).

Digital outputs

The diagram below shows you how to connect the connector pins of the digital outputs at interface X301 (example). You can connect connector X302 in the same way.



To supply the digital outputs, you must connect an external 24 VDC power supply (X301, X302: pins 47, 48, 49, 50).

You must also connect the reference ground of the external power supply to X301, X302: Pin 1 (M).

Note

You must ensure that the maximum current consumption at pin 47, pin 48, pin 49 or pin 50 does **not** exceed 1 A.

Note

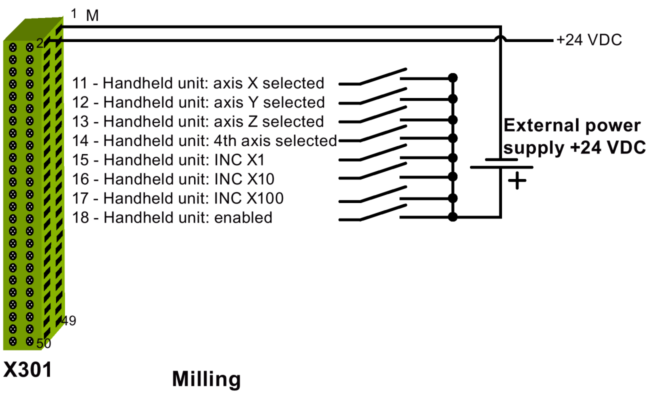
You must connect the 24 V power supply for the digital outputs to **all the four power input pins** (X301, X302: **pins 47, 48, 49, 50**).

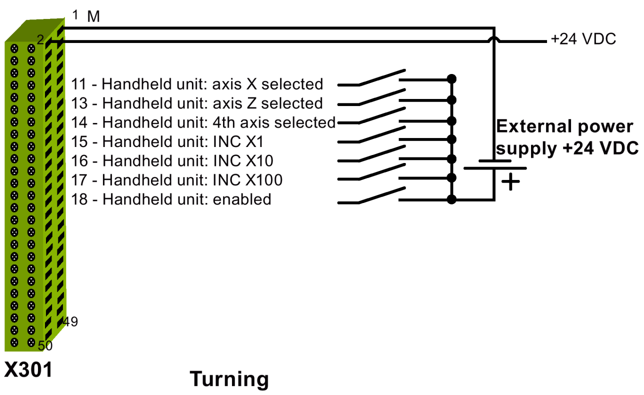
External power supply

When using an external power supply for the digital inputs, you must connect the reference ground to X301, X302: Pin 1 (M).

Connecting according to the default PLC program

The control system has integrated with a default PLC application. If you perform the commissioning work with the default PLC application, arrange wiring as follows.

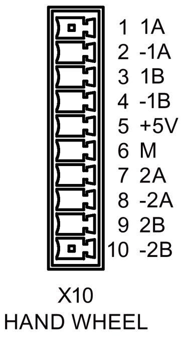




4.2.9 Handwheel inputs - X10

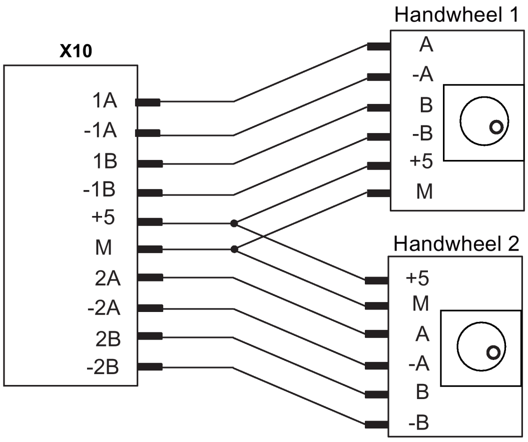
Pin assignment

Type	Mini Combicon 10-pin
Cable	Less than 3 m

Illustration	Pin	Signal	Comment
	1	1A	Track A, handwheel 1
	2	-1A	Negative Track A, handwheel 1
	3	1B	Track B, handwheel 1
	4	-1B	Negative Track B, handwheel 1
	5	+5 V	+5 V power output
	6	M	Ground
	7	2A	Track A, handwheel 2
	8	-2A	Negative Track A, handwheel 2
	9	2B	Track B, handwheel 2
	10	-2B	Negative Track B, handwheel 2

Connecting

You are allowed to connect at most two electronic handwheels at connector X10 on the PPU.



The handwheels must meet the following requirements:

Transmission procedure	5 V square wave signals (TTL level or RS422)
Signals	Track A as a true and negative signal ($U_{a1}U_{a1}$)
	Track B as a true and negative signal ($U_{a2}U_{a2}$)
Max. input frequency	500 kHz
Phase shift between Track A to Track B	$90^{o} \pm 30^{o}$
Supply	5 V, max. 250 mA

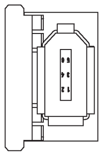
4.2.10 Drive Bus interface - X126

Pin assignment

Type IEEE 1394, 6-pin, female

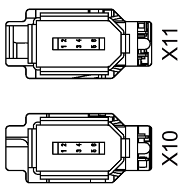
Cable Type: Drive Bus cable

Max. length: 20 m

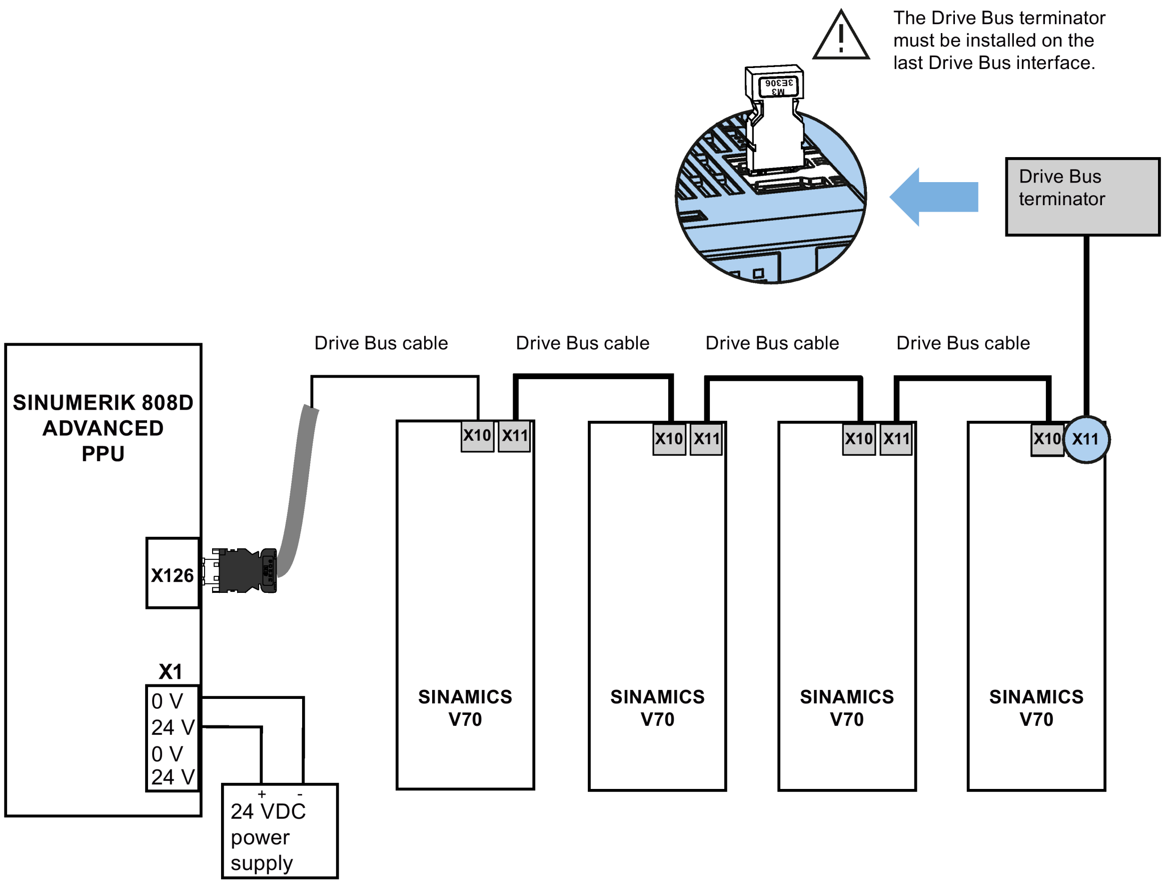
Illustration	Pin	Signal	Comment
 X126 Drive BUS	1	PB_N	Negative RxD/TxD of Drive Bus
	2	1P5	+5 V
	3	PB	Positive RxD/TxD of Drive Bus
	4	NULL	Not connected
	5	PB_RTS	Request to send
	6	1M5	Ground

Connecting

Drive Bus interfaces on the SINAMICS V70 - X10, X11

Illustration	Pin No.	Signal	Description
	1	A	Differential signal A
	2	P5PB	+ 5 V
	3	B	Differential signal B
	4	NC	Not assigned
	5	RTS	Request to send
	6	MPB	0 V

Connecting example



Note

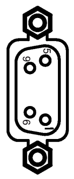
You must install the Drive Bus terminator (that ships with the PPU) on X11 of the last servo drive; otherwise, the servo system cannot work normally.

4.2.11 Analog spindle interface - X54, spindle encoder interface - X60

Interface X54 is for connecting the PPU to the inverter or servo spindle drive. Interface X60 is for connecting the PPU to the spindle encoder.

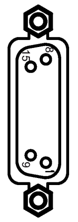
Pin assignment - X54

Type	Sub-D, 9-pin, female
Cable	Max. length: 10 m

Illustration	Pin	Signal	Comment
 X54 SPINDLE	1	AO	Analog voltage
	2	-	not assigned
	3	-	not assigned
	4	-	not assigned
	5	SE1	Analog drive enable (contact: electrically isolated n.o. contact)
	6	SE2	Analog drive enable (contact: electrically isolated n.o. contact)
	7	-	not assigned
	8	-	not assigned
	9	AGND	Ground

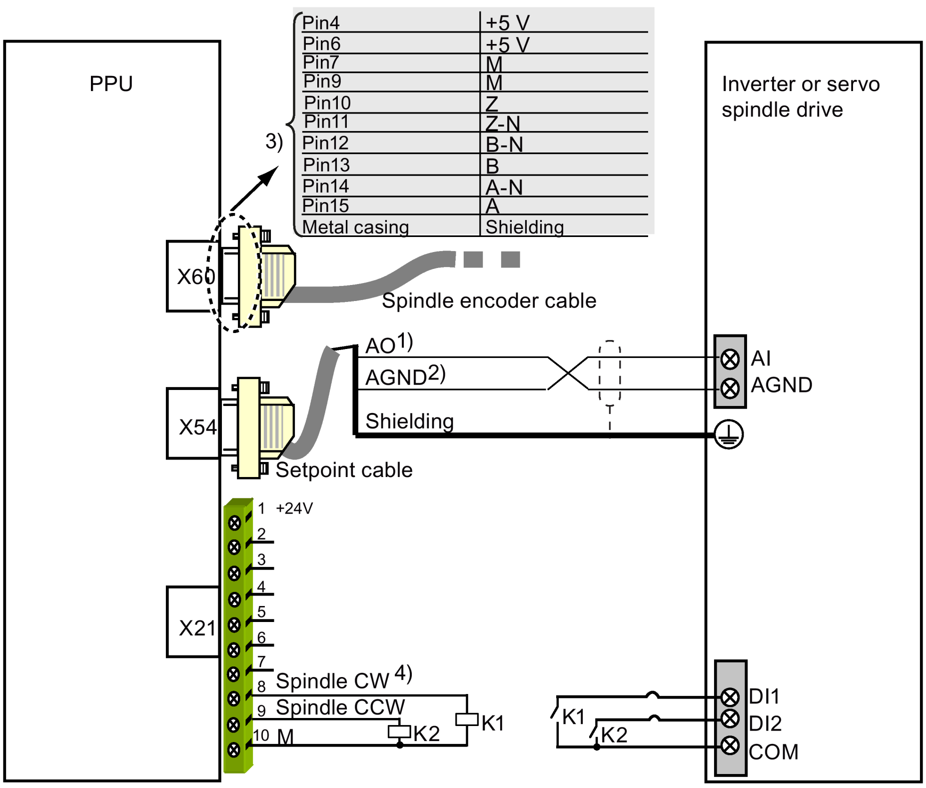
Pin assignment - X60

Type	Sub-D, 15-pin, female
Cable	Type: encoder cable Max. length: 10 m
Max. frequency	2 MHz

Illustration	Pin	Signal	Comment
 X60 SP ENCODER	1	-	Not assigned
	2	-	Not assigned
	3	-	Not assigned
	4	+5 V	+5 V power supply
	5	-	Not assigned
	6	+5 V	+5 V power supply
	7	M	Ground
	8	-	Not assigned
	9	M	Ground
	10	Z	Zero mark
	11	Z_N	Zero mark, negative
	12	B_N	Track B, negative
	13	B	Track B
	14	A_N	Track A, negative
	15	A	Track A

Connecting

Connecting the inverter or servo spindle drive (unipolar)



[1] 10 V analog voltage

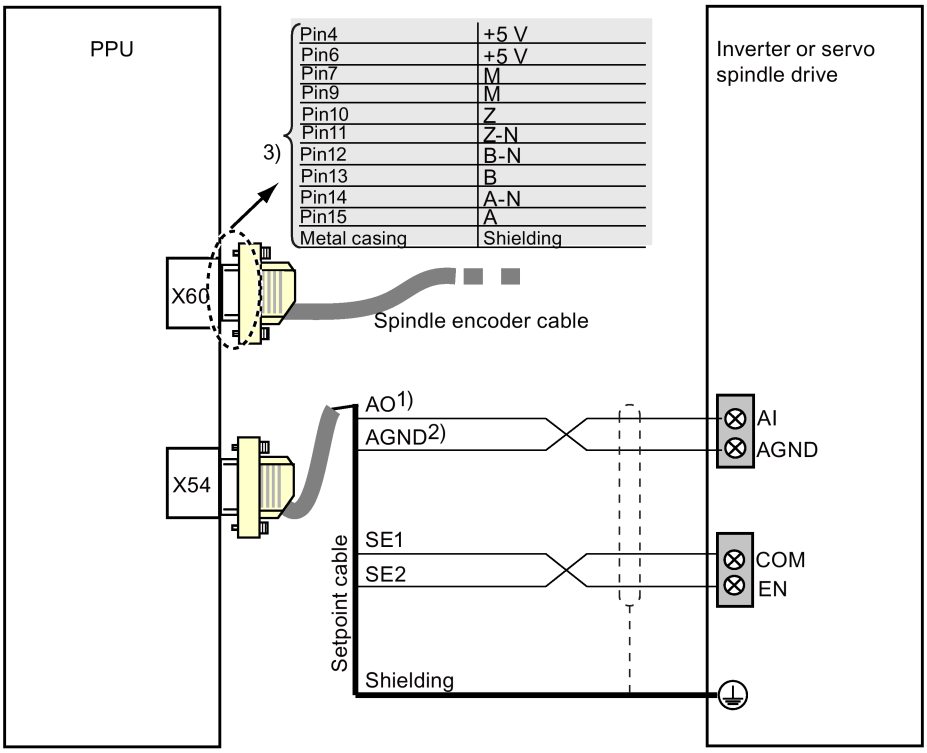
[2] 0 V signal

3) Use twisted pair cables for signals A/A_N, B/B_N, Z/Z_N, and +5 V/M.

4) See the following table for the enable status of pin 8 and pin 9 when the spindle rotates clockwise or counter-clockwise respectively for unipolar 1 and unipolar 2.

Setpoint output	Spindle CW		Spindle CCW	
	Pin 8	Pin 9	Pin 8	Pin 9
Unipolar 1	On	Off	On	On
Unipolar 2	On	Off	Off	On

Connecting the inverter or servo spindle drive (bipolar)



1) +/- 10 V analog voltage

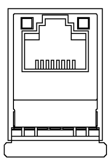
2) 0 V signal

3) Use twisted pair cables for signals A/A_N, B/B_N, Z/Z_N, and +5 V/M.

4.2.12 Ethernet interface - X130

Pin assignment

Type	8-pin RJ45 socket
Cable	Type: Ethernet cable

Illustration	Pin	Signal	Comment
 X130 ETHERNET	1	MX1+	Data 1
	2	MX1-	Data 1
	3	MX2+	Data 2
	4	MX3+	Data 3
	5	MX3-	Data 3
	6	MX2-	Data 2
	7	MX4+	Data 4
	8	MX4-	Data 4

Note

The length of the Ethernet cable must be less than 30 m or the communication will be unstable.

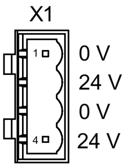
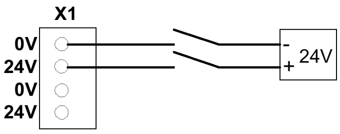
4.2.13 Power supply interface - X1

The PPU uses a 24 VDC power supply. You can connect the 24 VDC power supply via interface X1. For more information about the 24 VDC power supply, see Section "External 24 VDC power supply (Page 31)".

Pin assignment

Type Combicon 4-pin

Cable Max. length: 10 m

Illustration	Pin1	Signal	Name	Comment
	1	0 V	M24	0 V
	2	24 V	P24	+24 V
	3	0 V	M24	0 V
	4	24 V	P24	+24 V
	 **Note:** The 0 V terminals as well as the 24 V terminals are internally connected in parallel. This means that you can connect the 24 V power supply to either of the terminal pairs.			

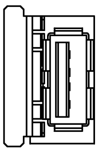
4.2.14 USB interface - X30

There is a USB interface on the back of the PPU. This USB interface is used for connecting with the MCP.

Pin assignment

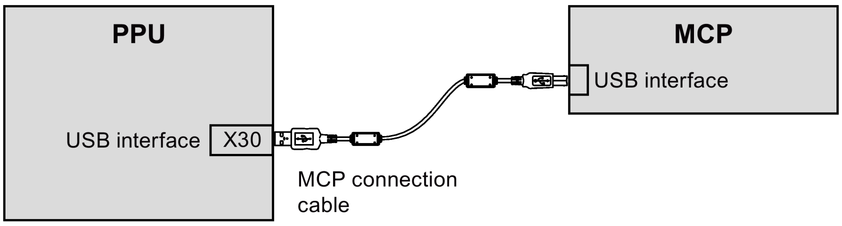
Type USB socket, type A Combicon 4-pin

Cable Type: USB cable (0.8 m)

Illustration	Pin	Signal name	Signal type	Comment
 X30 MCP	1	P5_USB0	VO	5 V power supply
	2	DM_USB0	I/O	USB data-
	3	DP_USB0	I/O	USB data+
	4	M	VO	Ground

Connecting

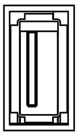
The illustration below shows the connection between the PPU and the MCP with the MCP connection cable.



4.2.15 USB interface on the front cover of the PPU

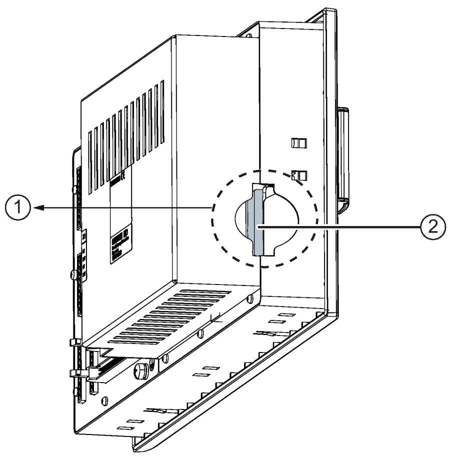
Pin assignment

Type	USB socket, type A
Cable	Type: USB 1.1 cable Length: less than 3 m
ESD protect	Contact discharge: ± 4 kV Air discharge: ± 8 kV

Illustration	Pin	Signal name	Signal type	Comment
	1	P5_USB0	VO	5 V power supply
	2	DM_USB0	I/O	USB data-
	3	DP_USB0	I/O	USB data+
	4	M	VO	Ground

4.2.16 Slot for the system CF card

The system CF card is installed on the PPU at the factory.



① Slot for the CF card

② System CF card

Note

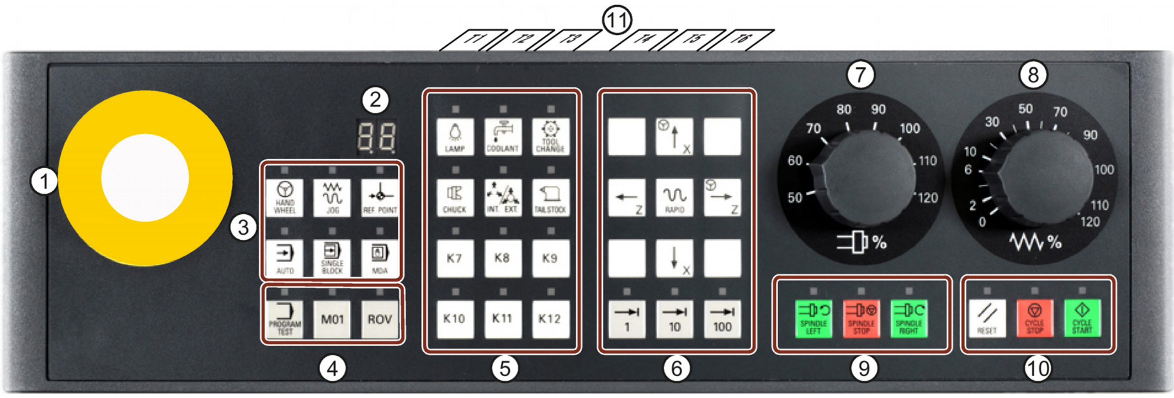
The system CF card is accessible only by the Siemens service personnel. Do not touch or remove the system CF card under any conditions.

4.3 Interfaces on the MCP

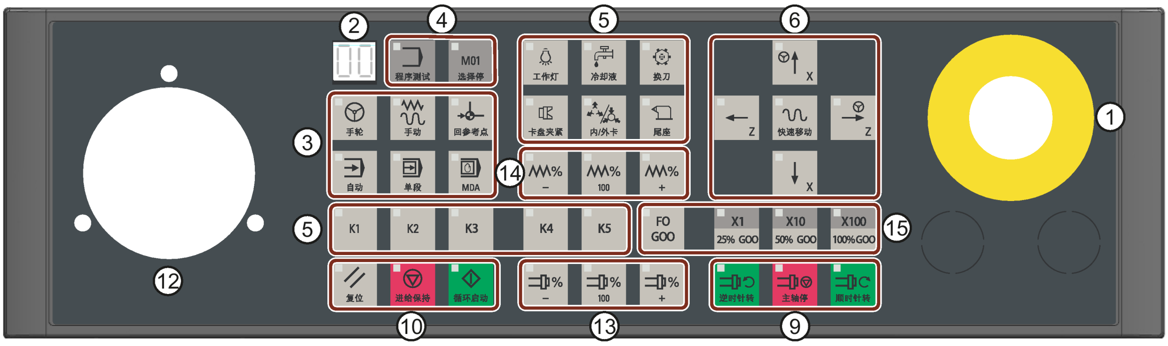
4.3.1 Control elements on the MCP

Horizontal MCP

- Variant with override switches

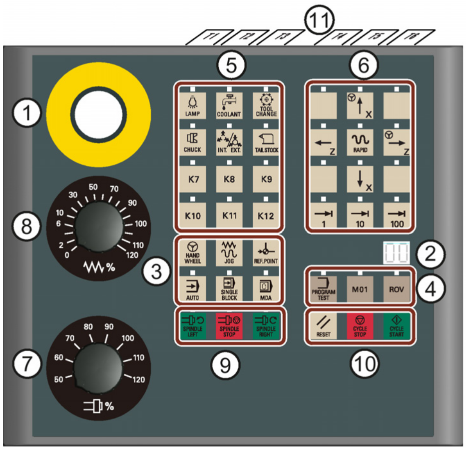


- Variant with a reserved slot for the handwheel

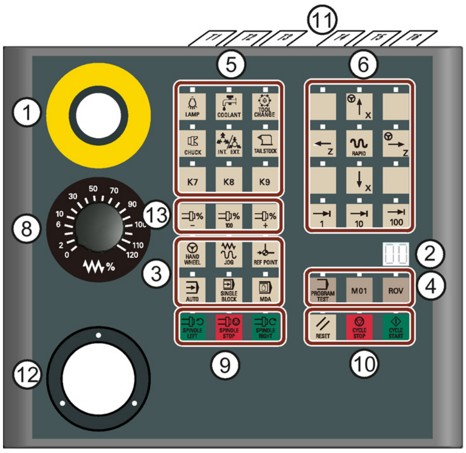


Vertical MCP

- Variant with an override switch for the spindle



- Variant with a reserved slot for the handwheel



①	Reserved hole for emergency stop button	⑨	Spindle control keys
②	Tool number display Displays the number of the currently active tool	⑩	Keys for program start, stop, and reset
③	Operating mode selection area	⑪	Pre-defined labeling strips for keys of the MCP

④ **Program control keys**

⑤ **User-defined keys**

⑥ **Axis traversing keys**

⑦ **Spindle override switch**

⑧ **Feedrate override switch**

⑫ **Reserved slot for the handwheel**

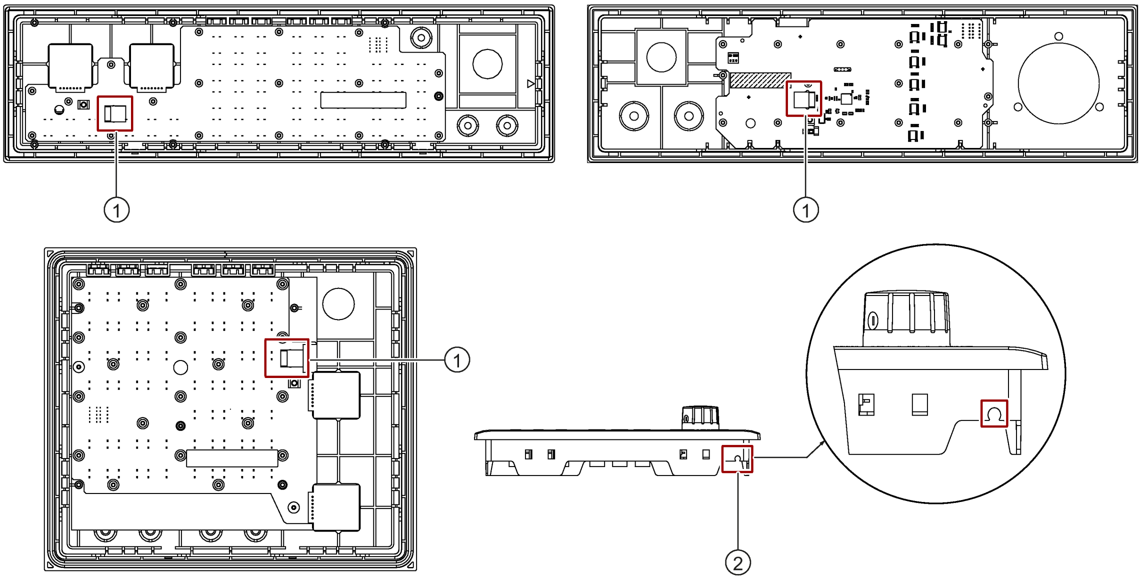
⑬ **Spindle override control keys**

⑭ **Feedrate override control keys**

⑮ **Keys for increment override/rapid traverse override ***

* The increment override can be activated in "JOG" mode, "Handwheel" mode, or "AUTO"/"MDA" mode with the contour handwheel activated. The rapid traverse override is effective only in "AUTO"/"MDA" mode with no contour handwheel activated. The "F0 G00" key can activate a rapid traverse override of 1% by default, which can be changed in the general machine data 12050[1], for example, 12050[1] = 0.15 as 15%.

4.3.2 MCP interface overview



Legend	Description
①	USB interface, for connection with the PPU
②	Reserved hole for fixing the USB cable that connects the PPU and the MCP

Note

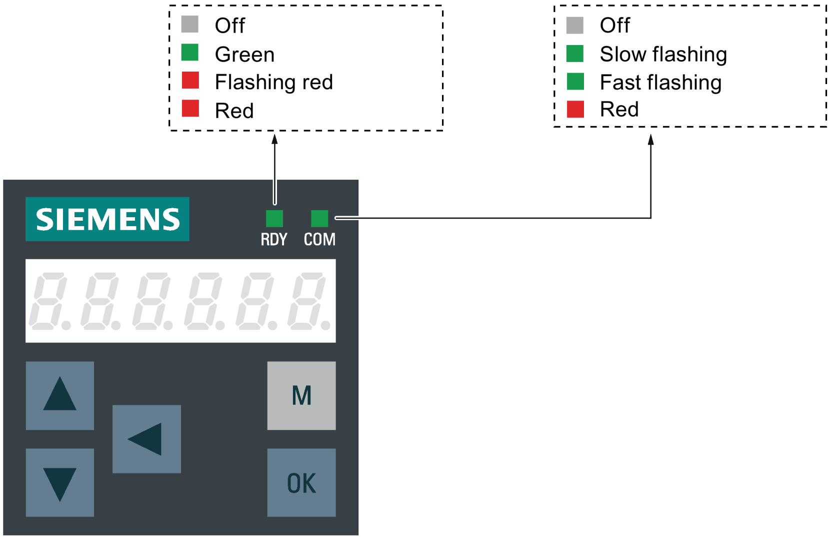
The two variants of the vertical MCP, with a reserved hole for the handwheel and with an override switch for the spindle, have the same mechanical interface design for the USB cable and reserved hole for fixing the USB cable on the back. The illustration above takes the vertical MCP with a spindle override switch for example.

4.4 Interfaces on the SINAMICS V70 servo system

The SINAMICS V70 servo system, consisting of the SINAMICS V70 servo drive and SIMOTICS servo motor, is an economical closed-loop servo drive solution for machine tool applications. It is designed for use with the SINUMERIK 808D ADVANCED controller.

4.4.1 Status LEDs on the SINAMICS V70 drive

Two LED status indicators (RDY and COM) are available to indicate drive readiness status and communication status respectively.



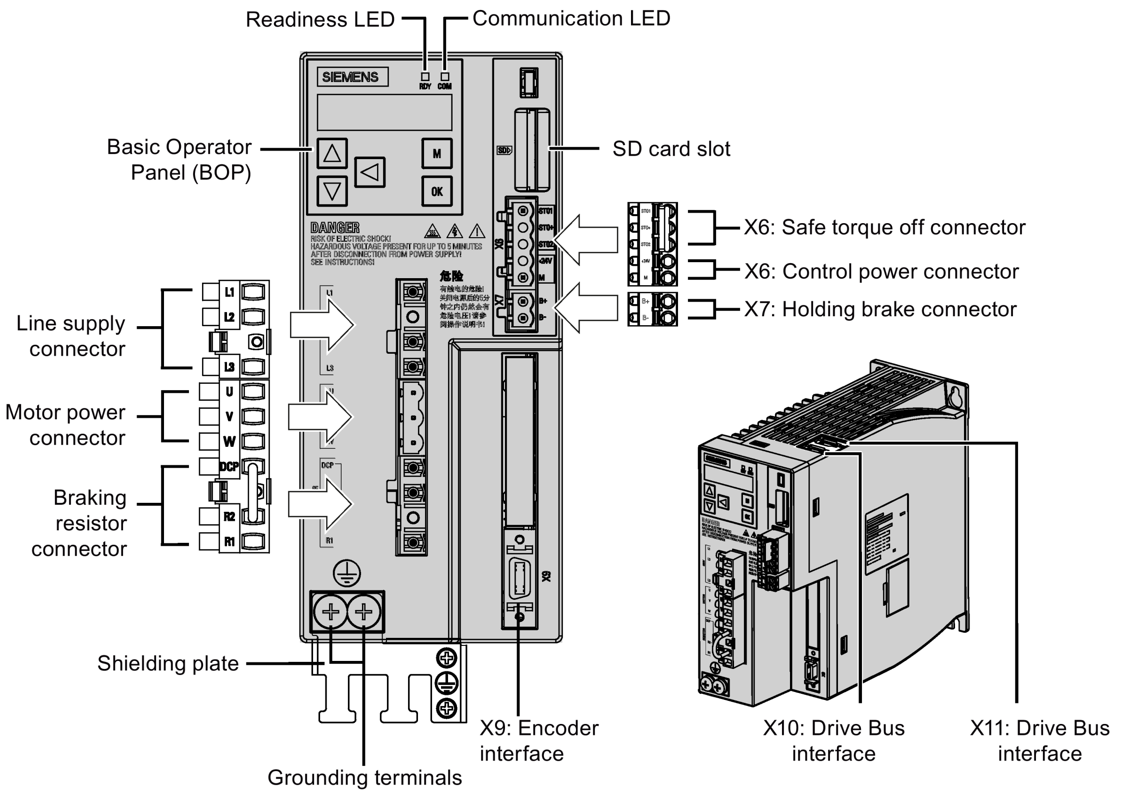
You can find detailed information about the status indications in the table below:

Status indicator	Color	Status	Description
RDY	-	Off	24V control board power supply is missing
	Green	Continuously lit	Drive is ready
	Red	Continuously lit	Enable signal is missing or drive is in startup states
		Flashing at 1 Hz	Alarms or faults occur
	Red and Orange	Flashing alternatively at an interval of 0.5 s	The servo drive is located
COM	-	Off	Communication with CNC is not active
	Green	Flashing at 0.5 Hz	Communication with CNC is active
		Flashing at 2 Hz	SD card operating (read or write)
	Red	Continuously lit	Communication with CNC is in error

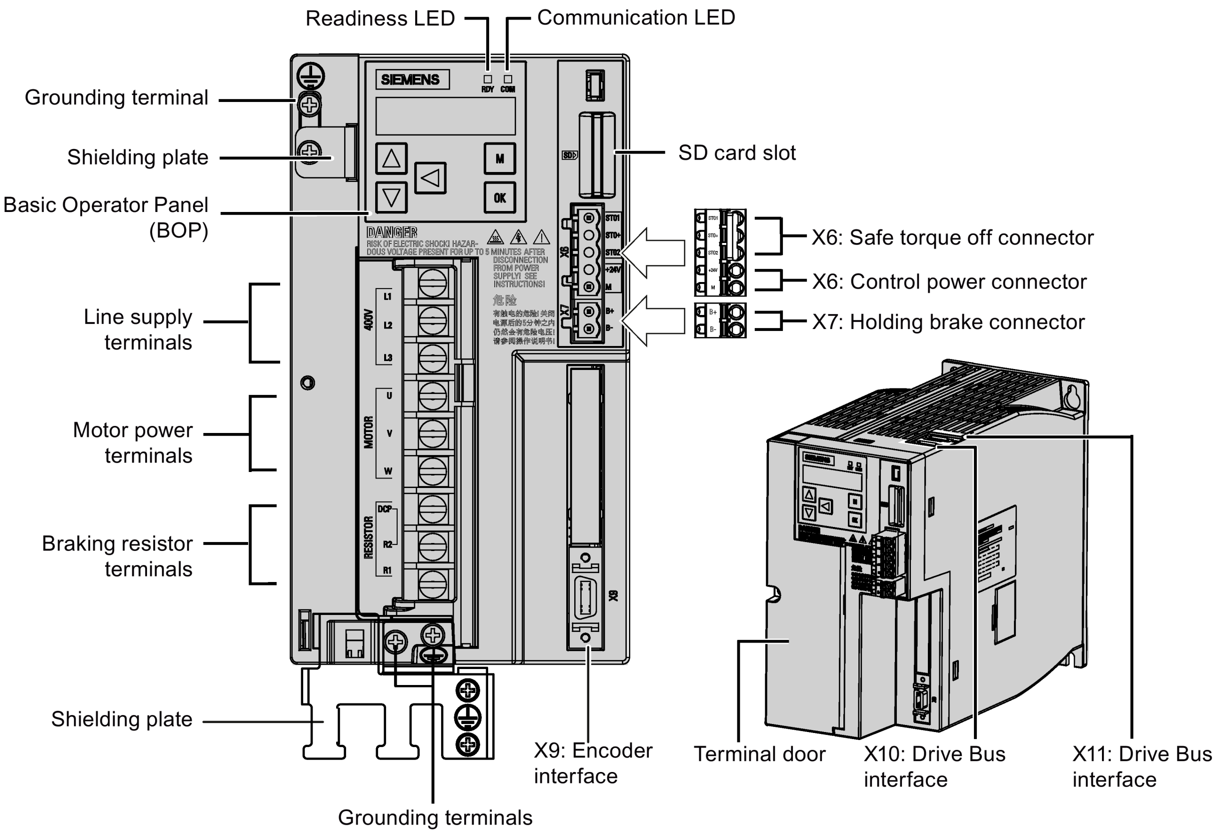
4.4.2 Interface overview

4.4.2.1 SINAMICS V70 feed servo system

SINAMICS V70 FSA (with detachable terminal blocks)



SINAMICS V70 FSB/FSC (with screw terminals)

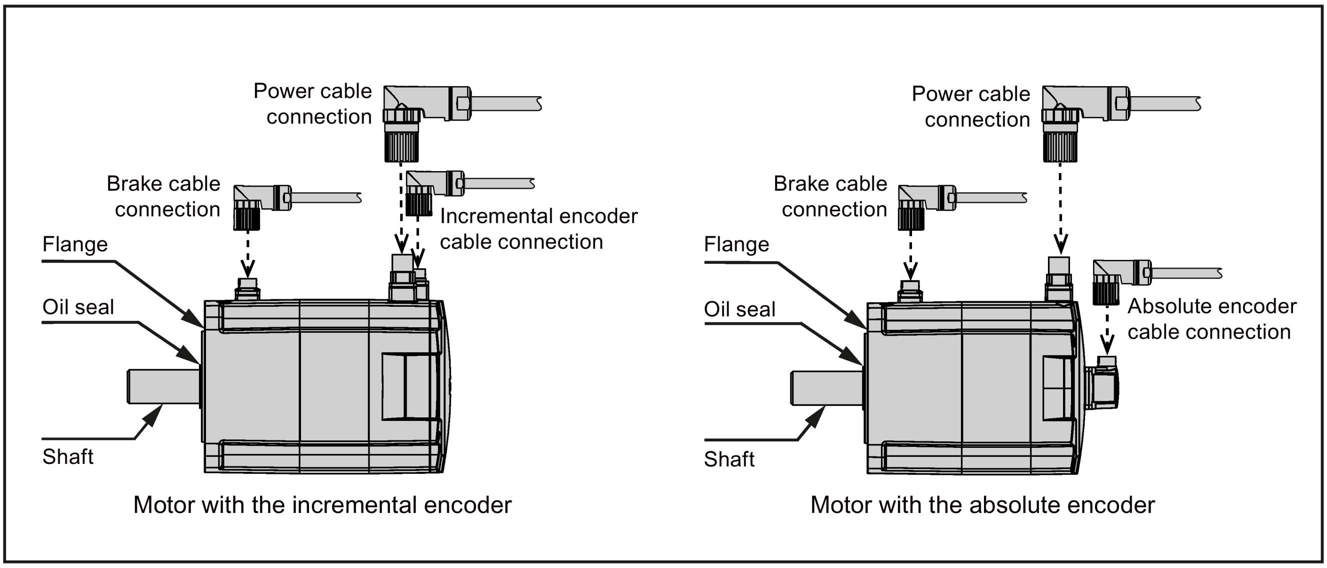


Note

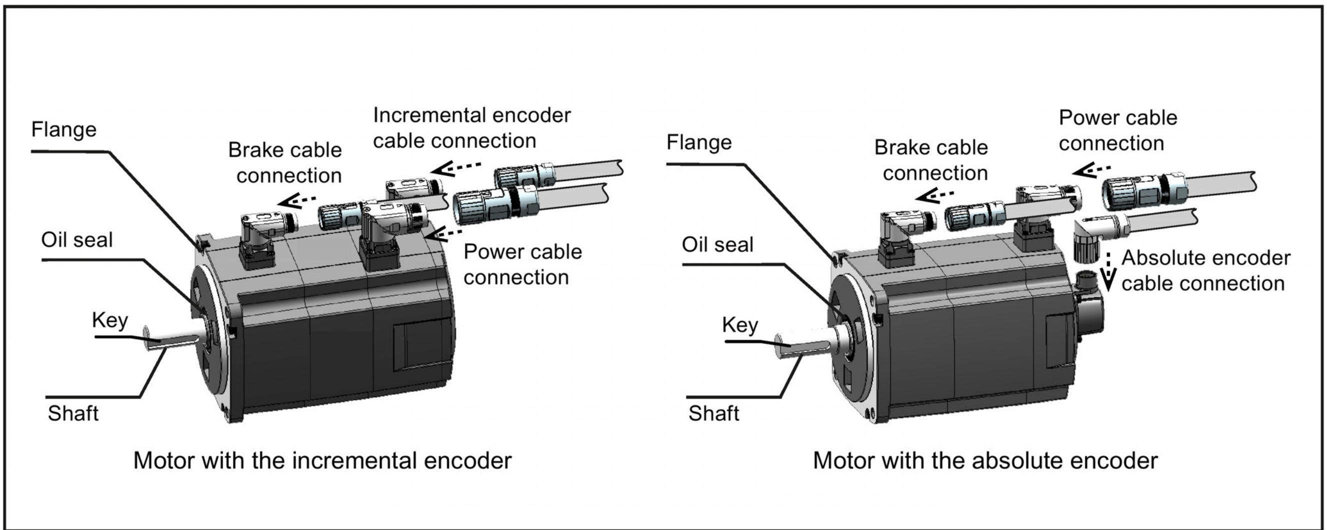
For more information about the connection of the X10 and X11, see Section "Drive Bus interface - X126 (Page 88)".

SIMOTICS S-1FL6 motor

- Motor with straight connectors:

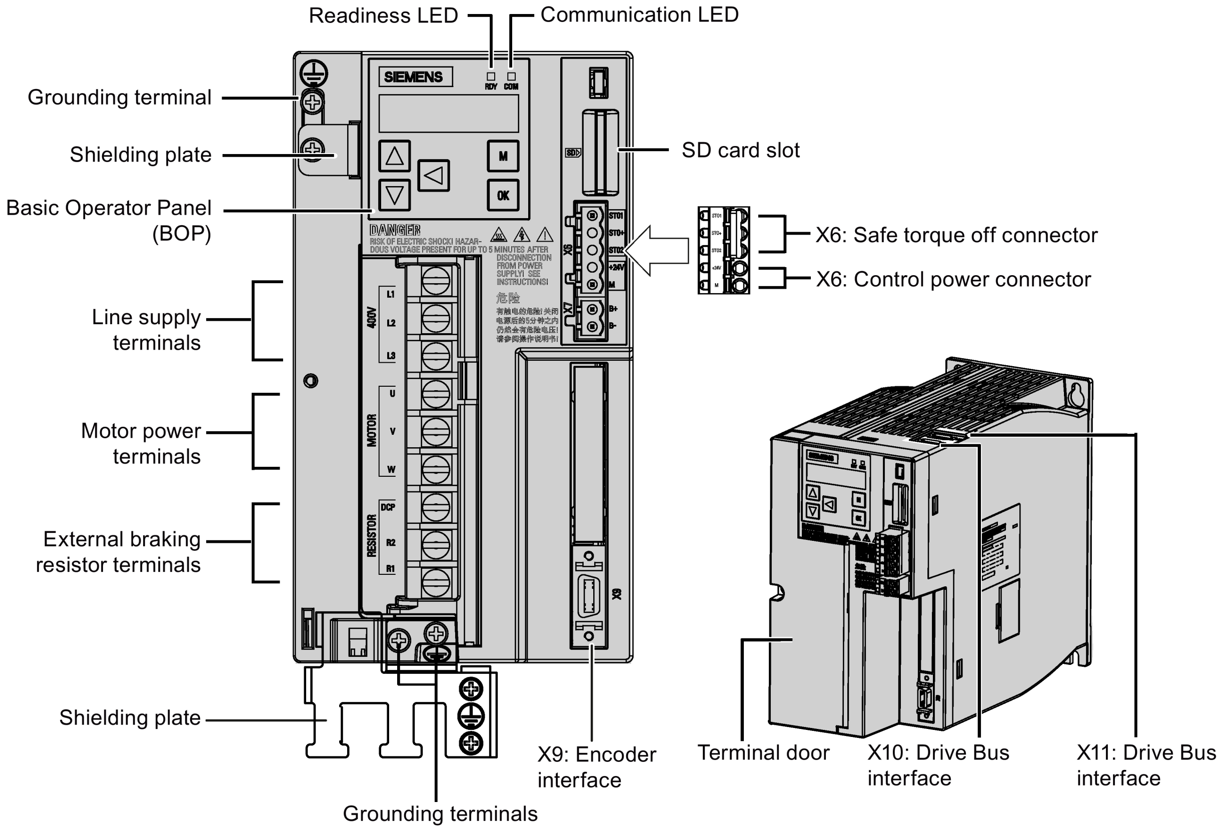


- Motor with angular connectors:

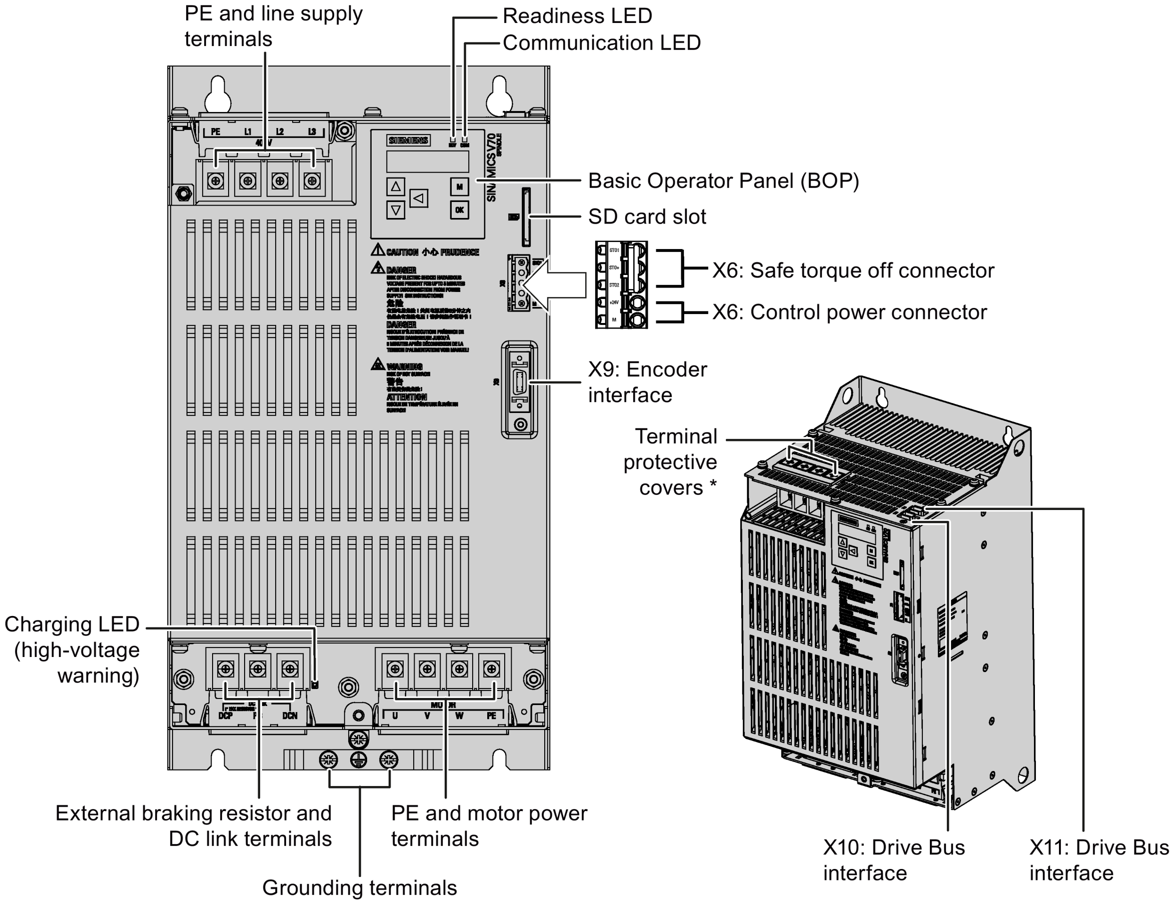


4.4.2.2 SINAMICS V70 spindle servo system

SINAMICS V70 FSB/FSC (with screw terminals)



SINAMICS V70 FSD

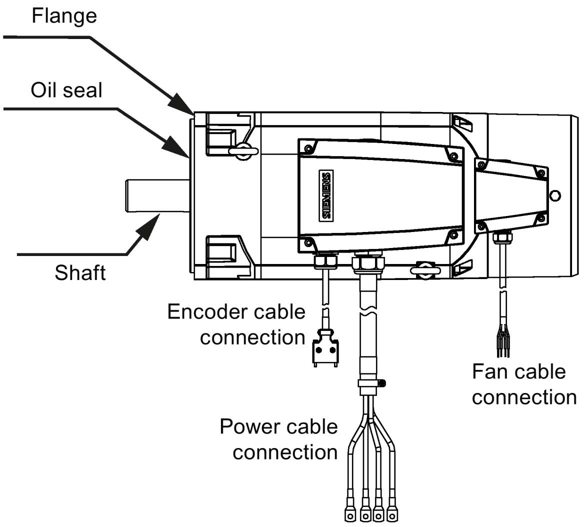


* The protective covers are available for the PE, line supply, motor power, external braking resistor, and DC link terminals. Before connecting these terminals, remove the plastic covers first with a slot/cross head screw driver.

Note

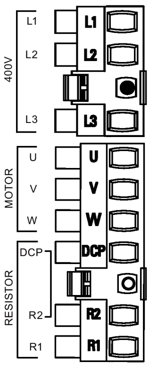
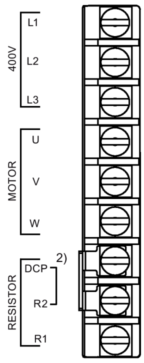
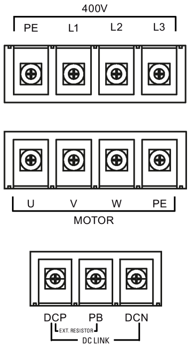
For more information about the connection of the X10 and X11, see Section "Drive Bus interface - X126 (Page 88)".

SIMOTICS M-1PH1 main motor



4.4.3 Main circuit interfaces

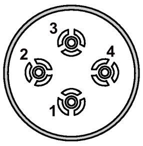
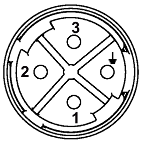
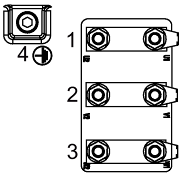
Main circuit interfaces (drive side)

<table>
<tr><th>Type</th><th colspan="3">Illustration</th><th>Signal</th><th>Description</th></tr>
<tr><td>Line supply input interface</td><td rowspan="4">FSA:

</td><td rowspan="4">FSB/FSC:

</td><td rowspan="4">FSD:

</td><td>Line phase L1
Line phase L2
Line phase L3
PE (protective earth, for FSD only)</td><td>For connecting to the 3 phase 380 VAC to 480 VAC power supply</td></tr>
<tr><td>Motor power interface</td><td>Motor phase U
Motor phase V
Motor phase W
PE (For FSD only)</td><td>• V70 feed drive: for connecting to the SIMOTICS S-1FL6 motor
• V70 spindle drive: for connecting to the SIMOTICS M-1PH1 main motor</td></tr>
<tr><td rowspan="2">Internal/external braking resistor interface [1)]</td><td>DCP (DC positive)
R2 (resistor 2)
R1 (resistor 1)</td><td>For connecting to an external braking resistor, available on V70 feed drive and V70 spindle drive FSB/FSC</td></tr>
<tr><td>DCP
PB (power brake)
DCN (DC negative)</td><td>For connecting to an external braking resistor, available on V70 spindle drive FSD</td></tr>
<tr><td>Grounding connector</td><td colspan="3"></td><td>PE</td><td>For connecting the power supply grounding connector and the servo motor grounding connector</td></tr>
<tr><td colspan="6">Screw types and recommended tightening torques:
• FSA: M2.5 screws (0.4 Nm (3.54 lbf.in) to 0.5 Nm (4.43 lbf.in))
• FSB/FSC: M4 screws (2.25 Nm (19.93 lbf.in))
• FSD: M5 screws (2.35 Nm (20.81 lbf.in))</td></tr>
<tr><td colspan="6">Recommended minimum cross-section of the line supply cable:
• V70 feed drive:
– FSA: 1.5 mm²
– FSB/FSC: 2.5 mm²
• V70 spindle drive:
– FSB: 2.5 mm²
– FSC: 4 mm²
– FSD: 16 mm²
For more information about how to assemble the terminals for the line supply cable, see Section "Assembling the line supply terminal for the drive (Page 459)".</td></tr>
</table>

1) The internal braking resistor is available only with the SINAMICS V70 feed drive.

2) For SINAMICS V70 feed drives, DCP is connected to R2 at the factory with a short-circuit stick.

Main circuit interface (motor side)

Type	Illustration			Signal	Description
Power connector	Straight connector for 1FL6 motor: 	Angular connector for 1FL6 motor: 	1PH1 motor: 	1: U	Phase U
				2: V	Phase V
				3: W	Phase W
				4/⏚: PE	Protective earth

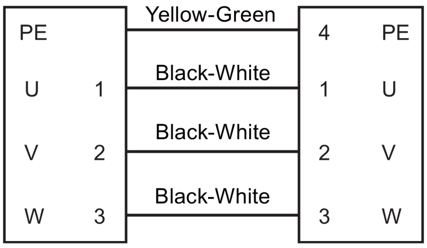
Wiring

V70 feed servo system

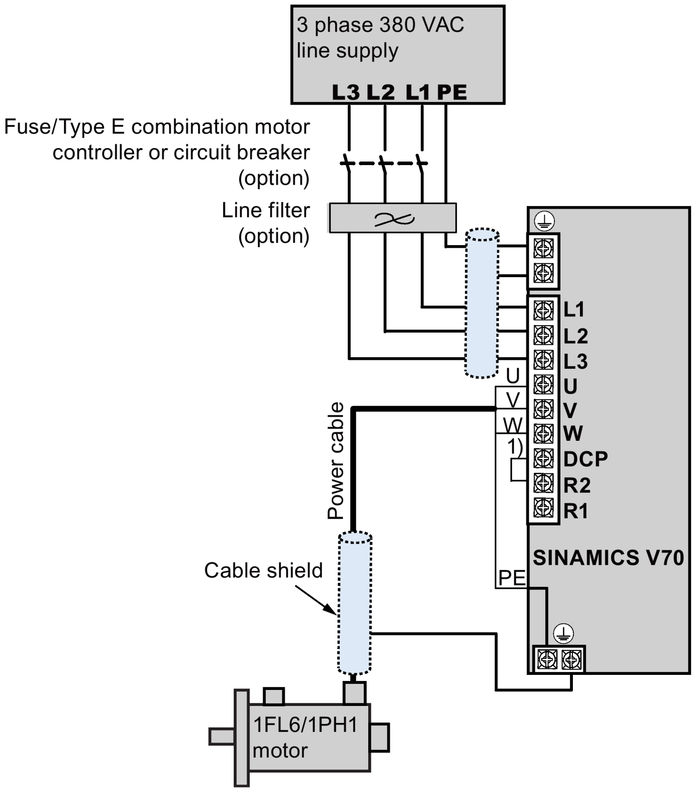
Drive side Motor side

V70 spindle servo system

Drive side Motor side

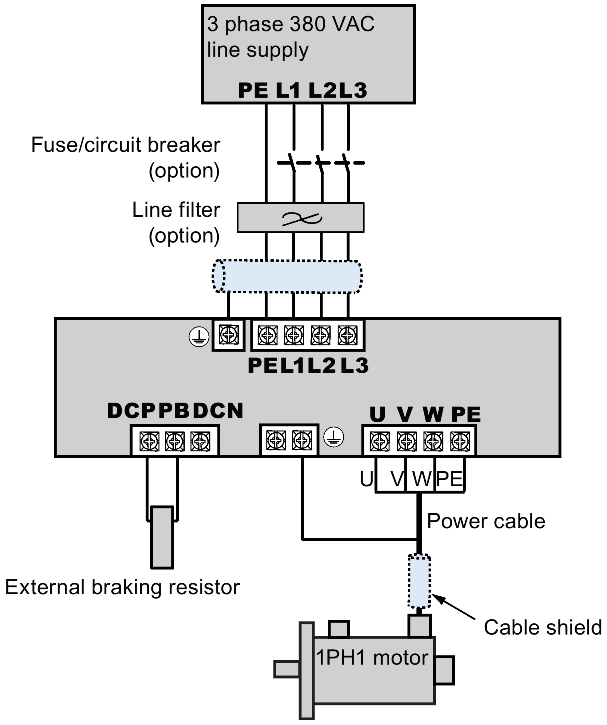


Main circuit wiring for SINAMICS V70 FSA/FSB/FSC



1) A short-circuit stick is available only for the SINAMICS V70 feed drive.

Main circuit wiring for SINAMICS V70 FSD



Note

For more information about the wiring of the external braking resistor, see Section "Connecting an external braking resistor (Page 109)".

Note

Filter

A line filter is required so that the system can pass the CE certification (radiated emission test or conducted emission test).

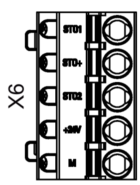
Type E combination motor controller/circuit breaker

You can install a Type E combination motor controller or circuit breaker to protect the system.

For more information about the article numbers of Siemens recommended filters and Type E combination motor controllers/circuit breakers, see Sections "Line filters (Page 33)" and "Fuse/Type E combination motor controllers and circuit breakers (Page 31)".

4.4.4 Connecting the 24 V power supply/STO - X6

Control circuit interfaces - drive side

Type	Illustration
Safe Torque Off (STO) interfaces	
Control power input interfaces[1)]	
Maximum connectable cross-section: 1.5 mm²	
Maximum cable length: 10 m	

[1)] Maximum current consumption values without a brake power supply and with a brake power supply are respectively 1 A and 3 A.

For more information about the 24 VDC power supply, see Section "External 24 VDC power supply (Page 31)".

Wiring

> **WARNING**
>
> **Unexpected drop of a hanging axis due to incorrect connection of 24 V power supply**
>
> When the servo system is used as a hanging axis, the axis will drop if the positive and negative poles of the 24 V power supply are connected inversely. Unexpected drop of the hanging axis may cause material damages and personal injuries.
>
> Make sure that the 24 V power supply is correctly connected.

Note

Make sure that you use different 24 V power supplies for the drive and for inductive loads such as relays or solenoid valves; otherwise, the drive may not work properly.

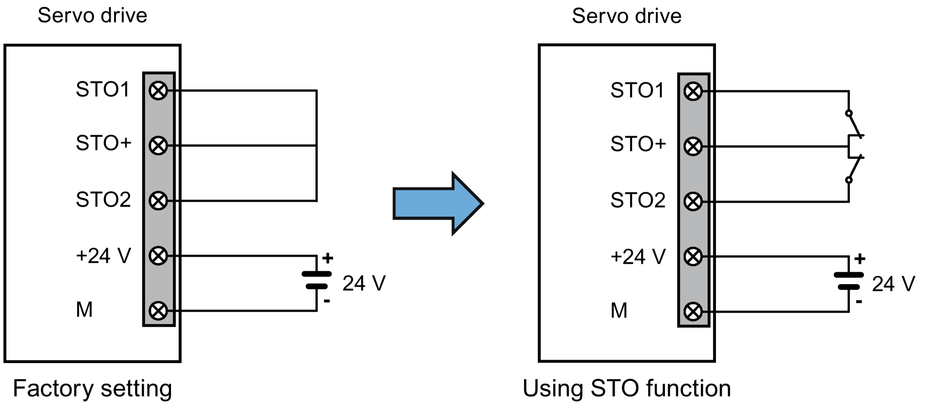
Note

Using the STO function

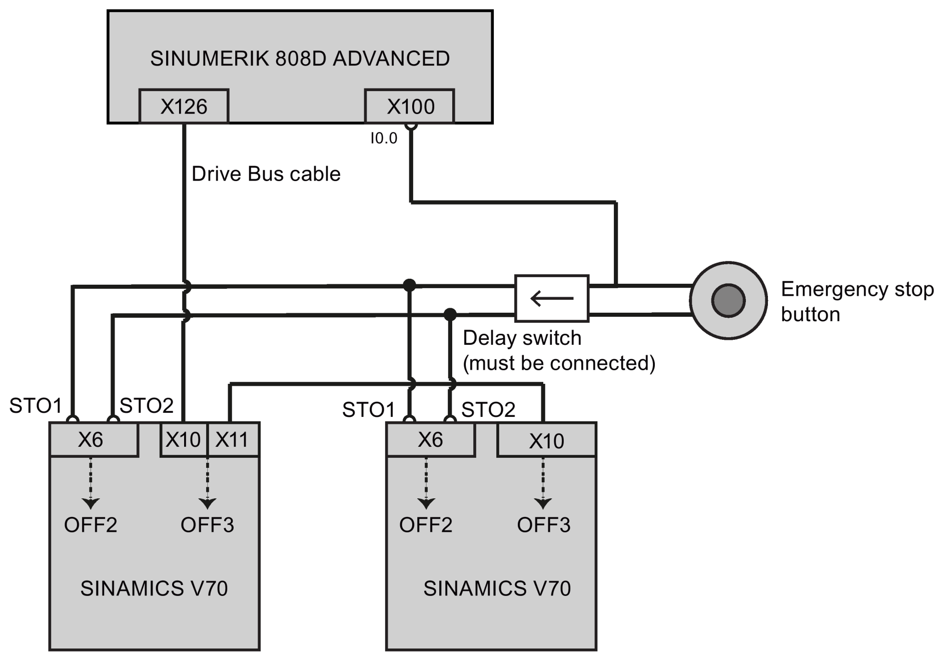
The STO1, STO+ and STO2 are short-circuited at the factory.

It is not allowed to use the STO with a hanging axis because the axis may drop. When the STO function is to be used, you must remove the short-circuit stick before connecting the STO interfaces. The safety function of the servo drive is SIL 2 (EN61800-5-2). If you do not need to use it any more, you must reinsert the short-circuit stick. Otherwise, the motor will not run.

The wiring for factory setting and using the STO function is shown as follows:



If you use the STO function with the SINUMERIK 808D ADVANCED control system, perform the wiring as illustrated below:



STO function

In conjunction with a machine function or in the event of a fault, the "Safe Torque Off" (STO) function is used to safely disconnect the torque-generating energy feed to the motor.

When the function is selected, the drive unit is in a "safe status". The switching on inhibited function prevents the drive unit from being restarted.

The two-channel pulse suppression function integrated in the module is a basis for this function.

Functional features of "Safe Torque Off"

- This function is integrated in the drive; this means that a higher-level controller is not required.
- The function is drive-specific, i.e. it is available for each drive and must be individually commissioned.
- When the "Safe Torque Off" function is selected, the following applies:
  - The motor cannot be started accidentally.
  - The pulse suppression safely disconnects the torque-generating energy feed to the motor.
  - The power unit and motor are not electrically isolated.
- By selecting/deselecting STO, in addition to the fault messages, the safety messages are also automatically withdrawn.

The STO function can be used wherever the drive naturally reaches a standstill due to load torque or friction in a sufficiently short time or when "coasting down" of the drive will not have any relevance for safety.

Note

Closing delay of the holding brake

The closing signal (low level) of the holding brake is output 30 ms after the STO is triggered.

Preconditions for using the STO function

When use the STO function, the following preconditions should be fulfilled:

- Each monitoring channel (STO1 and STO2) triggers safe pulse suppression with its switch off signal path.
- If a motor holding brake is connected and configured, the connected brake is not safe because there is no safety function for brake, such as safe brake.

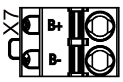
Behaviors of the STO function

Terminal		State	Action
STO1	STO2		
High level	High level	Safe	The servo motor can normally run when you power on the servo drive.
Low level	Low level	Safe	The servo drive starts up normally but the servo motor cannot run.
High level	Low level	Unsafe	Alarm occurs and servo motor coasts down.
Low level	High level	Unsafe	Alarm occurs and servo motor coasts down.

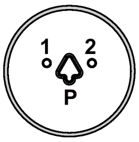
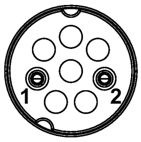
For more information about the STO function, see the SINUMERIK 808D ADVANCED Function Manual.

4.4.5 Connecting the holding brake - X7 (feed drive only)

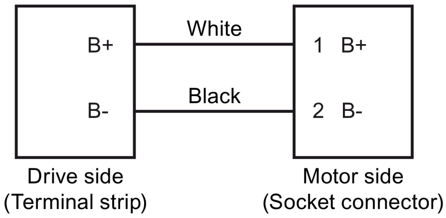
Holding brake (drive side)

Type	Illustration	Signal	Description
Brake interfaces		Phase B+	B+: + 24 V, motor brake voltage positive
		Phase B-	B-: 0 V, motor brake voltage negative
Maximum cable cross-section: 1.5 mm^2 Input voltage tolerance: 24 V ± 10%			

Holding brake (motor side)

Type	Illustration		Signal	Description
Brake connector	Straight connector: 	Angular connector: 	1: B+	Phase Brake +
			2: B-	Phase Brake -

Wiring



4.4.6 Connecting the encoder - X9

The SINAMICS V70 drive supports the following types of encoders:

V70 feed drive	Incremental encoder, TTL 2500 ppr
	Absolute encoder, 20-bit + 12-bit multi-turn
V70 spindle drive	Incremental encoder, TTL 2500 ppr
	Absolute encoder, single-turn 20-bit

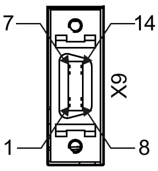
NOTICE

Cable shielding

The encoder cable must be shielded to meet the EMC requirements.

Encoder connector - drive side

14-pin socket connector for the incremental/absolute encoder interface X9

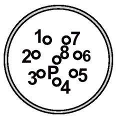
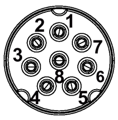
Illustration	Pin No.	Signal	Description
	1	Biss_DataP	Absolute encoder data signal, positive
	2	Biss_DataN	Absolute encoder data signal, negative
	3	Biss_ClockN	Absolute encoder clock signal, negative
	4	Biss_ClockP	Absolute encoder clock signal, positive
	5	P5V	Encoder power supply, +5V
	6	P5V	Encoder power supply, +5V
	7	M	Encoder power supply, grounding
	8	M	Encoder power supply, grounding
	9	Rp	Encoder R phase positive signal
	10	Rn	Encoder R phase negative signal
	11	Bn	Encoder B phase negative signal
	12	Bp	Encoder B phase positive signal
	13	An	Encoder A phase negative signal
	14	Ap	Encoder A phase positive signal

Note

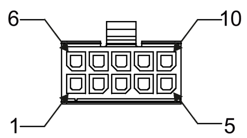
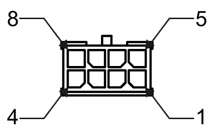
The screw type is UNC 4-40 (plug-in terminal block) and the recommended tightening torque is 0.4 Nm.

Encoder connector - motor side

8-pin connector for the incremental/absolute encoder, used for the 1FL6 motor:

Illustration	Pin No.	Incremental encoder		Absolute encoder	
		Signal	Description	Signal	Description
Straight connector:	1	P_Supply	Power supply 5 V	P_Supply	Power supply 5 V
	2	M	Power supply 0 V	M	Power supply 0 V
	3	A+	Phase A+	n. c.	Not connected
	4	A-	Phase A-	Clock_N	Inverted clock
Angular connector:	5	B+	Phase B+	Data_P	Data
	6	B-	Phase B-	Clock_P	Clock
	7	R+	Phase R+	n. c.	Not connected
	8	R-	Phase R-	Data_N	Inverted data

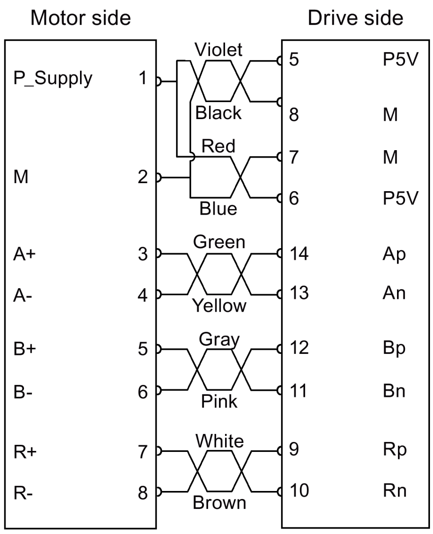
10-pin connector for the incremental encoder and 8-pin connector for the absolute encoder, used for the 1PH1 motor:

Illustration	Pin No.	Incremental encoder		Absolute encoder	
		Signal	Description	Signal	Description
Incremental encoder:	1	P_Supply	Power supply 5 V	P_Supply	Power supply 5 V
	2	M	Power supply 0 V	M	Power supply 0 V
	3	A+	Phase A+	n. c.	Not connected
	4	A-	Phase A-	Clock_N	Inverted clock
	5	B+	Phase B+	Data_P	Data
Absolute encoder:	6	B-	Phase B-	Clock_P	Clock
	7	R+	Phase R+	Shielding	Grounding
	8	R-	Phase R-	Data_N	Inverted data
	9	Shielding	Grounding	-	-
	10	n.c.	Not connected	-	-

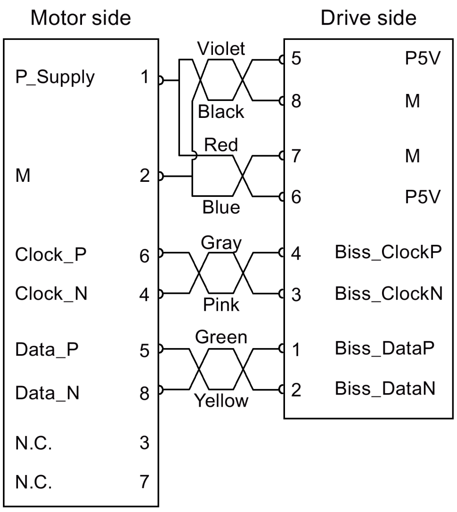
Wiring

SINAMICS V70 feed servo system

Incremental encoder

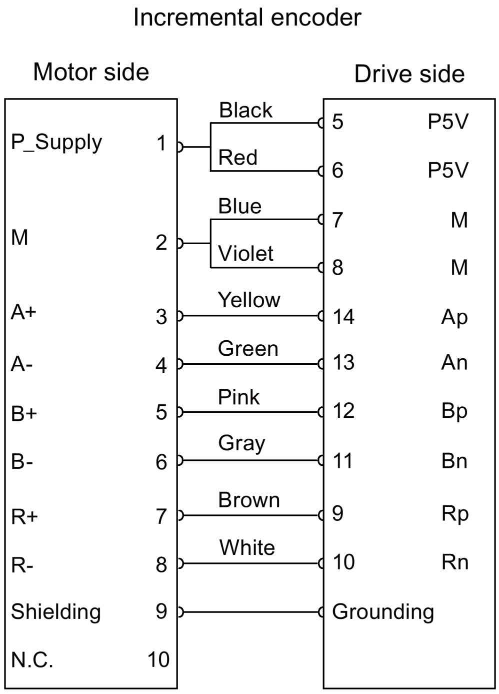


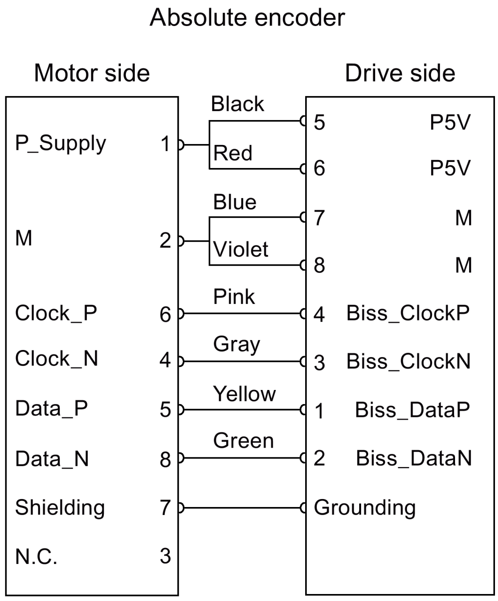
Absolute encoder



Twisted-pair wires

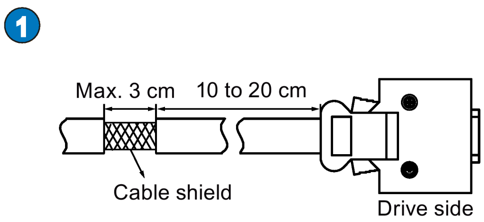
SINAMICS V70 spindle servo system

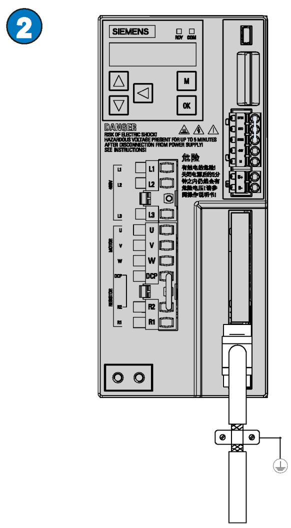




Grounding the shielded encoder cable

To ensure better EMC compliance, you are recommended to strip the encoder cable and connect the cable shield to earth to enhance the grounding effect:



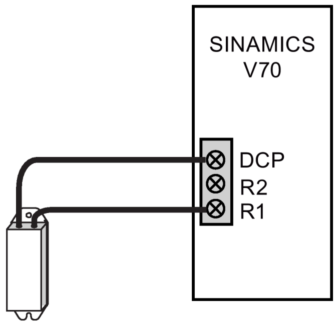


4.4.7 Connecting an external braking resistor

The SINAMICS V70 feed drive has been designed with an internal braking resistor to absorb regenerative energy from the motor. When the internal braking resistor cannot meet the braking requirements, you can connect an external braking resistor. For the SINAMICS V70 spindle drive, however, no internal braking resistor is available and an external braking resistor must be configured. For more information about the selection of braking resistors, see Section "Braking resistors (Page 32)".

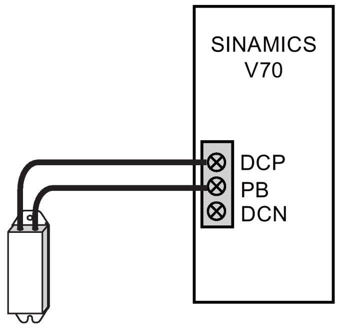
NOTICE
Damage to the drive For the SINAMICS V70 feed drive, before connecting an external resistor to DCP and R1, remove the connection between terminals DCP and R2; otherwise, the drive may be damaged.

FSA/FSB/FSC



External braking resistor

FSD



External braking resistor

4.5 Connecting the SINAMICS V70 servo system

4.5.1 Connecting the drive to the motor

CAUTION

Finger injuries caused by improper cable connection

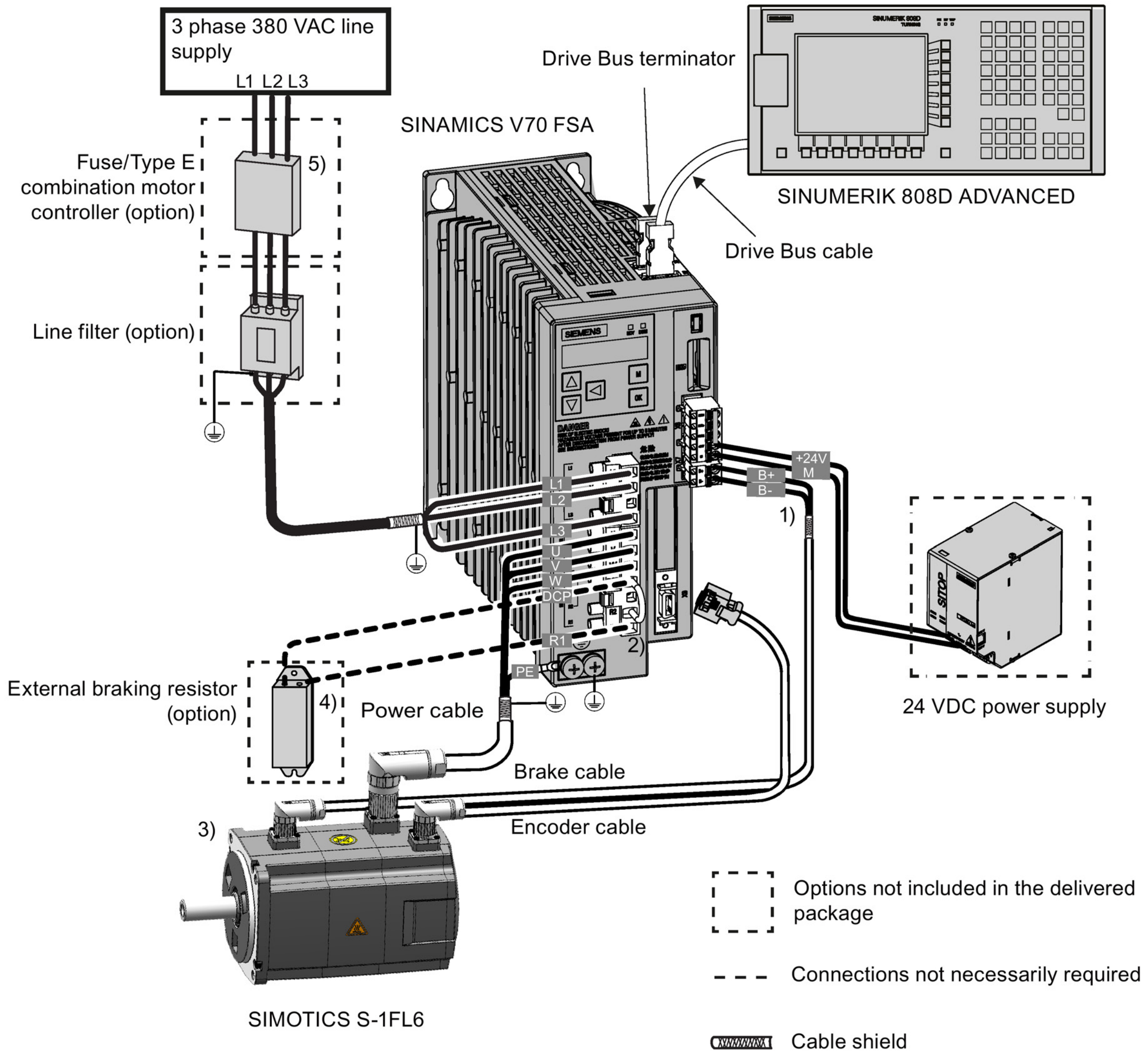
When connecting cables to the drive interfaces with detachable connectors, fixing the cables directly to the connectors which have not been fitted onto the drive may result in finger injuries.

- First fit the connectors onto the drive, and then fix the cables to the connectors.

Connecting the SINAMICS V70 FSA/FSB/FSC servo system

Note

The connection illustration below uses V70 FSA as an example, which is also applicable to V70 feed/spindle drives FSB and FSC.



1) The holding brake function is available only with the feed drive.

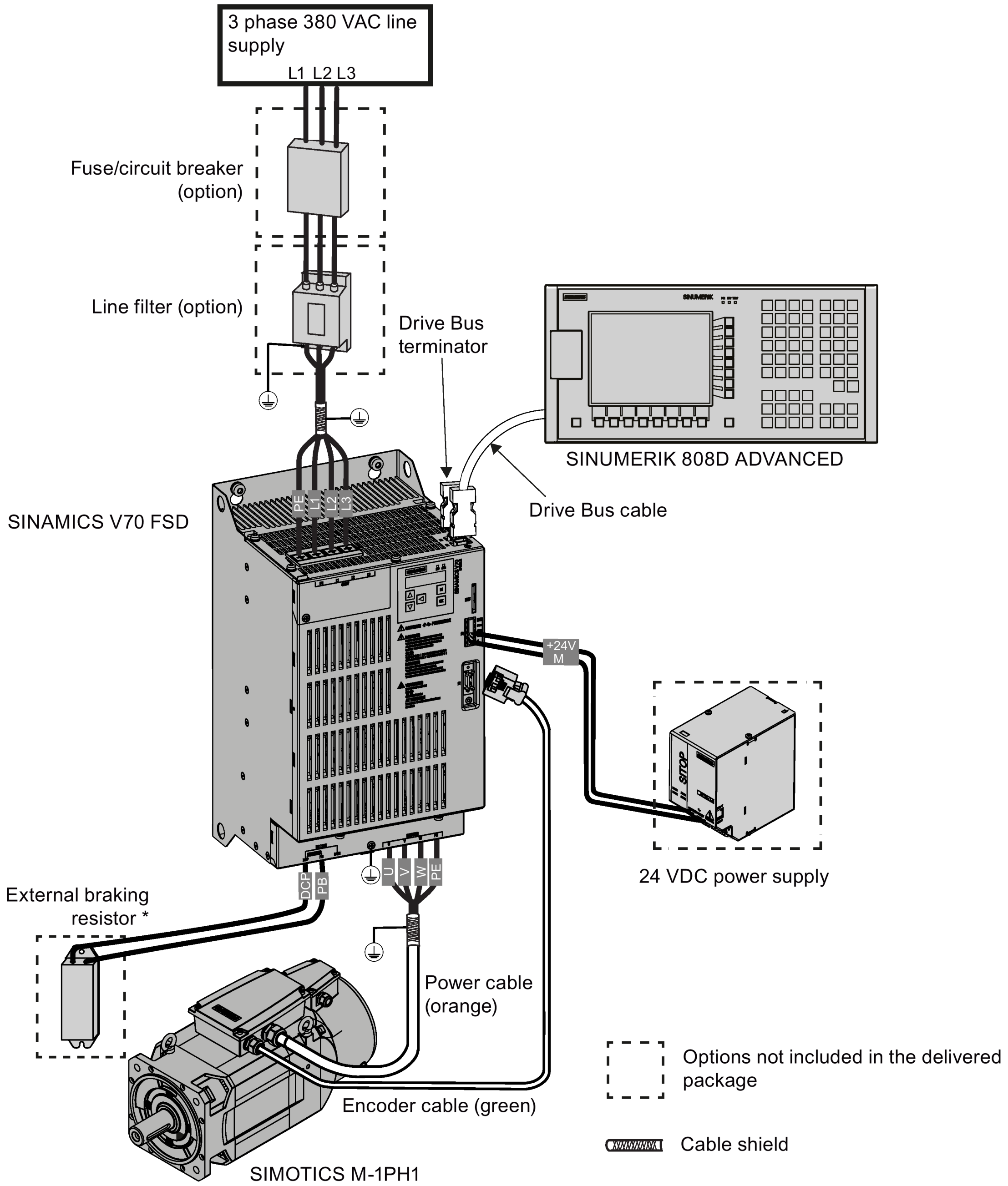
2) The short-circuit stick is available only with the feed drive for the use of an internal braking resistor.

3) For the V70 spindle drive, the SIMOTICS M-1PH1 main motor is connected.

4) An external braking resistor can be used to absorb excess regenerative energy in the DC link when the capacity of the internal braking resistor is insufficient. Note that no internal braking resistor is available in the V70 spindle drive, and you must select an external braking resistor as specified in Section "Braking resistors (Page 32)".

5) For V70 spindle drives FSC, circuit breakers are used instead of Type E combination motor controllers.

Connecting the SINAMICS V70 FSD servo system



* No internal braking resistor is available with the V70 spindle drive, and you must select an external braking resistor as specified in Section "Braking resistors (Page 32)".

Note

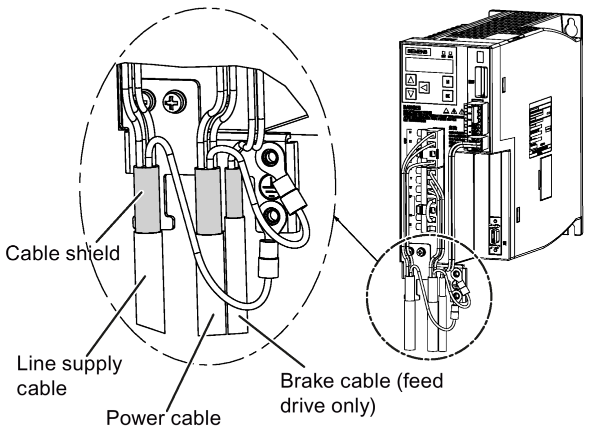
- The maximum length for all cables must be shorter than 30 m.
- For more information about the connection of the external braking resistor, see Section "Connecting an external braking resistor (Page 109)".
- For more information about the connection of the STO terminals, see Section "Connecting the 24 V power supply/STO - X6 (Page 103)".

> **WARNING**
>
> **Electric shock or short circuit due to improper connections**
>
> Improper connections have high risks of electric shock and short circuit, which will jeopardize personal safety and equipment.
>
> - The drive must be directly connected with the motor. It is not permissible to connect a capacitor, inductor or filter between them.
> - The line supply voltage must be within the allowable range (refer to the drive rating plate). Never connect the line supply cable to the motor terminals U, V, W or connect the motor power cable to the line input terminals L1, L2, L3.
> - Never wire up the U, V, W terminals in an interchanged phase sequence.
> - If the CE marking for cables is mandatory in some cases, the motor power cable, line supply cable and brake cable used must all be shielded cables.
> - For terminal box connection, make sure that the clearances between non-insulated live parts are at least 5.5 mm.
> - Route signal cables and power cables separately in different cable conduits. The signal cables shall be at least 10 cm away from the power cables.
> - Cables connected may not come into contact with rotating mechanical parts.

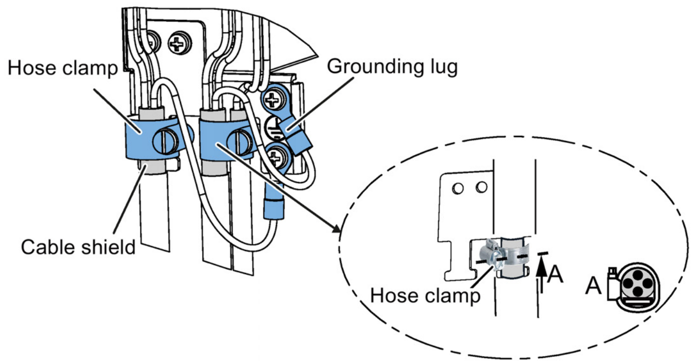
Connecting the cable shields with the shielding plate

To achieve EMC-compliant installation of the drive, use a shielding plate to connect the cable shields. See the following example of the steps of connecting cable shields with the shielding plate:

① Connect the line supply cable, the power cable, and the brake cable (available for feed drives only), and strip the cables where necessary.



② Slip the hose clamps over the cable shields and the shielding plate; tighten the screws to press the cable shields onto the shielding plate as well as fix the grounding lugs.



Note

The connection diagram above takes the V70 feed drive FSA as an example. It is applicable also to the V70 feed/spindle drive FSB and FSC. For the V70 spindle drive FSD, the shielding plate is available as an option only. For more information, see Section "Shielding plate (Page 32)".

> **WARNING**
>
> **Danger to life due to fire or electric shock when using unsuitable residual current protection devices**
>
> The drive can cause a current to flow in the protective conductor.
>
> This current can cause the residual current device (RCD) or residual current monitoring (RCM) to incorrectly trip (nuisance trip).
>
> In the case of a fault (ground fault), the fault current can contain a DC component, which prevents the RCD/RCM from tripping, with the risk of subsequent fault or electric shock.
>
> Use only the type B RCD in the supply system for the SINAMICS V70 drive.

WARNING

Electric shock due to earth leakage current

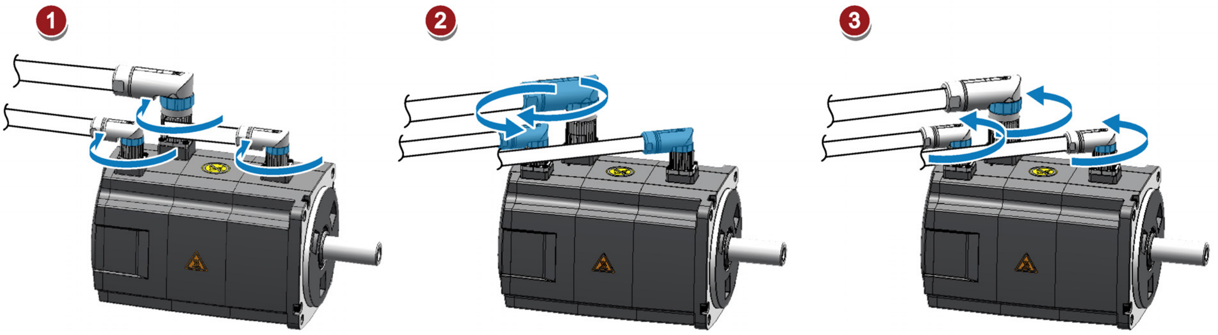
The earth leakage current for the drive can be greater than AC 3.5 mA, which may cause death or severe personal injury due to electrical shock.

A fixed earth connection is required to eliminate the dangerous leakage current. In addition, the minimum size of the protective earth conductor shall comply with the local safety regulations for high leakage current equipment.

Adjusting cable orientations from the motor side

1FL6 motor with straight connectors:

From the motor side, you can adjust the orientation of the power cable, encoder cable, and brake cable as follows to facilitate cable connection:



Rotate the screw rings clockwise to loosen the connectors. | Rotate the connectors to adjust the cable directions. | Rotate the screw rings counter-clockwise to tighten the connectors.

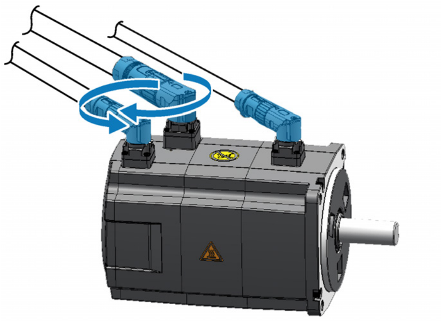
Note

Rotating the connectors

You can rotate the power connector and brake connector within 360°, rotate the incremental encoder connector within 270°, and the absolute encoder connector within 180°.

1FL6 motor with angular connectors:

From the motor side, for the power cable, brake cable, and incremental encoder cable, you can simply rotate the connectors to adjust the cable orientations; for the absolute encoder cable, follow the steps above for 1FL6 motor with straight connectors to adjust the cable orientation.



Rotate the connectors to adjust the cable directions.

Note

Rotating the connectors

You can rotate the power connector, brake connector, and incremental encoder connector within 310°, and rotate the absolute encoder connector within 180°.

1PH1 motor:

There are holes through which you pass cables on both sides of the terminal box of 1PH1 motor. You can connect the cables through the holes on any of the both sides. For more information about how to adjust cable orientations, see Section "Connecting the terminal boxes of the 1PH1 motor (Page 114)".

4.5.2 Connecting the terminal boxes of the 1PH1 motor

CAUTION

Use of appropriate connecting cables

To reduce the risk of cable overheating and even overburning, appropriate cables are necessary for connecting the terminal box.

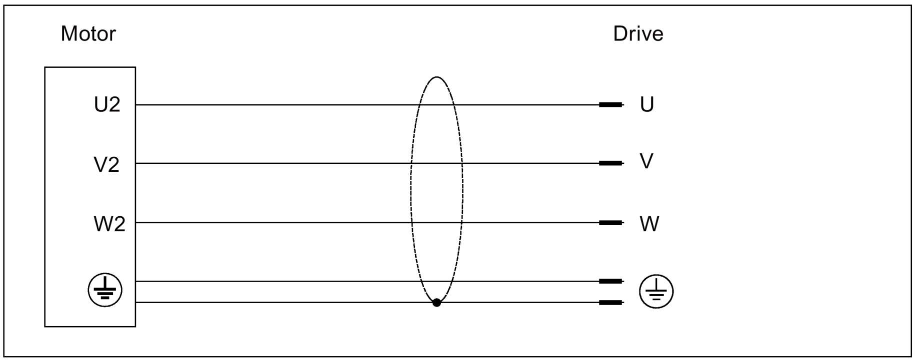
- Carefully observe the current which the motor draws for your particular application. Adequately dimension the connecting cables according to IEC 60204-1 or IEC 60364-5-52.

NOTICE

Damage to cables or connectors

- Do not put much stress upon cables or connectors while wiring.

Power connection between the motor and the drive

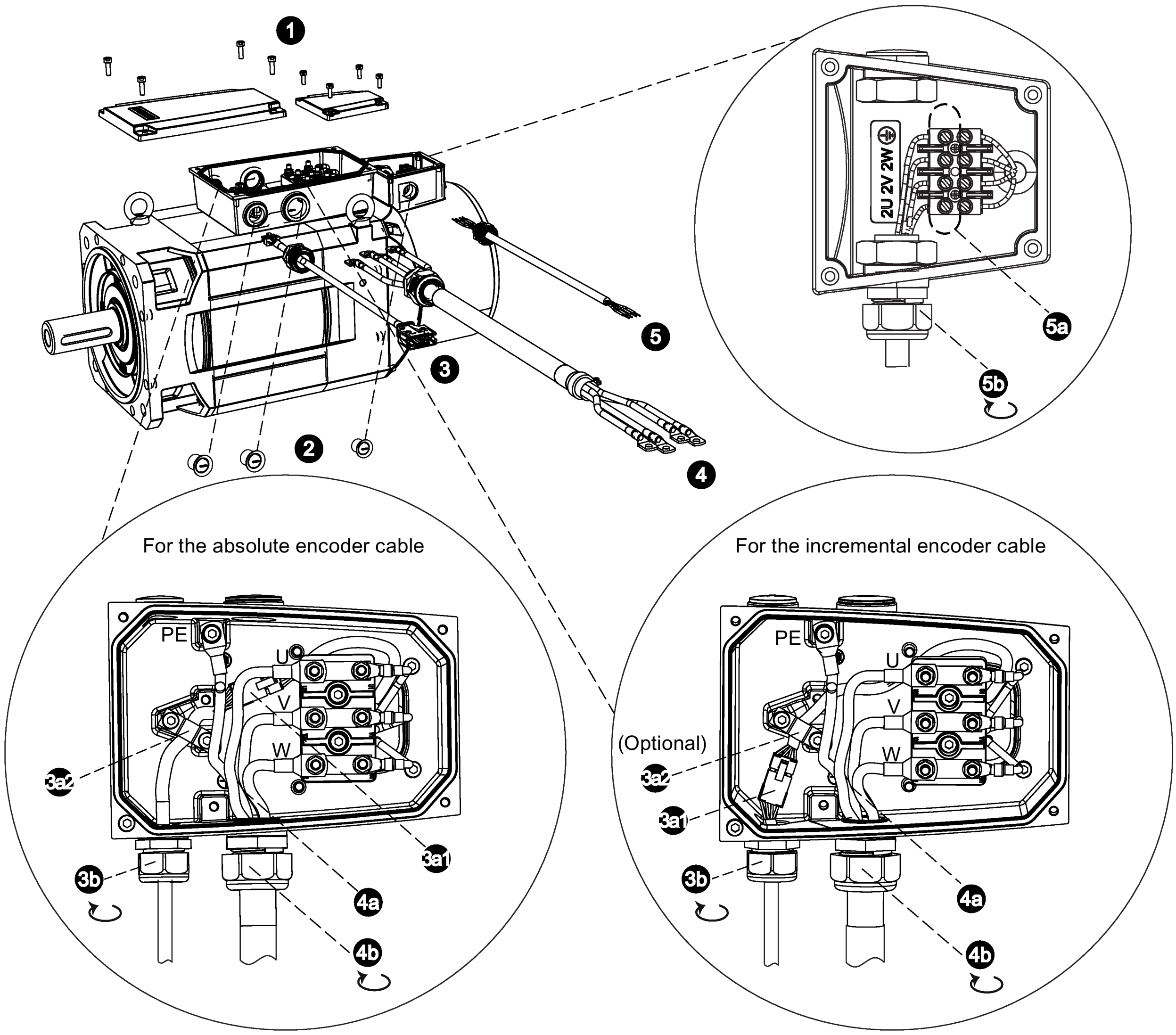


Technical data for the fan of the 1PH1 motor

Shaft height	Supply voltage	Frequency	Rated current	Rated power
100 mm	3 AC 380 V	50 Hz	0.12 A	52 W
132 mm	3 AC 380 V	50 Hz	0.18 A	40 W

Note

- The recommended sequence for cable connections is as follows: encoder cable first, power cable next, and then the fan cable.
- There are threaded holes available on both sides of the terminal box housing for you to pass the cables through. You can select to connect the individual cables to the terminal boxes from the threaded holes on the desired side.
- No fan cable is provided at delivery. When connecting your own fan cable, make sure you connect the fan terminals U, V, and W correspondingly to the line supply terminals L1, L2, and L3 of the machine tool using appropriate cable connectors.



1. Loosen the screws on the top of both the motor terminal box and the fan terminal box to remove the terminal box covers.
2. Remove the three screw plugs on one side of the two terminal boxes.
3. Loosen the cable gland pre-assembled on the encoder cable. Pass the encoder cable through the first threaded hole in the motor terminal box housing. Follow the steps below to connect the encoder cable to the motor terminal box:
   - For the absolute encoder cable:

3a1. Insert the male connector of the absolute encoder cable into the female connector in the motor terminal box.

3a2. Remove from the terminal box the grounding screws as well as the hose clamp. Lay the absolute encoder cable appropriately. Place the hose clamp onto the cable shield, and then tighten the screws. You can select to fix the cable in the desired direction by screwing the hose clamp at any two of the three screw holes.

- For the incremental encoder cable:

3a1. Insert the male connector of the incremental encoder cable into the female connector in the motor terminal box.

3a2. (Optional) You can select to fix the cable in the desired direction by screwing the hose clamp at any two of the three screw holes. For detailed information about how to fix the cable, see step 3a2 for connecting the absolute encoder cable mentioned above.

3b. Tighten the cable gland of the encoder cable onto the threaded hole.

4. Pass the power cable through the cable gland, and then through the second threaded hole in the motor terminal box housing. Follow the steps below to connect the power cable to the motor terminal box:

4a. Remove from the terminal box the three binding post nuts that correspond to the power cable terminals U, V, and W. Place the three terminal lugs at the end of the power cable conductors onto the corresponding binding posts. Fasten the cable conductors with the nuts (3 x M5, max. 4.7 Nm). Remove the grounding screw for power terminal PE. Place the terminal lug of the PE conductor on the grounding screw, and then tighten the screw for the PE terminal (1PH110❑: 1 x M5, max. 4.7 Nm; 1PH113❑: 1 x M6, max. 4.7 Nm).

4b. Tighten the cable gland of the power cable onto the threaded hole.

5. Pass your own fan cable (recommended cable outer diameter: 4 mm to 8 mm) through the cable gland, and then through the threaded hole in the fan terminal box housing. Follow the steps below to connect the fan cable to the fan terminal box:

5a. Loosen the four screws that correspond to the fan cable terminals U, V, W and PE. Insert the terminal lugs at the end of fan cable conductors into the corresponding sockets under the binding posts, and then fasten the cable conductors with the screws.

5b. Tighten the cable gland of the fan cable onto the threaded hole.

6. Replace the covers of the terminal boxes, and then tighten the screws respectively for the motor terminal box (4 x M5: max. 4.7 Nm) and the fan terminal box (4 x M4: max. 2.4 Nm).

NOTICE
Damage to the motor
• After you finish connecting the terminal boxes and start the motor, make sure the fan rotates in the correct direction as indicated by the arrow marked on the fan rating plate; otherwise, the motor may be damaged due to overheat.

4.6 Switching on the drive

NOTICE
Plugging or unplugging the SD card will cause startup failure.
Do not plug or unplug the SD card during startup; otherwise, the drive will fail to start up.

NOTICE
Firmware damage due to drive power-off during data transfer
Switching off the 24 VDC power supply for the drive during data transfer from the SD card to the drive can cause damage to the drive firmware.
• Do not switch off the drive power supply when the data transfer from the SD card to the drive is in process.

NOTICE
Existing setting data may be overwritten by the setting data on the SD card during startup.
• When a drive is switched on with an SD card containing user setting data, the existing setting data on the drive will be overwritten.
• When a drive is switched on with an SD card containing no user setting data, the drive will automatically save the existing user setting data onto the SD card.
Before starting up the drive with an SD card, check whether the SD card contains user setting data. Otherwise, the existing data on the drive may be overwritten.

Note

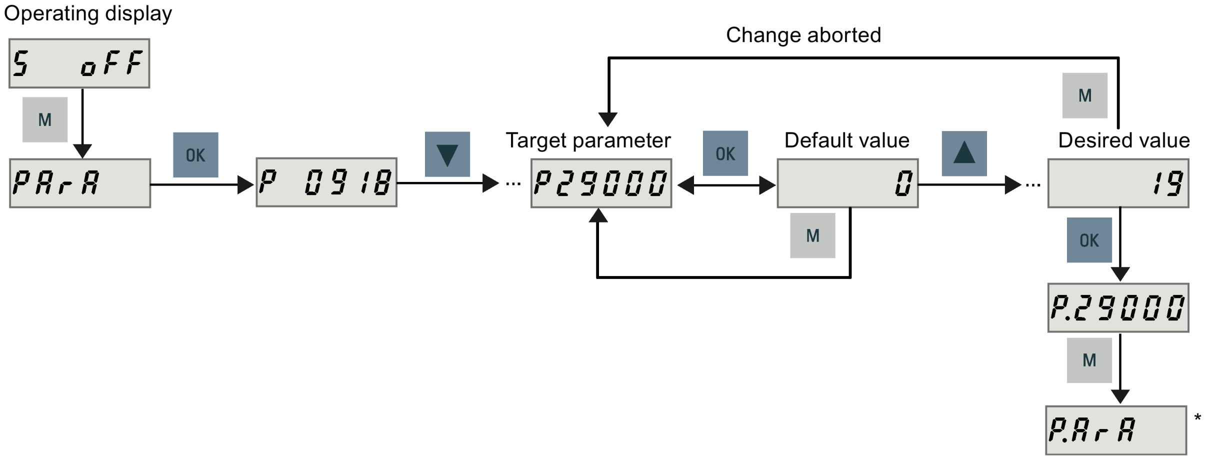
- Make sure that all cables are correctly connected and the connected servo system is in good condition with no faults before switching on.
- Prior to commissioning or operation, read carefully "Safety instructions (Page 11)" and "Operating the SINAMICS V70 Basic Operator Panel (BOP) (Page 442)".
- See Chapters "Diagnostics (Page 461)" and "Parameter list (Page 398)" for detailed information about any possible alarms and parameters used during commissioning.

4.6.1 Jog test

To implement Jog test for the SINAMICS V70 drive, proceed through the following steps:

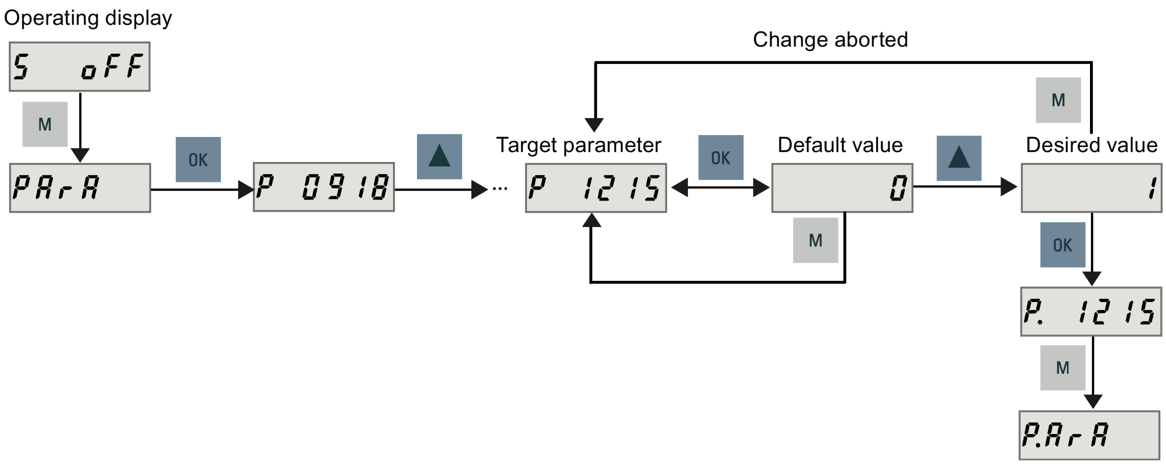
1. Switch on the 24 VDC power supply to the drive.
2. Switch on the 3 phase 380 VAC line supply to the drive.
3. Proceed as follows to configure a motor with an incremental encoder; otherwise, skip Steps 3 and 4 and go to Step 5 directly.

   Configure the motor ID p29000 (default = 0). You can find the motor ID of the connected motor on its rating plate.



* The dot means that at least one parameter is changed without saving. To save the parameter changes, see Step 6.

4. Configure the motor brake p1215 as follows. For a motor without a holding brake, skip this step and go to Step 5 directly.
   - = 0 (default): No motor holding brake available
   - = 1: Motor holding brake under sequence control
   - = 2: Motor holding brake always open
   - = 3: Motor holding brake under sequence control by the SINUMERIK 808D ADVANCED



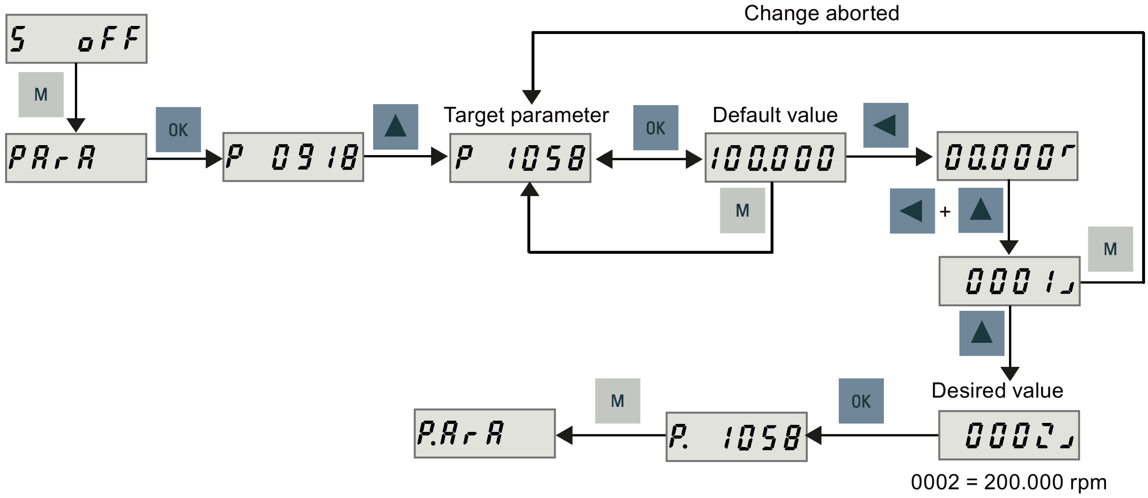
Note

For a motor with an absolute encoder, the operating principle of the holding brake is configured automatically.

NOTICE
Shortening the service life of motor brake The motor brake is used for holding the load in position only. Frequent emergency stops with the motor brake can shorten its service life. Unless absolutely necessary, do not apply the motor brake as an emergency stop or deceleration mechanism.

5. Set the Jog speed p1058 with a value between 0 and the rated speed of the connected motor. If you want to use the default Jog speed (100 rpm), skip this step.

Operating display

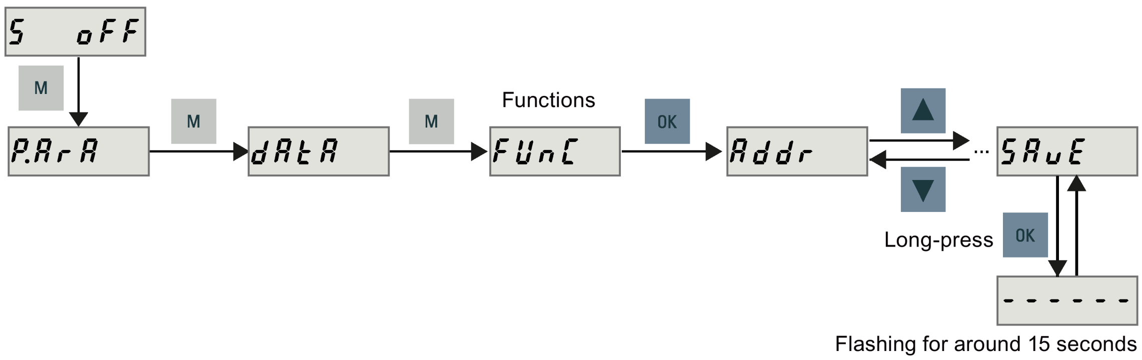


Note

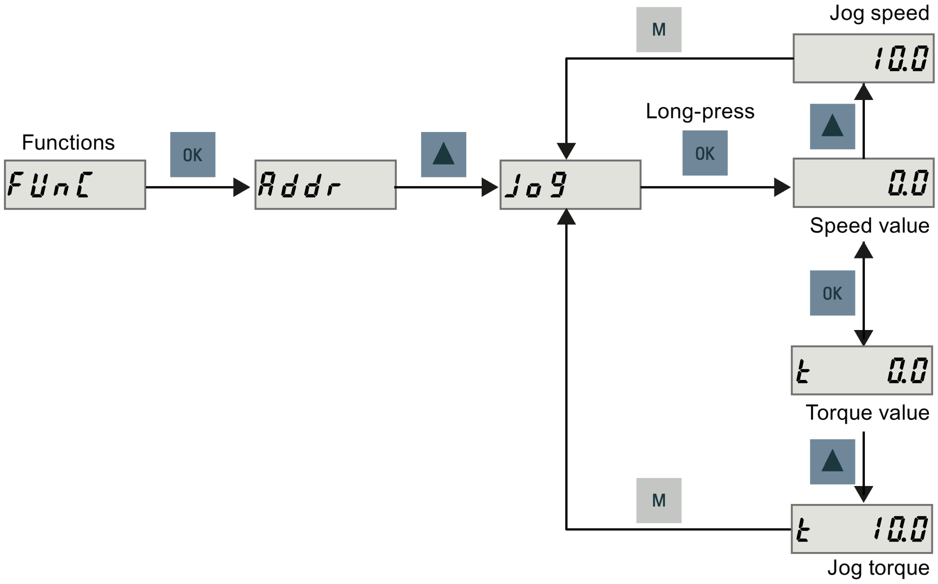
For more information about the rated speed of a motor, see sections "SIMOTICS S-1FL6 feed motors (Page 380)" and "SIMOTICS M-1PH1 main motors (Page 384)".

6. Save the parameter settings as follows. For a motor with an absolute encoder, you can skip this step if you use the default Jog speed (100 rpm).

Operating display



7. Run the connected motor with the Jog function and check the Jog speed or Jog torque.



Note

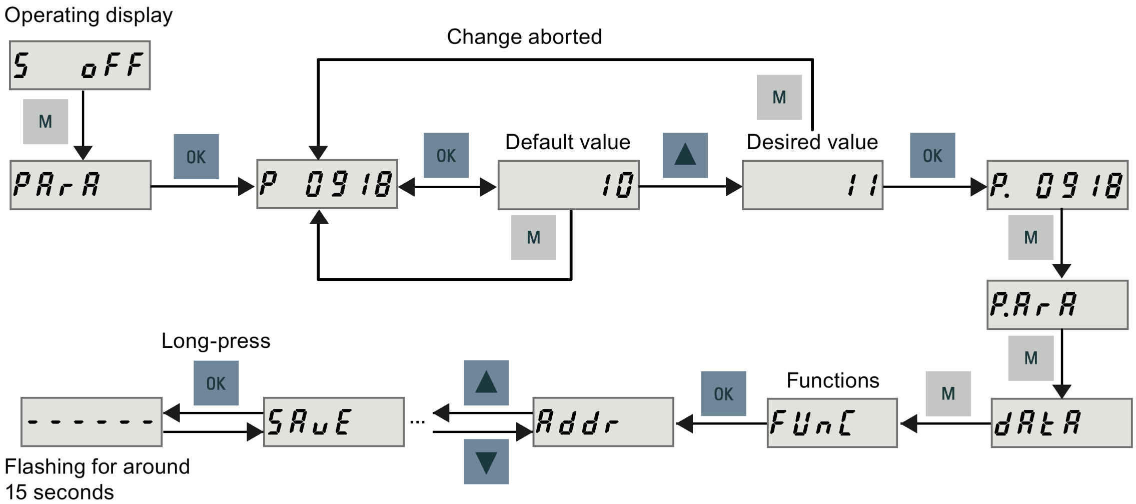
When you run a servo motor with an incremental encoder in JOG mode, the servo motor makes a short buzzing sound indicating that it is identifying the magnetic pole position of the rotor.

4.6.2 Configuring Drive Bus addresses

To configure the Drive Bus addresses on the SINAMICS V70 drive, set parameter p0918 (default = 10) with the drive BOP as required. You must set a proper address according to the actual application of the drive.

- 11: X axis
- 12: Y axis (or additional axis for the turning variant of the control system)
- 13: Z axis
- 14: Digital spindle (SINAMICS V70 spindle drive only)
- 15: Additional axis 1 *
- 16: Additional axis 2 *

* Note that Drive Bus addresses 15 and 16 are not supported on the control system with PPU15x.3. In addition, to use Drive Bus address 16, make sure the drive firmware version is 1.05.00.02 or higher and MD11240[0] is set to 1.



You can also set the Drive Bus address with the auxiliary function menu on the drive BOP. For more information, see Section "Setting Drive Bus address (Page 450)".

Note

Do not switch on the 24 VDC power supply for the SINUMERIK 808D ADVANCED before you finish setting the Drive Bus addresses for all connected drives.

After setting a proper address, you must save the parameter and then restart the drive to apply your setting.

Note

After the Drive Bus communication is established for the first time, the internal communication parameters are automatically changed and hence a dot appears on the display as follows:

You must perform a save operation to remove the dot.

Note

After the Drive Bus communication is established, the BOP is protected from any operation except clearing alarms and acknowledging faults.

4.7 Switching on the control system

Preparation before switch-on

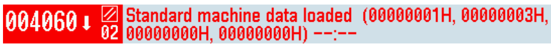
Make sure the following before switching on the control system:

- You have finished the mechanical installation of the whole system based on the information included in Chapter "Mounting (Page 49)".
- You have completed the wiring of the whole system according to the information included in Chapter "System connection (Page 73)" (if you use the default PLC program).

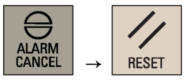
Operating sequence

1. Switch on the 24 VDC power supply to the control system.

   When the control system starts up for the first time, the following two alarms appear.



2. Press this key or the key combination to clear the alarms. For more information about the alarms and system responses, refer to the SINUMERIK 808D ADVANCED Diagnostics Manual.

3. When the control system enters the main screen, check the status LEDs on the PPU:
   - **POK**: green
   - **RDY**: green
   - **TEMP**: off

4. Check the status LEDs on the drive:
   - **RDY**: green
   - **COM**: slow flashing green every two seconds

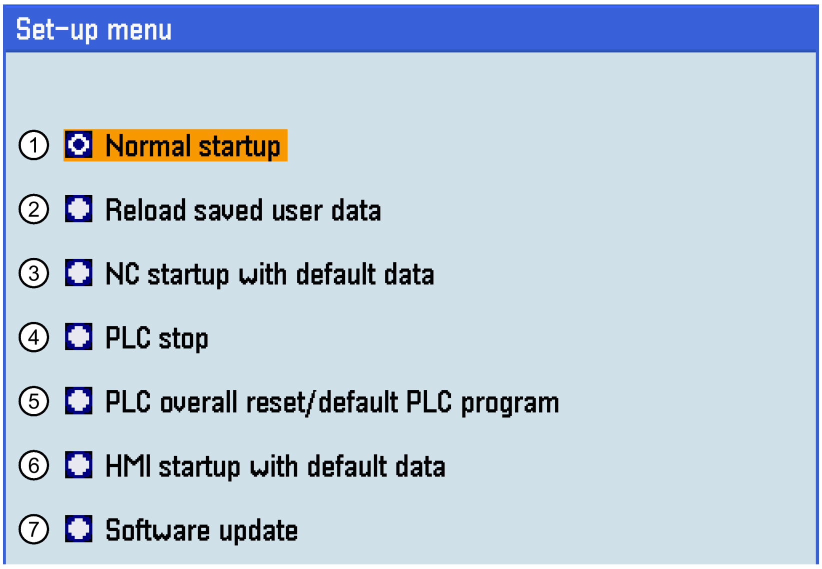
Note

The control system constantly creates restoring points during operation. In case of data loss due to power failure or other problems, the control system automatically restores the last autosaved system data upon startup with an alarm appearing on the screen.

5 Initial system setup

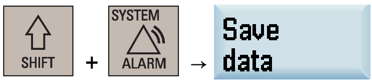
5.1 System startup menu

The control system carries out a normal startup by default after power-on. When necessary, you can press this key on the PPU once the message "Press the SELECT key to enter set-up menu" appears while the system boots to select other startup options via the following menu:



① The system carries out a normal startup.

② The system loads the user data saved through the following operations from the system CF card:



③ The system loads the default NC data and settings, and deletes the retentive data on the PLC.

④ The PLC is stopped.

⑤ The system resets the PLC and loads the default PLC program.

⑥ The system loads the default HMI settings.

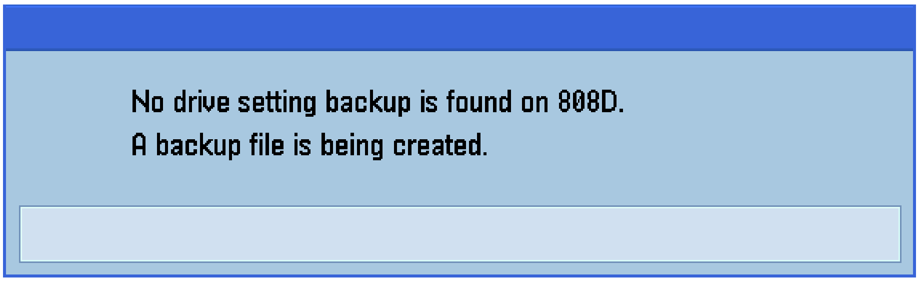
⑦ The system installs an update on the system CF card from the USB flash drive.

Note: The above menu options ③ to ⑥ are only visible if the manufacturer password is set before last power-off.

5.2 Synchronizing drive data files between NC and drive

The NC always compares its data backup with the drive data upon every startup.

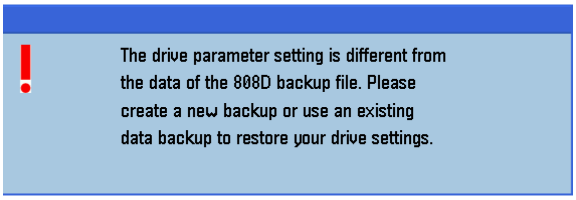
- If no data backup files can be found, the NC creates a new backup file automatically with the following message displaying on the screen:



- If the drive data differs from the NC data backup, data synchronization is required for synchronizing the drive data files between the NC and the drives.

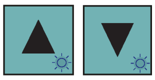
Operating sequence

1. Press this softkey to enter the setting window when the following data synchronization dialog box appears.



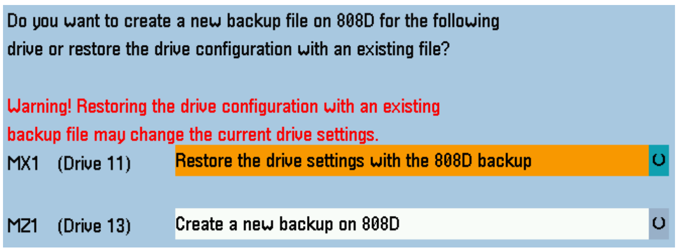
Note: a password input field appears in this dialog if you have not set an access level on the control system. For more information, see Section "Setting the password (Page 123)".

If you cancel the data synchronization with the following softkey, this dialog appears again on next NC startup.



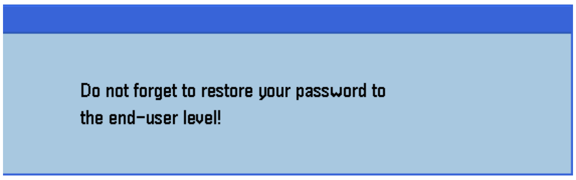
2. Select a drive for which you desire to perform the data synchronization.

3. Press this key to choose a synchronization method for the selected drive.



4. Press this softkey to confirm your settings and start the data synchronization.

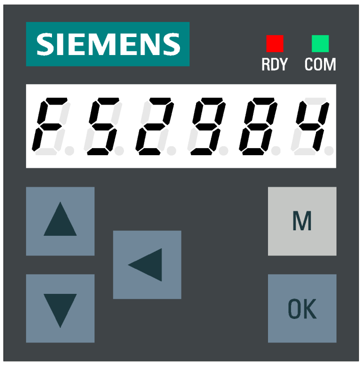
5. After the synchronization finishes successfully, the following dialog box displays on the screen.



6. Press this softkey to exit the dialog box.

Checking the status LEDs on the SINAMICS V70 drives

When the data synchronization is completed, the LEDs on the drive indicate the drive is in ready state (**RDY**: green; **COM**: slow flashing green every two seconds). The drive BOP displays S-off or a fault depending on the type of connected encoder.



5.3 Setting the password

The control system provides a concept of protection levels for enabling data areas. Different protection levels control different access rights.

The control system delivered from Siemens is set by default to the lowest protection level 7 (without password). If the password is no longer known, you must reinitialize the control system with the default machine/drive data. All passwords are then reset to default passwords for this software release.

Note

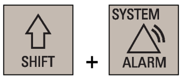
Before you boot the control system with default machine/drive data, make sure that you have backed up your machine/drive data; otherwise, all data are lost after rebooting with default machine/drive data.

Protection level	Locked by	Area	Access right
0	Siemens password	Siemens, reserved	-
1	Manufacturer password (Default password: "SUNRISE")	Machine manufacturers	• Entering or changing part of the machine data and drive data • Conducting NC and drive commissioning
2	Reserved	-	-
3-6	End-user password (Default password: "CUSTOMER")	End users	• Entering or changing part of the machine data • Editing programs • Setting offset values • Measuring tools
7 *	No password	End users	-

* Protection level 7 is set automatically if no password is set and no protection level interface signal is set. The protection level 7 can be set from the PLC user program by setting the bits in the user interface.

The number of machine data and drive data which can be read or modified depends on the protection level. You can set the protection level for these function areas with the display machine data (**USER_CLASS**...).

The control system is delivered with no password. You must set the factory default manufacturer password "**SUNRISE**" to perform the commissioning work. Perform the following steps to enter the password:



1. Select the system data operating area.

2. Press this vertical softkey to open the following dialog box.

3. Enter "SUNRISE" with the PPU keyboard and press this softkey.

   A message now shows at the bottom of the screen, which indicates that you have successfully set the password.

The following password operations are also available in this operating area:

Changes the default password of the control system

Note

To avoid unauthorized access to the controller, you must change the Siemens default passwords to your own ones.

Deletes the current password

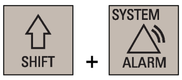
Note

Clear the password before the machine is delivered; otherwise, end users can start the controller with the standard data, which can initialize the control system. As a consequence, the machine will not run.

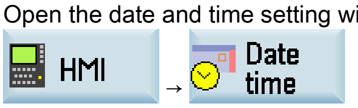
5.4 Setting the date and time

By default, the system date and time remain the factory settings. You can proceed through the following operating sequence to change the date and time as required.

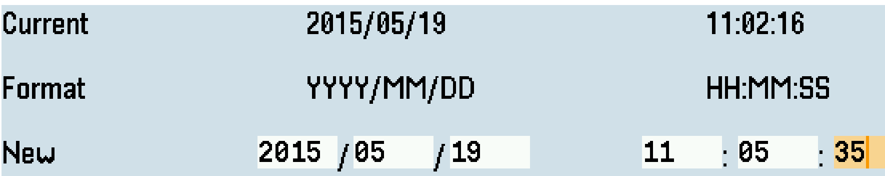
Operating sequence

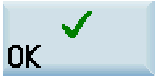


1. Select the system data operating area.
2. Open the date and time setting window through the following softkey operations:



3. Enter the date and time in the specified format.





4. Press this softkey to confirm your settings.

Note

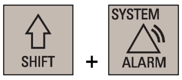
The settings of date and time are effective for 30 days if the control system is powered off for a long time at 25 °C surrounding air temperature.

5.5 Setting the user interface language

5.5.1 Changing the system language

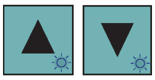
In the basic configuration, the control system is delivered with two system languages (simplified Chinese and English). The default user interface language is dependent on the PPU type. For a PPU with Chinese keys, the default language is Chinese after power-on; otherwise it's English.

Operating sequence

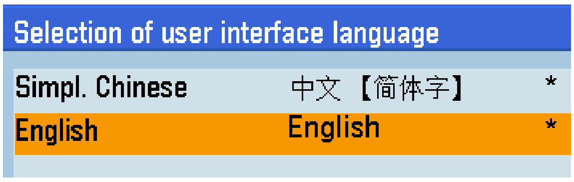


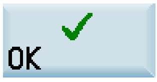
1. Select the system data operating area.

2. Open the user interface language selection window.



3. Use the cursor keys to select the desired language.





4. Press this softkey to confirm your selection and the system is automatically restarted to activate the selected language.

5.5.2 Loading system languages

You can load a new system language or update an existing language on the control system. Siemens will provide each language in the form of an archive file. The file name format is as follows:

808_lang_<LANG>_04080100yyy.arc

Where, <LANG> stands for the language code, for example, <chs> for Chinese, <eng> for English. "040801" refers to the applicable software version of the control system. "yyy" refers to the language version code.

The following table provides different language codes for your reference.

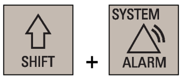
Language	Code	Language	Code
Simplified Chinese	chs [1)]	Italian	ita
Traditional Chinese	cht	Korean	kor
Czech	csy	Dutch	nld
Danish	dan	Polish	plk
German	deu	Portuguese	ptb
English	eng [1)]	Romanian	rom
Spanish	esp	Russian	rus
Finnish	fin	Swedish	sve
French	fra	Turkish	trk
Hungarian	hun		

[1)] Factory default system languages that are already loaded on the control system at delivery.

Operating sequence

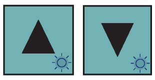
Proceed through the following steps to load a system language:

1. Copy the system language file to a USB stick.
2. Insert the USB stick into the USB interface at the front of the PPU.

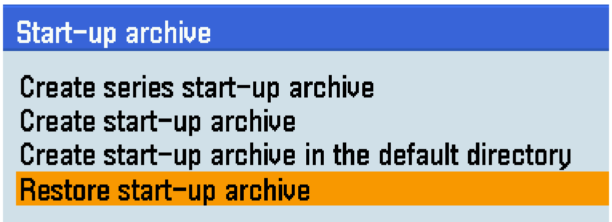


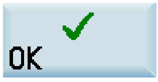
3. Select the system data operating area.

4. Press this softkey to open the start-up archive window.

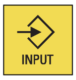


5. Use the cursor keys to select the following option to restore a start-up archive.

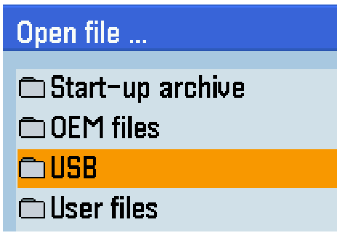


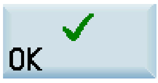


6. Press this softkey to confirm, and the file opening dialog box appears.

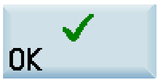


7. Select the USB folder and press this key to enter it.

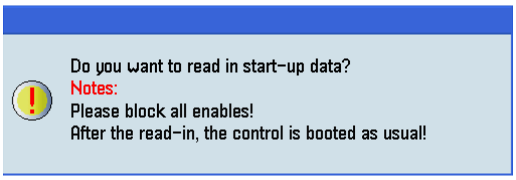


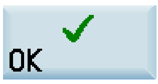


8. Navigate to the system language file you desire to load and press this softkey to confirm.

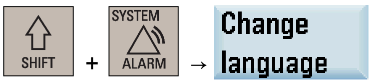


9. Press this softkey to confirm the archive information, and then the following message appears:





10. Press this softkey to confirm and start loading the archive. The control system restarts to complete restoring the system language archive.
11. Power off/on the control system to activate the loaded language. Then you can find the new system language and select it through the following operations:



5.6 Activating the optional functions

The following optional functions can be purchased for the control system:

- Additional axis
- Additional positioning axis/auxiliary spindle *
- Contour handwheel
- Bidirectional leadscrew error compensation
- Generic Coupling 'CP-BASIC' (for the turning variant of the control system only)
- Manual Machine Plus (for the turning variant of the control system only)
- Lock MyCycles
- Transmit/Tracyl
- Gantry (BASIC) *
- CNC lock

* This optional function is available on PPU16x.3 only.

Note

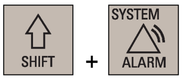
Before activating the Manual Machine Plus function, make sure that MD20050 is set to default.

Note

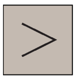
The control system with PPU16x.3 supports up to three additional axes (configured as standard NC axes or positioning axes) for the turning variant and two for the milling variant. The control system with PPU15x.3 only supports one additional axis configured as standard NC axis for the turning variant only.

To use a purchased option, you must first activate it with a license key on the control system. After you purchase the desired option(s), you can obtain the corresponding license key from the Web License Manager.

Operating sequence



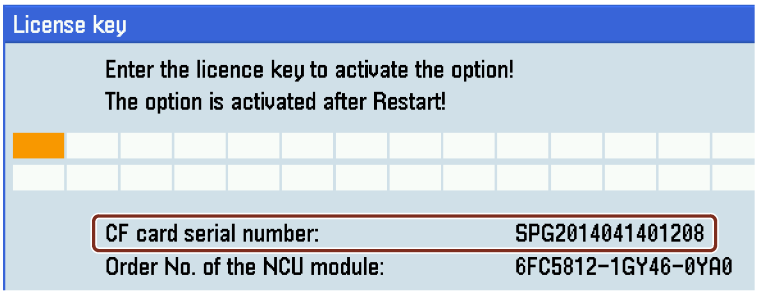
1. Select the system data operating area.



2. Press this key to view the extended softkeys.

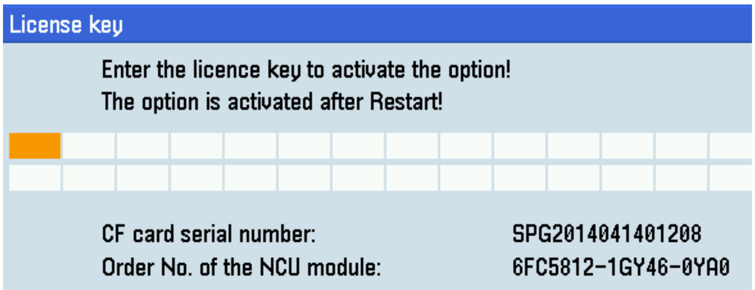
3. Open the dialog box for entering the license key through the following softkey operations:

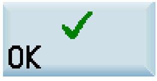
Then you can find the serial number of the CF card in the following dialog box:



4. Go to the Web License Manager (http://www.siemens.com/automation/license) on a computer with Internet access, and login via "Direct access".
5. Follow the instructions in the Web License Manager to assign the licenses of your purchased options to the specified PPU. A license key is generated after the licenses are assigned successfully.

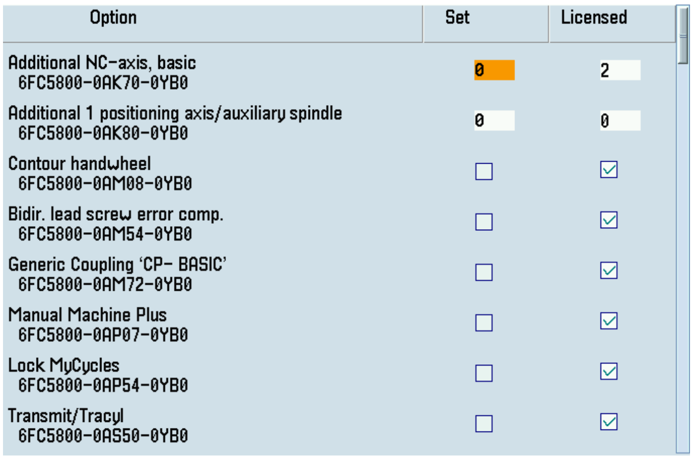
6. Enter the license key generated by the Web License Manager in the following dialog box:





7. Press this softkey to confirm your entry.

8. Press this softkey to open the window of available options. You can find the licensing status in this window, for example:



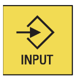
Option	Set	Licensed
Additional NC-axis, basic 6FC5800-0AK70-0YB0	0	2
Additional 1 positioning axis/auxiliary spindle 6FC5800-0AK80-0YB0	0	0
Contour handwheel 6FC5800-0AM08-0YB0	☐	☑
Bidir. lead screw error comp. 6FC5800-0AM54-0YB0	☐	☑
Generic Coupling 'CP- BASIC' 6FC5800-0AM72-0YB0	☐	☑
Manual Machine Plus 6FC5800-0AP07-0YB0	☐	☑
Lock MyCycles 6FC5800-0AP54-0YB0	☐	☑
Transmit/Tracyl 6FC5800-0AS50-0YB0	☐	☑

If you have licensed one or more additional axes, you can find the number of the licensed axes in the column of licensing status. For other licensed options, a "☑" symbol displays in this column.

Note: The last option (see below) in this window indicates the variant information and the licensing status of your control system, for example:

In case of any problems with the licensing status of your control system, contact Siemens service personnel.

9. Set the licensed options.
   - For the additional axes, enter a number as required in the setting column and press the following key:



   - For the other options, press the following key to select:

10. Press this softkey to restart the NCK, so that the licensed options are activated.

Note

To use the CNC lock function, further activation operations are required after the CNC lock option is activated. For more information, see Section "CNC lock function (Page 267)".

---

6 Commissioning the PLC

6.1 PLC programming conventions

Program organization

During the PLC programming, you must structure your program into finished program parts (subroutines). The programming language for the S7-200 offers you the capability to set up your user program in a structured manner.

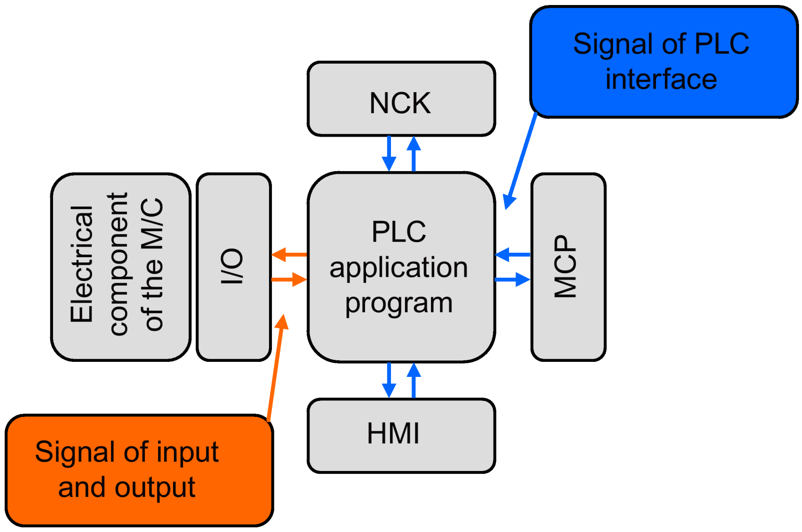
There are the following two types of programs:

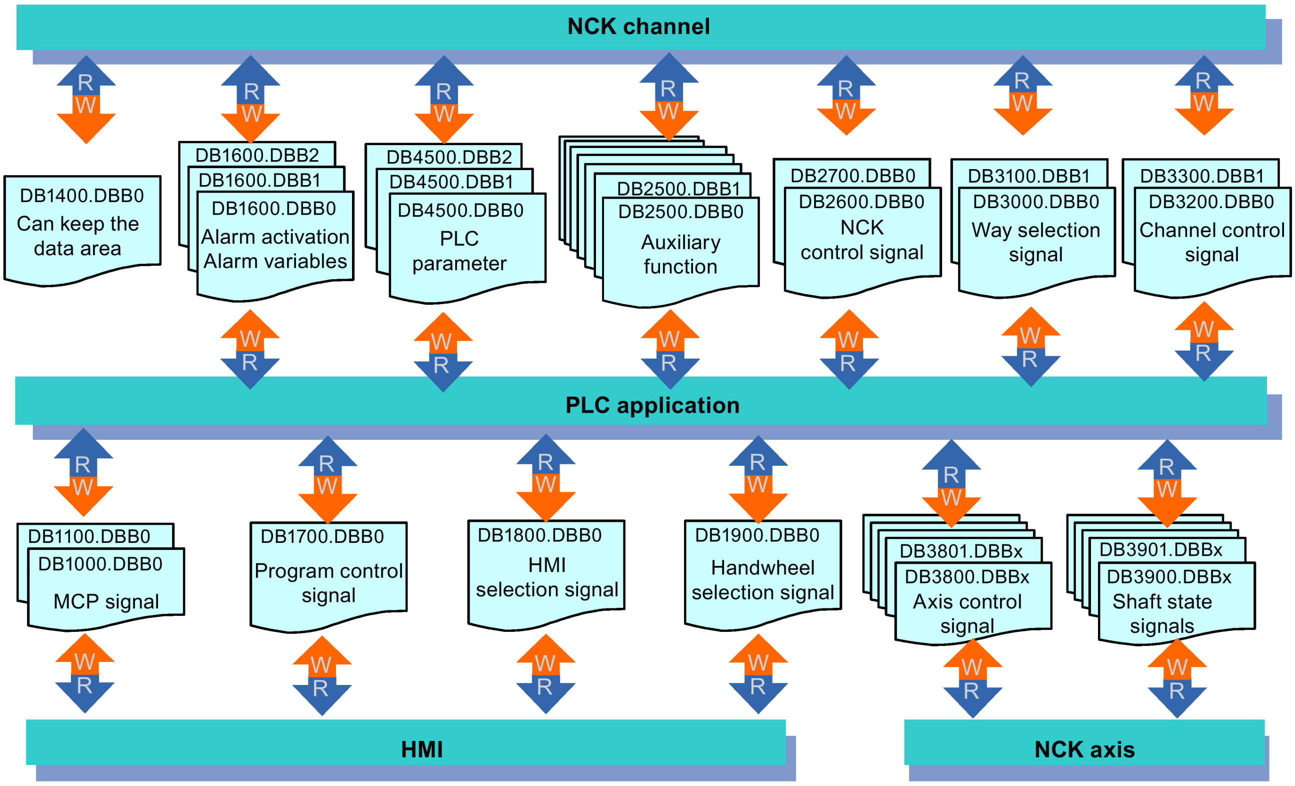
- Main program
- Subroutine

Eight levels of programming are possible.

6.2 Signal overview of PLC interface

The PLC program exchanges information among the NCK, HMI, MCP, and I/O through the signals of the PLC interface and signals of the input and output cards.



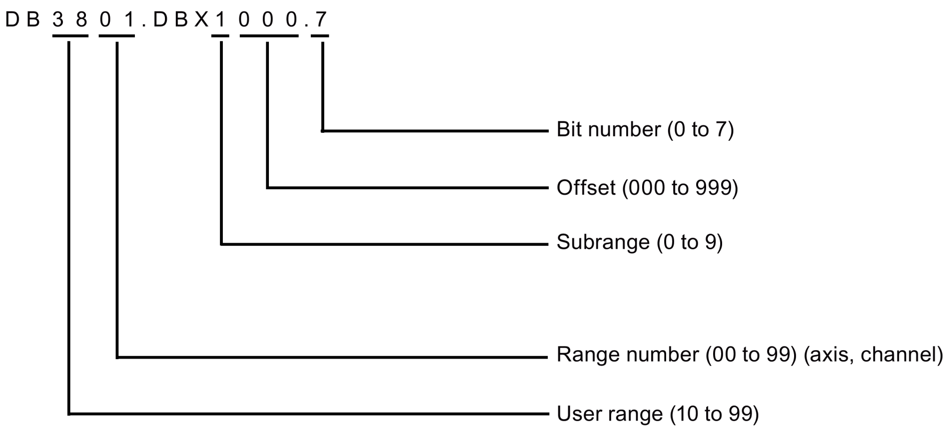


6.3 Operation symbols of PLC programming languages

Operand identifier

Address identifier	Description	Range
DB	Data	DB1000 to DB7999 DB9900 to DB9906
T	Timers	T0 to T15 (100 ms) T16 to T63 (10 ms)
C	Counters	C0 to C63
I	Image of digital inputs	I0.0 to I8.7
Q	Image of digital outputs	Q0.0 to Q5.7
M	Bit memory	M0.0 to M255.7
SM	Special bit memory	SM0.0 to SM0.6 ()
AC	Accumulators	AC0 to AC3

Structure of the DB-range address



Access	Example	Description
Bit	DB3801.DBX1000.7	Bit 7 of the byte with offset 0 in subrange 1 for axis 2, user range 38
Byte	DB3801.DBB0	Byte with offset 0 in subrange 0 for axis, user range 38
Word	DB4500.DBW2	Work with offset 2 in subrange 0, range 0, user range 45
Double Word	DB2500.DBD3004	Double word with offset 4 in subrange 3, range 0, user range 25

Note

The permitted offset for an address depends on the access as follows:

- Bit or byte access: any offset
  Byte-size variables are placed one beside another seamlessly in a DB.
- Word access: the offset must be divisible by 2.
  Word-size variables (2 bytes) are always saved on straight offsets.
- Double word access: the offset must be divisible by 4.
  Double word-size variables (4 bytes) are always saved on offsets that are divisible by 4.

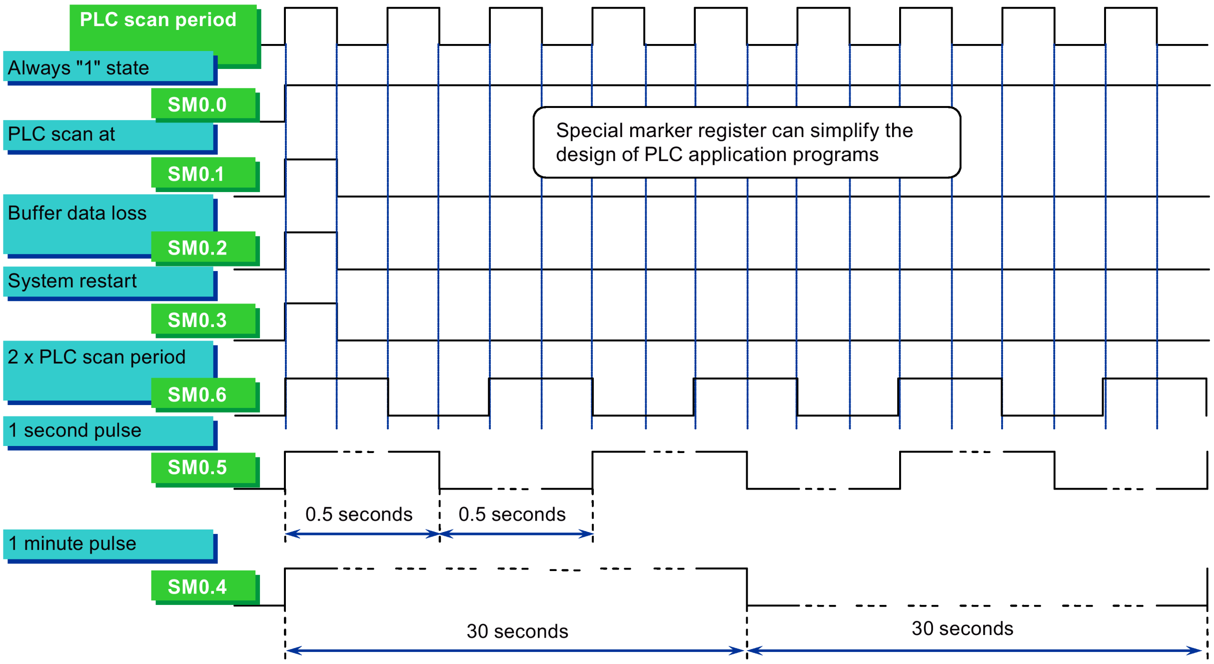
Notes on the PLC interface signal address representation

Currently, PLC interface signal addresses are represented by the V structure on the HMI while the manual shows them by the DB structure.

See the following table for the relationship between the two representations.

V Structure		DB Structure	
Access	Example	Example	Access
Bit	V38000002.1	DB3800.DBX2.1	Bit
Byte	VB38000002	DB3800.DBB2	Byte
Word	VW38000002	DB3800.DBW2	Word
Double Word	VD38000004	DB3800.DBD4	Double word

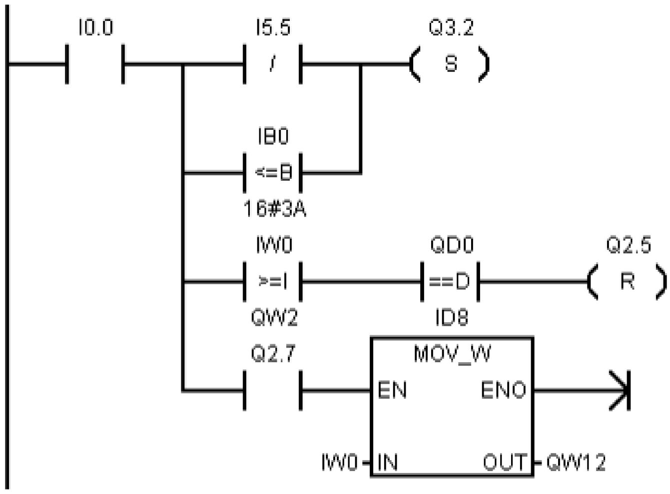
Special bit memory SM bit definition (read-only)



Inputs (I) and outputs (Q)

Form

- Bit: I0.0, I4.6; Q2.1, Q1.7
- Byte: IB4, IB12; QB3, QB7
- Word: IW2, IW4; QW0, QW6
- Double word: ID2, ID8; QD0, QD4



Accumulators (AC)

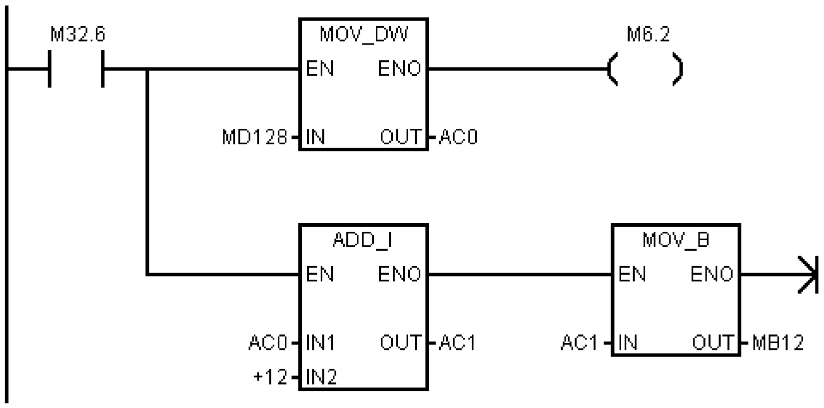
A maximum of four accumulators are available:

- Arithmetic accumulators: AC0, AC1
- Logical accumulators: AC2, AC3

Flag registers (M)

Form

- Bit: M0.1, M124.5
- Byte: MB21, MB12
- Word: MW22, MW106
- Double word: MD4, MD28



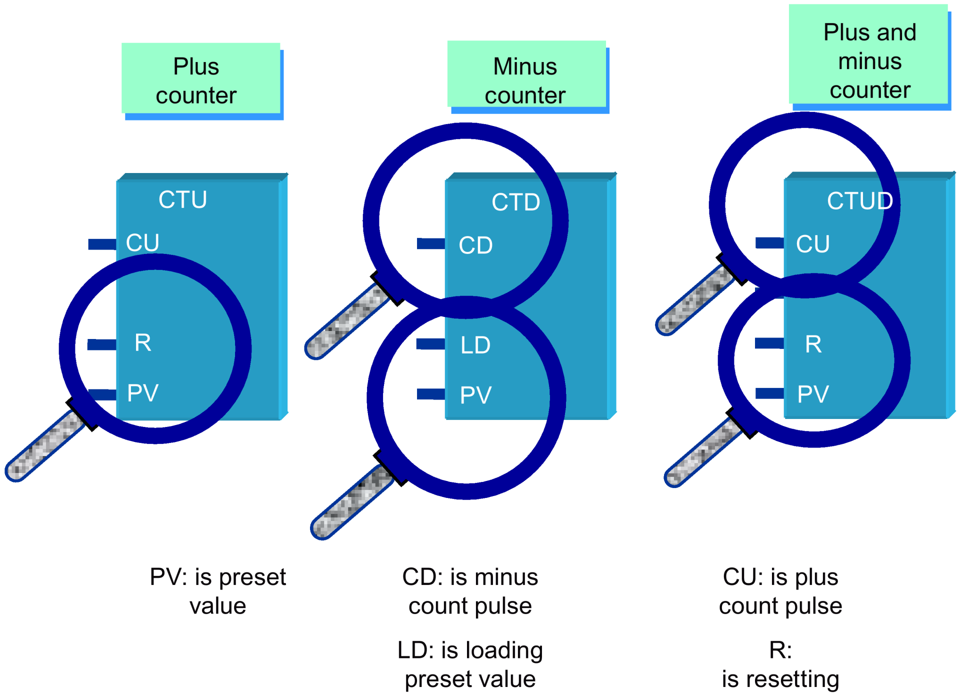
Counters (C)

Form

Condition of counter: C3 and C25 - represent the comparison result of the counter and preset value

Type

- Plus counter CTU: counter value + 1; R = 1 resets the counter; counter value > preset value; Cn = 1
- Minus counter CTD: counter value - 1; LD counter value = preset value = counter value = 0; Cn = 1
- Plus-minus counter CTUD: counter value + 1 for plus count; for minus count, counter value R = 1 resets the counter; counter value > preset value; C = 1



Timers (T)

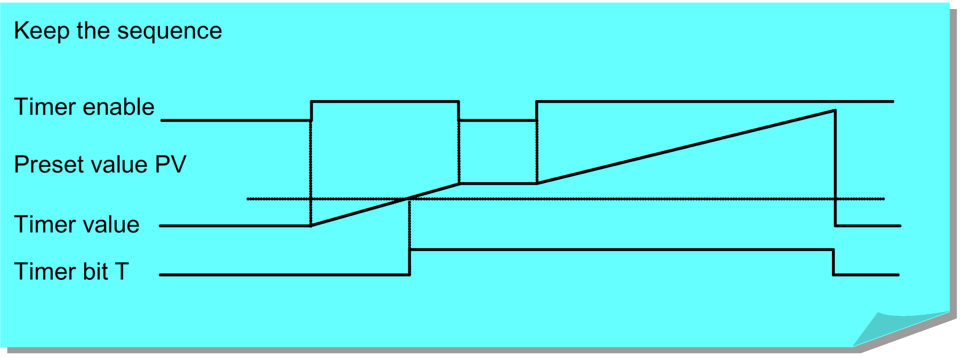
Form

Condition of timer: T3 and T25 - represent the comparison result of timer value and preset value

Type

- On-delay timer TON: IN = 1 starts timing; IN = 0 resets timer; timer value > preset value; Tn = 1
- Off-delay timer TOF: IN = 1 resets timer; IN = 0 starts timing; timer value > preset value; Tn = 0
- Retentive delay timer CTUD: IN = 1 starts timing; IN = 0 stops timing; timer value > preset value; Tn = 1

Assigning value "0" to T resets the timer.



Variable access rights

[r]	You can "read only" the designated area.
[r/w]	You can "read and write" the designated area.

Data format information

1	BIT
8	BYTE
16	INT/WORD
32	DINT/DWORD/REAL

Note

All of the empty fields in the user interface are reserved for Siemens and may neither be written to nor be evaluated.

Fields designated with "0" always have the value "logical 0".

If there is no data format information, you can read or write to all the specified data formats.

6.4 PLC sample applications

6.4.1 PLC sample application (turning)

This sample application is applicable to machines with the following configurations:

- Two axes: axes X and Z, with a hardware limit switch respectively in the positive and negative directions of each axis
- A spindle: SP
- HALL effect device turret with six working stations
- PLC-controlled timely and quantitatively lubrication system
- PLC-controlled cooling system

Assignment of inputs and outputs

Signal	Description	Remark
I0.0	Emergency Stop button	Normally closed
I0.1	Limit switch in the "+" direction of axis X	Normally closed
I0.2	Limit switch in the "-" direction of axis X	Normally closed
I0.3	-	Reserved
I0.4	-	Reserved
I0.5	Limit switch in the "+" direction of axis Z	Normally closed
I0.6	Limit switch in the "-" direction of axis Z	Normally closed
I0.7	Reference point switch of axis X	Normally open
I1.0	-	Reserved
I1.1	Reference switch of axis Z	Normally open
I1.2	Tool path detecting signal T1	Valid at a low level
I1.3	Tool path detecting signal T2	Valid at a low level
I1.4	Tool path detecting signal T3	Valid at a low level
I1.5	Tool path detecting signal T4	Valid at a low level
I1.6	Tool path detecting signal T5	Valid at a low level
I1.7	Tool path detecting signal T6	Valid at a low level
I2.0	Turret motor overload	Normally closed
I2.1	Reserved for other types of turrets	Reserved
I2.2	-	Reserved
I2.3	Chuck foot switch	Normally open
I2.4	Coolant level too low	Normally closed
I2.5	Cooling pump motor overload	Normally closed
I2.6	Lubricant level to low	Normally closed
I2.7	Lubrication pump motor overload	Normally closed
I3.0	-	Reserved
I3.1	-	Reserved
I3.2	-	Reserved
I3.3	-	Reserved
I3.4	-	Reserved
I3.5	-	Reserved
I3.6	-	Reserved
I3.7	-	Reserved
I4.0	Handheld unit: axis X selected	Valid at a high level
I4.1	Handheld unit: axis Y selected	Valid at a high level

Signal	Description	Remark
I4.2	Handheld unit: axis Z selected	Valid at a high level
I4.3	Handheld unit: fourth axis selected	Reserved
I4.4	Handheld unit: increment X1	Valid at a high level
I4.5	Handheld unit: increment X10	Valid at a high level
I4.6	Handheld unit: increment X100	Valid at a high level
I4.7	Handheld unit: enabled	Valid at a high level
Q0.0	Working lamp	
Q0.1	-	
Q0.2	Tailstock forward	
Q0.3	Tailstock backward	
Q0.4	Cooling pump	
Q0.5	Lubrication pump	
Q0.6	Chuck output 1	
Q0.7	Chuck output 2	
Q1.0	Turret motor rotating clockwise	
Q1.1	Turret motor rotating counter-clockwise	
Q1.2	Reserved for other types of turrets	
Q1.3	Reserved for other types of turrets	
Q1.4	Gear shift: low gear level (SBR49: GearChg1_Auto) / Gear level status (SBR50: GearChg2_Virtual)	
Q1.5	Gear shift: high gear level (SBR49: GearChg1_Auto)	
Q1.6	-	
Q1.7	Handheld unit valid	

Definition of user-defined keys on the MCP

User-defined key 1	Working lamp
User-defined key 2	Manual cooling
User-defined key 3	Manual tool change
User-defined key 4	Manual chuck clamping and unclamping
User-defined key 5	Chuck clamping internally/externally
User-defined key 6	Tailstock

Structure of the sample application (OB1)

Call Conditions	Subroutine Name	Description
Each scan (SM0.0)	AUX_MCP (SBR20)	Auxiliary function
Each scan (SM0.0)	AUX_3Color_LAMP (SBR24)	Three-color lamp control
First scan (SM0.1)	PLC_INI (SBR32)	PLC initialization
Each scan (SM0.0)	EMG_STOP (SBR33)	Emergency Stop control
Each scan (SM0.0)	MCP_NCK (SBR37)	Transferring MCP and HMI signals to the NCK interface
Each scan (SM0.0)	HANDWHL (SBR39)	Selecting a handwheel through the interface signal DB1900.DBB1xxx
Each scan (SM0.0)	AXIS_CTL (SBR40)	Coordinate enabling control, hardware limit, etc.
Each scan (SM0.0)	MINI_HHU (SBR41)	Handwheel on hand-held unit
Each scan (SM0.0)	SPINDLE (SBR42)	Spindle control
Each scan (SM0.0)	COOLING (SBR44)	Cooling control

Call Conditions	Subroutine Name	Description
Each scan (SM0.0)	PI_SERVICE (SBR46)	ASUP (Asynchronous Subroutine Program)
Each scan (SM0.0)	ServPlan (SBR48)	Maintenance plan example: first task
Each scan (SM0.0)	Turret1_HED_T (SBR51)	HALL effect device turret control
Each scan (SM0.0)	Tail_stock_T (SBR55)	Tailstock control
Each scan (SM0.0)	Lock_unlock_T (SBR56)	Clamp or release control
Each scan (SM0.0)	MM_MAIN (SBR58)	Manual machine
Each scan (SM0.0)	MM_MCP_808D (SBR59)	Spindle signal processing for the manual machine
Each scan (SM0.0)	Trg_key_OR (SBR62)	Override control

6.4.2 PLC sample application (milling)

This sample application is applicable to machines with the following configurations:

- Three axes: axes X, Y and Z, with a hardware limit switch respectively in the positive and negative directions of each axis
- A spindle: SP (the fourth axis)
- PLC-controlled timely and quantitatively lubrication system
- PLC-controlled cooling system

Assignment of inputs and outputs

Signal	Description	Remark
I0.0	Emergency Stop button	Normally closed
I0.1	Limit switch in the "+" direction of axis X	Normally closed
I0.2	Limit switch in the "-" direction of axis X	Normally closed
I0.3	Limit switch in the "+" direction of axis Y	Normally closed
I0.4	Limit switch in the "-" direction of axis Y	Normally closed
I0.5	Limit switch in the "+" direction of axis Z	Normally closed
I0.6	Limit switch in the "-" direction of axis Z	Normally closed
I0.7	Reference point switch of axis X	Normally open
I1.0	Reference point switch of axis Y	Normally open
I1.1	Reference point switch of axis Z	Normally open
I1.2	Disk-style tool magazine: tool magazine count	Valid at a low level
I1.3	Disk-style tool magazine: tool magazine at the spindle position	Valid at a low level
I1.4	Disk-style tool magazine: tool magazine at the original position	Valid at a low level
I1.5	Disk-style tool magazine: tool at the release position	Valid at a low level
I1.6	Disk-style tool magazine: tool at the clamping position	Valid at a low level
I1.7	-	Reserved
I2.0	-	Reserved
I2.1	-	Reserved
I2.2	-	Reserved
I2.3	-	Reserved
I2.4	Coolant level too low	Normally closed
I2.5	Cooling pump motor overload	Normally closed
I2.6	Lubricant level too low	Normally closed
I2.7	Lubrication pump motor overload	Normally closed
I3.0	-	Reserved
I3.1	-	Reserved

Signal	Description	Remark
I3.2	-	Reserved
I3.3	-	Reserved
I3.4	-	Reserved
I3.5	-	Reserved
I3.6	-	Reserved
I3.7	-	Reserved
I4.0	Handheld unit: axis X selected	Valid at a high level
I4.1	Handheld unit: axis Y selected	Valid at a high level
I4.2	Handheld unit: axis Z selected	Valid at a high level
I4.3	Handheld unit: fourth axis selected	Valid at a high level
I4.4	Handheld unit: increment X1	Valid at a high level
I4.5	Handheld unit: increment X10	Valid at a high level
I4.6	Handheld unit: increment X100	Valid at a high level
I4.7	Handheld unit: enabled	Valid at a high level
Q0.0	Working lamp	
Q0.1	-	
Q0.2	Chip forward	
Q0.3	Chip backward	
Q0.4	Cooling pump	
Q0.5	Lubrication pump	
Q0.6	Safety door open	
Q0.7	-	
Q1.0	Magazine rotating clockwise	
Q1.1	Magazine rotating counter-clockwise	
Q1.2	Magazine approaching spindle position	
Q1.3	Magazine approaching original position	
Q1.4	Tool release from the spindle	
Q1.5	-	
Q1.6	-	
Q1.7	Handheld unit valid	

Definition of user-defined keys on the MCP

User-defined key 1	Working lamp
User-defined key 2	Manual cooling
User-defined key 3	Safety door
User-defined key 4	Manual clockwise rotation of the tool magazine
User-defined key 5	Manual reset of the tool magazine
User-defined key 6	Manual counter-clockwise rotation of the tool magazine
User-defined key 7	Removing chip forward
User-defined key 8	Removing chip backward

Structure of the sample application (OB1)

Call Conditions	Subroutine Name	Description
Each scan (SM0.0)	AUX_MCP (SBR20)	Auxiliary function
First scan (SM0.1)	PLC_INI (SBR32)	PLC initialization
Each scan (SM0.0)	EMG_STOP (SBR33)	Emergency Stop control

Call Conditions	Subroutine Name	Description
Each scan (SM0.0)	MCP_NCK (SBR37)	Transferring MCP and HMI signals to the NCK interface
Each scan (SM0.0)	HANDWHL (SBR39)	Selecting a hand wheel through the interface signal DB1900.DBB1xxx
Each scan (SM0.0)	AXIS_CTL (SBR40)	Coordinate enabling control, hardware limit, etc.
Each scan (SM0.0)	SPINDLE (SBR42)	Spindle control
Each scan (SM0.0)	COOLING (SBR44)	Cooling control
Each scan (SM0.0)	LUBRICAT (SBR45)	Lubrication control

6.5 PLC machine data

Note

The following tables list the PLC machine data used in the default PLC applications. The machine data not listed below is reserved for the manufacturer.

USER_DATA_INT

MD14510 Machine data - Integer	PLC interface address	Unit	Range	Function
14510[12]	DB4500.DBW24	-	0 to 1	Layout of the traverse keys
14510[13]	DB4500.DBW26	0.1 s	5 to 200	Time for spindle braking
14510[15]	DB4500.DBW30	0.1 s	5 to 30	Spindle override 50% key holding on time defined
14510[16]	DB4500.DBW32	0.1 s	1 to 30	Spindle override 100% key holding on time defined
14510[17]	DB4500.DBW34	0.1 s	5 to 30	Feedrate override 0% key holding on time defined
14510[18]	DB4500.DBW36	0.1 s	1 to 30	Feedrate override 100% key holding on time defined
14510[20]	DB4500.DBW40	-	2 to 64	Maximum number of tools
14510[21]	DB4500.DBW42	0.1 s	5 to 30	Turret clamping time
14510[22]	DB4500.DBW44	0.1 s	30 to 200	Monitoring time when searching for tools
14510[24]	DB4500.DBW48	1 min	5 to 300	Lubrication interval
14510[25]	DB4500.DBW50	0.01 s	100 to 2000	Lubrication duration

USER_DATA_HEX

MD14512 Machine data - Hex		PLC interface address	Function
14512[16]	Bit 1	DB4500.DBX1016.1	Function of chip conveyor (milling)
	Bit 2	DB4500.DBX1016.2	Function of safety door (milling)
	Bit 3	DB4500.DBX1016.3	When the function of safety door is active, it can be triggered by M01/M02 (milling)
	Bit 7	DB4500.DBX1016.7	Handwheel assignment with the MCP/HMI
14512[17]	Bit 0	DB4500.DBX1017.0	Turret (turning); tool magazine (milling)
	Bit 1	DB4500.DBX1017.1	Clamping function (turning)
	Bit 2	DB4500.DBX1017.2	Tail stock function (turning)
	Bit 3	DB4500.DBX1017.3	Selection between handwheel and hand-held unit (0: handwheel; 1: hand-held unit)
14512[18]	Bit 2	DB4500.DBX1018.2	Automatic lubrication at power-on
	Bit 4	DB4500.DBX1018.4	External signal for spindle stop
	Bit 5	DB4500.DBX1018.5	Fixed spindle direction
	Bit 6	DB4500.DBX1018.6	The hardware limit is independent from a PLC program
	Bit 7	DB4500.DBX1018.7	Each feed axis has a hardware limit switch (activated when Bit 6 = 0)

MD14512 Machine data - Hex		PLC interface address	Function
14512[19]	Bit 1	DB4500.DBX1019.1	Function of spindle braking
	Bit 2	DB4500.DBX1019.2	Password clearing by power-on (0: delete the password; 1: do not delete the password)
	Bit 4	DB4500.DBX1019.4	Spindle speed selection in "JOG" mode (0: select the speed set in MD32020; 1: select the speed set last time)
	Bit 7	DB4500.DBX1019.7	Manual machine function (this function becomes active if you have installed licensed turning machine system and called it with a PLC subroutine)
14512[20]	Bit 0	DB4500.DBX1020.0	Grey coded switch (0: spindle override controlled by the grey code; 1: spindle override controlled by triggering user keys)
	Bit 1	DB4500.DBX1020.1	Spindle disable mode (0: disable by pressing the spindle stop key; 1: disable when detecting the standstill speed) [1)]
	Bit 2	DB4500.DBX1020.2	Activate the first additional axis (0: disable the additional axis control; 1: enable the additional axis control)
	Bit 3	DB4500.DBX1020.3	The first additional axis as the second spindle and does not need to be kept enabled (1: as the second spindle and does not need to be kept enabled)
	Bit 5	DB4500.DBX1020.5	Define the spindle override startup value (0: the startup spindle override is always 100%; 1: recode the spindle override value of the last machine turn off for the next startup)
	Bit 6/7	DB4500.DBX1020.6/7	Define the spindle override shift speed
14512[21]	Bit 1	DB4500.DBX1021.1	Bit 1: switch of the I/O interface (0: set I0.0-I2.7/Q0.0-Q1.7 as the standard I/O wiring in the default PLC; 1: set I6.0-I8.7/Q4.0-Q5.7 as the standard I/O wiring in the default PLC) Bit 2: selection of the three-color lamp function (0: deactivate; 1: activate) Bit 3: switch of three-color lamp flashing (0: the lamp does not flash; 1: the lamp flashes)
	Bit 2	DB4500.DBX1021.2	Selection of the three-color lamp function (0: deactivate; 1: activate)
	Bit 3	DB4500.DBX1021.3	Switch of three-color lamp flashing (0: the lamp does not flash; 1: the lamp flashes)
	Bit 4	DB4500.DBX1021.4	Define the spindle override, feedrate override, and rapid feedrate control (1: spindle override and feedrate override controlled via trigger keys; rapid feedrate is active; 0: feedrate override controlled by gray coded switch)
	Bit 5	DB4500.DBX1021.5	Define the feedrate override startup value (0: the startup feedrate override is always 100%; 1: recode the feedrate override value of the last machine turn off for the next startup)
14512[22]	Bit 0	DB4500.DBX1022.0	Activate the second additional axis (0: disable the additional axis control; 1: enable the additional axis control)
	Bit 1	DB4500.DBX1022.1	The second additional axis as the second spindle and does not need to be kept enabled (1: as the second spindle and does not need to be kept enabled)

Note:

When you set MD14512, you can use the following key to open the editor for bit setting:

[1)] When the position control mode is active, do not disable the spindle by detecting the standstill speed.

USER_DATA_FLOAT

MD14514 Machine data - Float	PLC interface address	Unit	Range	Function
14514[0]	DB4500.DBD2000	-	-3.40e38 to 3.40e38	Tool magazine: spindle poisoning angle
14514[1]	DB4500.DBD2004	-	-3.40e38 to 3.40e38	Tool magazine: preparation position of Z axis for tool change
14514[2]	DB4500.DBD2008	-	-3.40e38 to 3.40e38	Tool magazine: tool change position of Z axis
14514[3]	DB4500.DBD2012	-	-3.40e38 to 3.40e38	Tool magazine: velocity of Z axis, go to tool change position
14514[4]	DB4500.DBD2016	-	-3.40e38 to 3.40e38	Tool magazine: velocity of Z axis, back to tool change preparation position

6.6 PLC subroutine library

6.6.1 Overview

In order to simplify the PLC design, we provide refined PLC functions which have generality, such as initialization, machine panel signal processing, emergency stop processing, axis enable control, hard limit, and reference point etc. By adding the desired subroutine module to the main procedure, plus other supplementary procedures, you can complete the PLC procedure design easily.

The PLC subroutine library consists of the following files:

- PLC project file: SAMPLE_TURN.PTP (application program as examples for a turning machine)
- PLC project file: SAMPLE_MILL.PTP (application program as examples for a milling machine)

Note

Through these examples, you can clearly realize how to create or invoke PLC subroutines. You can reorganize PLC subroutines or modify networks to realize most machine functions, test and debug subroutines of the library.

System resource

	Resource	
PLC system resource	Input	I0.0 to I2.7 (24 inputs on X100, X101, and X102) I6.0 to I8.7 (48 distributed inputs on X301 and X302)
	Output	Q0.0 to Q1.7 (16 outputs on X200 and X201) Q4.0 to Q5.7 (32 distributed outputs on X301 and X302)
	RAM	M0.0 to M255.7 (256 bytes)
	Non-volatile memory	DB1400.DBX0.0 to DB14000.DBX127.7 (128 bytes)
	PLC user alarm	DB1600.DBX0.0 to DB16000.DBX15.7 (128 user alarms)
	Timer	T0 to T15 (100 ms timer) T16 to T32 (10 ms timer)
	Counter	C0 to C63 (64 counters)
NC resource	Parameter MD14510(32)	Statistic INT: DB4500.DBW0 to DB4500.DBW62 (32 double words)
	Parameter MD14514(32)	Statistic HEX: DB4500.DBB1000 to DB4500.DBB1031 (32 bytes)
	Parameter MD14514(8)	Statistic REAL: DB4500.DBD2000 to DB4500.DBD2028 (8 double words)
Programming tool resource	Subroutine (64)	SBR0 to SBR63 (64 subroutines)
	Symbol table (32)	SYM1 to SYM32 (32 symbol tables)

Constant definition

Constant input	Symbol	Address
Constant "1"	ONE	SM0.0
Constant "2"	ZERO	M251.0

Zero output definition

Data type	Symbol	Address
bit	NULL_b	M255.7
byte	NULL_B	M255
word	NULL_W	M254
double-word	NULL_DW	M252

Structure of symbol tables

All the addresses in the PLC subroutine library are programmed with symbols. All the signals of interfaces are named by symbols and arranged in different symbol tables.

The name of a symbol follows some conventions. For details, see Section "Conventions for the symbols used in the subroutines (Page 144)".

Symbol table	Table name	Descriptions
1	IO_1	Module I/O are defined by the manufacturer
2	IO_2	Distributed I/O are defined by the manufacturer
3, 5, 7, 13		Reserved for the manufacturer
6	MANMACH	JOG function
14	ASUP	ASUP function
15	PLC_sel_PP	PLC selects part programs
16	IS_MCP	Signals from/to the MCP
17	IS_HMI	Signals from/to the HMI
18	IS_AUX	Auxiliary functions from the NCK
19	IS_NCK	Signals from/to the NCK
20	IS_CHA	Signals from/to the channel
21	IS_AX1	Signals to/from axis 1
22	IS_AX2	Signals to/from axis 2
23	IS_AX3	Signals to/from axis 3
24	IS_AX4	Signals to/from axis 4
27	MD_PLC	PLC machine data
28	ALARM	User alarms
29	NV_MEM	Non-volatile memory
30	SPC_MEM	Special memory bit
31	SBR_MEM	Global memory used in the sample applications and subroutines
32	RESVD1	Reserved for the sample applications and subroutines

Structure of subroutines

PLC sample subroutines offer PLC functions for the machine tool.

Subroutine No.	Name	Description
0 to 19	-	Reserved
20	AUX_MCP	Auxiliary function
21	AUX_LAMP	Working lamp control, called in the subroutine "AUX_MCP"
22	AUX_SAFE_DOOR	Safety door control, called in the subroutine "AUX_MCP" for a milling application

Subroutine No.	Name	Description
23	AUX_CHIP	Chip conveyor control, called in the subroutine "AUX_MCP" for a milling application
24	AUX_3Color_LAMP	Three-color lamp control, called in the subroutine "AUX_MCP"
31	PLC_ini_USR_INI	Reserved for initialization functions of the manufacturer (this subroutine is automatically called by subroutine 32)
32	PLC_INI	PLC initialization, executed at the first PLC cycle (SM0.1)
33	EMG_STOP	Emergency Stop
37	MCP_NCK	Signals from the MCP and HMI are sent to NCK interfaces
38	MCP_Tool_Nr	Display tool numbers via the 7-segment LED of the MCP
39	HANDWHL	Handwheel selection via the HMI
40	AXIS_CTL	Control of feed axis enable and spindle enable
41	MINI_HHU	Handwheel on hand-held unit
42	SPINDLE	Spindle control, including the spindle braking function
43	MEAS_JOG	Tool measurement in JOG mode
44	COOLING	Coolant control (Manual Machine key and M code: M07, M08, M09)
45	LUBRICATE	Lubrication control (interval and time)
46	PI_SERVICE	ASUP (Asynchronous Subroutine Program)
47	PLC_Select_PP	PLC selects a subroutine
48	ServPlan	Service planner
49	Gear_Chg1_Auto	Automatic gear change of the spindle
50	Gear_Chg2_Virtual	Virtual gear change of the spindle
51	Turret1_HED_T	Turret control for turning machine (turret type: Hall element transistor, 4/6 position)
52	Turret2_BIN_T	Turret control for turning machine (turret type: position detection with encodings)
53	Turret3_CODE_T	Hydraulic turret control for turning machine (turret type: position detection with encodings)
54	Turret2_3_ToolDir	Evaluate tool direction and calculate tool position (called by Turret2_BIN_T, Turret3_CODE_T)
55	Tail_stock_T	Tailstock control for turning machine
56	Lock_unlock_T	Clamp or release control for turning machine
58	MM_MAIN	Manual machine
59	MM_MCP_808D	Spindle signal processing for the manual machine
60	Disk_MGZ_M	Disk tool magazine for a milling machine
62	Trg_key_OR	Spindle override, feedrate override, and rapid feedrate control for a turning application Spindle override control for a milling application
63	TOGGLE	Six key-operated switches: K1 to K6 Two delay switches: K7, K8
34-36/57/61	-	Reserved

Turning and milling functions

PLC sample subroutines for turning functions:

For turning only		
SBR 51	Turret1_HED_T	HED turret control
SBR 52	Turret2_BIN_T	Bi-direction turret (binary coded)
SBR 53	Turret3_CODE_T	Bi-direction turret (coded by turret supplier)

SBR 55	Tail_stock_T	Tailstock control
SBR 56	Lock_unlock_T	Chuck control

PLC sample subroutines for milling functions:

For milling only		
SBR 60	Disk_MGZ_M	Disk magazine control (without automatic tool changer)

6.6.2 Conventions for the symbols used in the subroutines

The symbols used in the subroutines follow the conventions listed below:

- Leading characters designate the destinations of interface signals.
  - P_: to PLC interface
  - H_: to HMI interface
  - N_: to NCK interface
  - M_: to MCP interface
- Subsequent characters are for areas.
  - N_: NCK
  - C_: Channel
  - 1_: Axes
  - M_: MCP
- Other short forms of the symbols are as follows.
  - HWL: **H**ardware **L**imit
  - HW: **H**and**w**heel
  - RT: **R**apid **T**raverse
  - TK: **T**raverse **k**ey
  - ACT: **Act**ive
  - SEL: **Sel**ected
- Symbols consist of a maximum of 11 upper case characters and numbers (including the leading character). Except for underlines, you cannot use any other special symbols like =, +, -, [ ], etc.

6.6.3 Subroutine 20 - AUX_MCP (machine auxiliary functions)

Purpose

Subroutine 20 is used to call the Auxiliary function Subroutines AUX_LAMP, AUX_CHIP, and AUX_SAFETY_DOOR.

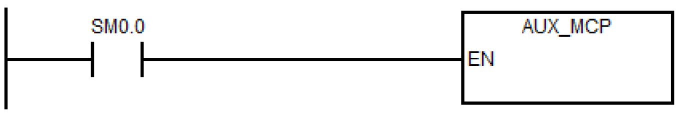
Local variable definition

None

Relevant PLC machine data

None

Example for calling subroutine 20



6.6.4 Subroutine 21 - AUX_LAMP (working lamp)

Purpose

Subroutine 21 is used to control working lamp and can be called in AUX_MCP. One-time pressing of the "**LAMP**" key activates the working lamp while double pressing de-activates the working lamp.

Local variable definition

Inputs

Variable	Type	Description
nodef	BYTE	Reserved
LampK	BOOL	Lamp on/off key

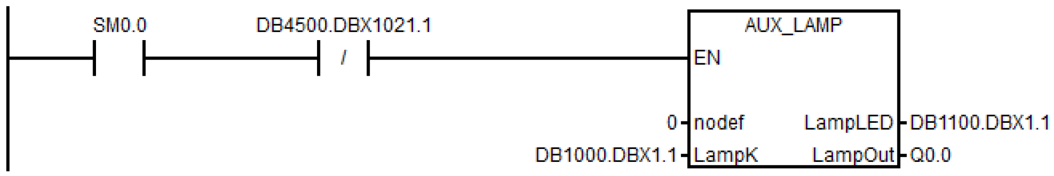
Outputs

Variable	Type	Description
LampLED	BOOL	Lamp status
LampOut	BOOL	Lamp output

Relevant PLC machine data

No.	Description
14512 [21].1	Switch of the I/O interface (0: set I0.0 to I2.7/Q0.0 to Q1.7 as the standard I/O wiring in the default PLC; 1: set I6.0 to I8.7/Q4.0 to Q5.7 as the standard I/O wiring in the default PLC)

Example for calling subroutine 21



6.6.5 Subroutine 22 - AUX_SAFE_DOOR (safety door)

Purpose

Subroutine 22 is used to control the safety door and can be called in AUX_MCP.

If you open the safety door, that means you activate the spindle speed limiting function, with the speed limit being specified in MD35160.

Local variable definition

Inputs

Variable	Type	Description
nodef	BYTE	Reserved
DoorK	BOOL	Door control key
IsDoorCls	BOOL	Signal: door is closed
M1_2_OpDoor	BOOL	Open door when M01/M02 is active

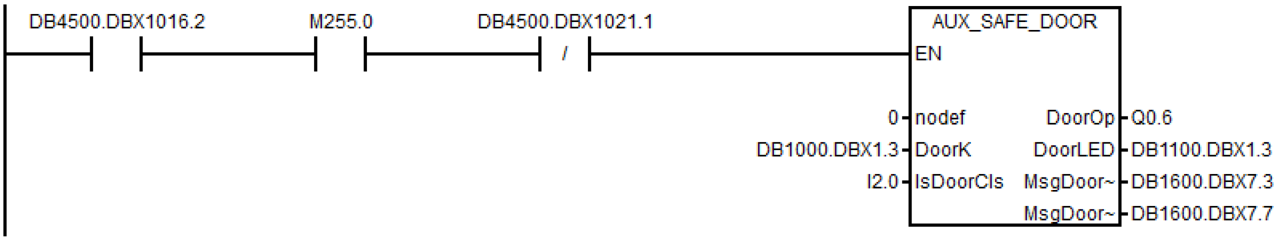
Outputs

Variable	Type	Description
DoorOp	BOOL	Door open output
DoorLED	BOOL	Door status
MsgDoorNotCls	BOOL	Message for door open

Relevant PLC machine data

No.	Description
14512 [16].2	Selection of safety door function (0: do not use; 1: use)
14512 [16].3	Safety door function is activated by M01/M02 (0: deactivate; 1: activate)
14512 [21].1	Switch of the I/O interface (0: set I0.0 to I2.7/Q0.0 to Q1.7 as the standard I/O wiring in the default PLC; 1: set I6.0 to I8.7/Q4.0 to Q5.7 as the standard I/O wiring in the default PLC)

Example for calling subroutine 22



6.6.6 Subroutine 23 - AUX_CHIP (chip conveyor)

Purpose

Subroutine 23 is used to control the chip conveyor and can be called in AUX_MCP. At first-time pressing of the "Chip Forward" key the output "ChipFwd" is high; at second-time pressing of the "Chip Forward" key the output "ChipFwd" becomes low. When the output "ChipFwd" is low, the output "ChipRev" becomes high at pressing "Chip Reverse" key and becomes low at releasing the "Chip Reverse" key.

Local variable definition

Inputs

Variable	Type	Description
nodef	BYTE	Reserved
ChipFwdK	BOOL	Chip forward key
ChipRevK	BOOL	Chip reverse key

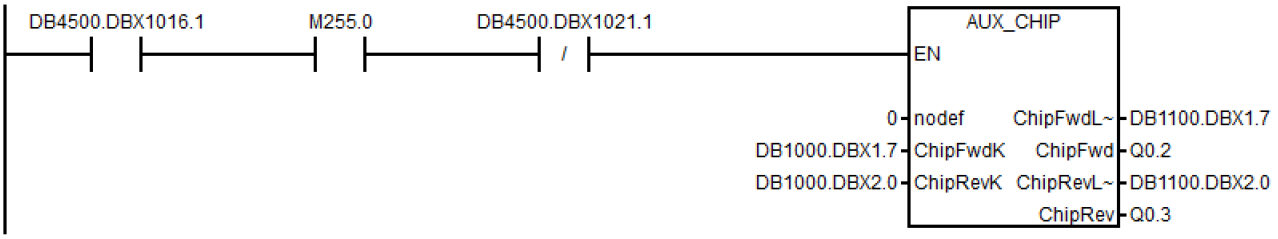
Outputs

Variable	Type	Description
ChipFwdLED	BOOL	Chip forward led
ChipFwd	BOOL	Chip forward output
ChipRevLED	BOOL	Chip reverse led
ChipRev	BOOL	Chip reverse output

Relevant PLC machine data

No.	Description
14512 [16].1	Selection of chip conveyor function (0: do not use; 1: use)
14512 [21].1	Switch of the I/O interface (0: set I0.0 to I2.7/Q0.0 to Q1.7 as the standard I/O wiring in the default PLC; 1: set I6.0 to I8.7/Q4.0 to Q5.7 as the standard I/O wiring in the default PLC)

Example for calling subroutine 23



6.6.7 Subroutine 24 - AUX_3Color_LAMP

Purpose

Subroutine 24 is used to control the three-color lamp function and can be called in AUX_MCP.

Local variable definition

Inputs

Variable	Type	Description
nodef	BYTE	Reserved

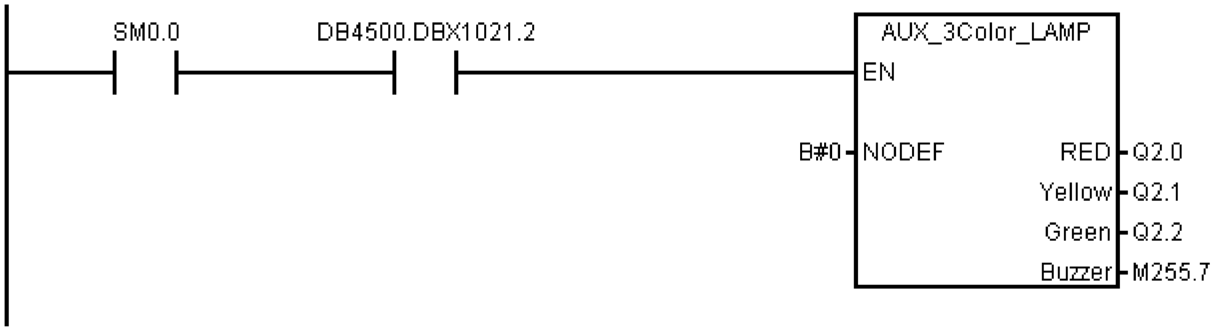
Outputs

Variable	Type	Description
Red	BOOL	Alarm lamp: red
Yellow	BOOL	Alarm lamp: yellow
Green	BOOL	Alarm lamp: green
Buzzer	BOOL	Alarm hint: buzzer

Relevant PLC machine data

No.	Description
14512 [21].2	Selection of the three-color lamp function (0: deactivate; 1: activate)
14512 [21].3	Switch of three-color lamp flashing (0: the lamp does not flash; 1: the lamp flashes)

Example for calling subroutine 24



6.6.8 Subroutine 31 - PLC_ini_USR_ini (user initialization)

Purpose

Subroutine 31 is used for user initialization and should be called in subroutine PLC_INI. Since the subroutine PLC_INI is called only during the first PLC cycle, the subroutine PLC_ini_USER_ini is also only called during the first PLC cycle.

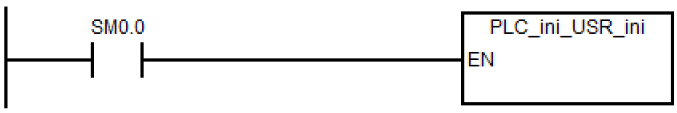
Local variable definition

None

Relevant PLC machine data

None

Example for calling subroutine 31



6.6.9 Subroutine 32 - PLC_INI (PLC initialization)

Purpose

Subroutine 32 is executed at the first PLC cycle (SM0.1). This subroutine sets NCK interface signals according to the machine settings defined by PLC machine data. In this subroutine, the following interface signals are set:

- DB3200.DBX6.7: feed override of the NCK channel becomes active
- DB380x.DBX1.5: measurement system 1 of the axes is active
- DB380x.DBX1.7: feed override of the axes is active
- DB1700.DBX1.3: active ROV

The following signals are reset:

- DB1700.DBX0.6:reset DRY

At the end of this subroutine, subroutine 31 (**PLC_ini_USR_ini**) is called. You can program the initialization of customer PLC project in the subroutine 31.

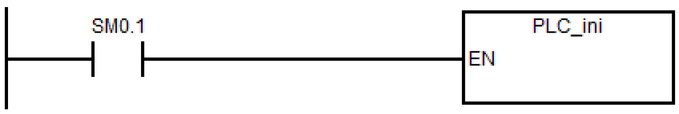
Local variable definition

None

Relevant PLC machine data

None

Example for calling subroutine 32



6.6.10 Subroutine 33 - EMG_STOP

NOTICE
Program safety Check whether this subroutine complies with the relevant safety requirements or not.

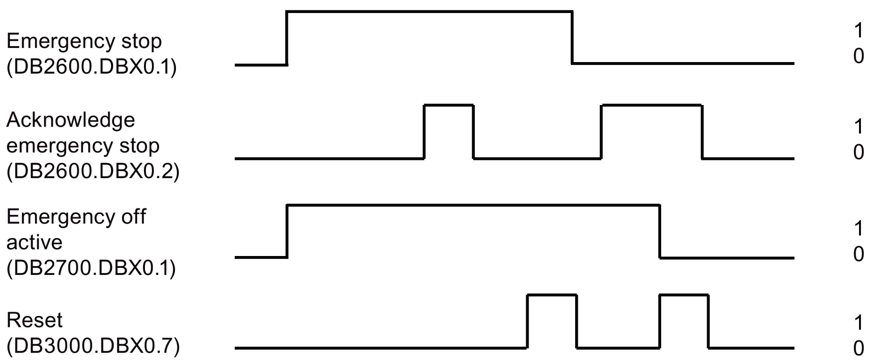
Purpose

Subroutine 33 handles emergency stop. Pressing down the Emergency Stop button produces an emergency stop alarm and disables the drive enable signal (DB380x.DBX2.1). If you want to clear the emergency stop alarm, you must first release the Emergency Stop button and then press the **RESET** key on the MCP.

This subroutine activates the alarm below:

Alarm 700016: DRIVE NOT READY

Timing diagram



Local variable definition

Inputs

Variable	Type	Description
nodef	BYTE	Reserved
E_KEY	BOOL	Emergency stop key (NC)
HWL_ON	BOOL	Any one of the hardware limit switches is active (NO) 1)
SpStop	BOOL	Spindle stopped (NO) 2)
NO: Normally Open NC: Normally Closed		

1) This input can come from signal OVlmt of subroutine 40, and triggers emergency stop when the hardware limit appears.

2) Before the drive system disables the control enable signal, the PLC detects the spindle stop signal from NCK to ensure that the spindle has stopped.

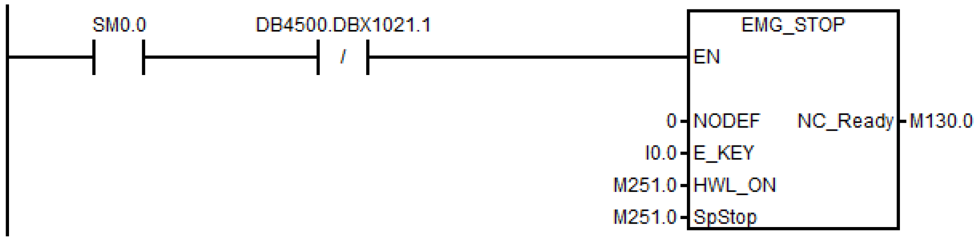
Outputs

Variable	Type	Description
NC_Ready	BOOL	NC being in the cyclic state and able to enable the drive

Relevant PLC machine data

No.	Value	Description
14512 [18].4	1	Spindle has an external stop signal
	0	Spindle has no external stop signal
14512 [21].1	0	Set I0.0 to I2.7/Q0.0 to Q1.7 as the standard I/O wiring in the default PLC
	1	Set I6.0 to I8.7/Q4.0 to Q5.7 as the standard I/O wiring in the default PLC

Example for calling subroutine 33



6.6.11 Subroutine 37 - MCP_NCK (MCP and HMI signal processing)

Purpose

Subroutine 37 is used to transfer the interface signals from the MCP and HMI to the NCK interfaces, and thus to activate the specific operating mode and control sequences. It has the following main functions:

- Selecting specific operating mode
- Selecting override
- Transferring signals from the HMI to NCK interfaces (for instance, program control, handwheel, etc.)
- Controlling the axis traversing signal according to the PLC machine data

Local variable definition

Inputs

Variable	Type	Description
nodef	BYTE	Reserved
AFL_Key	BOOL	Define the Auxiliary Function Lock at the MCP key 1)
ConHw_Key	BOOL	Define the Contour Handwheel at the MCP key

Variable	Type	Description
SimConHw_Key	BOOL	Define the simulation contour handwheel at the MCP key
NegDir-SimConHw_Key	BOOL	Define the negative direction for simulation contour handwheel at the MCP key
INCvar_Key	BOOL	Define the INCvar at the MCP key

1) When the Auxiliary Function Lock function is active, all the outputs caused by auxiliary functions (like T, M, or S code) are disabled, only with the axis moving as usual.

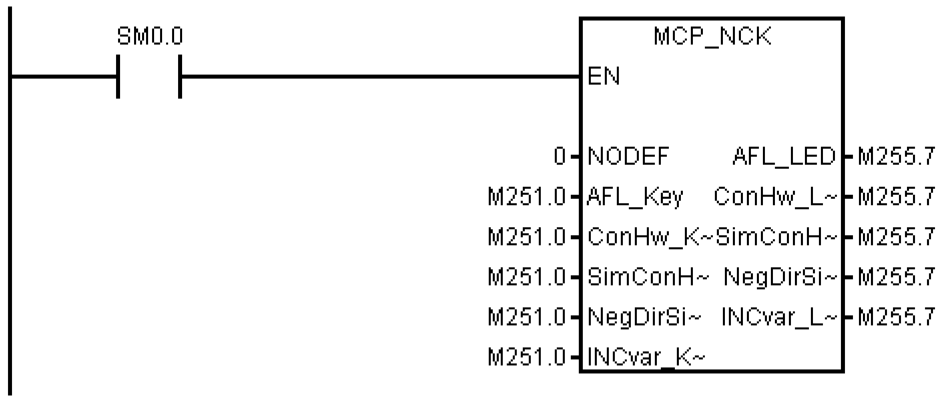
Outputs

Variable	Type	Description
AFL_LED	BOOL	Define the Auxiliary Function Lock at the MCP LED
ConHw_LED	BOOL	Define the Contour Handwheel at the MCP LED
SimConHw_LED	BOOL	Define the simulation contour handwheel at the MCP LED
NegDir-SimConHw_LED	BOOL	Define the negative direction for simulation contour handwheel at the MCP LED
INCvar_LED	BOOL	Define the INCvar at the MCP LED

Relevant PLC machine data

No.	Description
14512 [20].0	Grey coded switch (0: spindle override controlled by the grey mode; 1: spindle override controlled by trigger user keys)
14512 [20].2	Activate the first additional axis (0: disable the additional axis control; 1: enable the additional axis control)
14510 [12]	Layout of the traverse keys • For a turning variant, 0: horizontal version; 1: inclined version • For a milling variant, 0: vertical milling; 1: knee-type

Example for calling subroutine 37



6.6.12 Subroutine 38 - MCP_Tool_Nr (display tool number on the MCP)

Purpose

Subroutine 38 is used to display active tool number (< 100) with the 7-segment LED on the MCP, and should be called in subroutine MCP_NCK. For a tool number ≥ 100, it displays "FF".

Local variable definition

None

Assigned global variables

None

Relevant PLC machine data

None

Example for calling subroutine 38

6.6.13 Subroutine 39 - HANDWHL (selecting a handwheel according to HMI interface signals)

Purpose

Subroutine 39 is used to select one of the two handwheels to control an axis (X, Y or Z) in the machine coordinate system or the workpiece coordinate system according to the HMI signals. With the HANDWHEEL key and axis selection key on the MCP, you can assign the handwheel 1 in the workpiece coordinate system to any axis.

Note

You cannot use subroutine 39 together with subroutine 41 - MINI_HHU.

Local variable definition

None

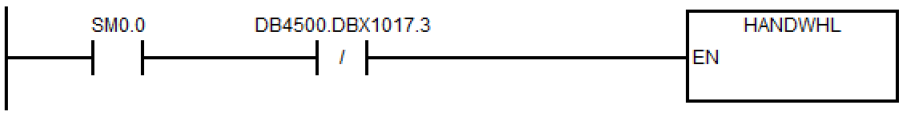
Assigned global variable

None

Relevant PLC machine data

No.	Value	Description
14512 [16].7	1	Handwheel assignment with the HMI
	0	Handwheel assignment with the MCP

Example for calling subroutine 39



6.6.14 Subroutine 40 - AXIS_CTL (controlling the spindle and axes)

Purpose

Subroutine 40 is used to control the drive pulse enable (DB380x.DBX4001.7) and controller enable (DB380x.DBX2.1), monitoring the hardware limits and the reference cam signals, and controlling the enable signal for the spindle according to a spindle command (for example, SPINDLE CW, SPINDLE CCW, M03, M04, SPOS, etc.). The motor brake is automatically controlled by the SINAMICS V70 drives.

This subroutine provides two ways to realize the hardware limit control:

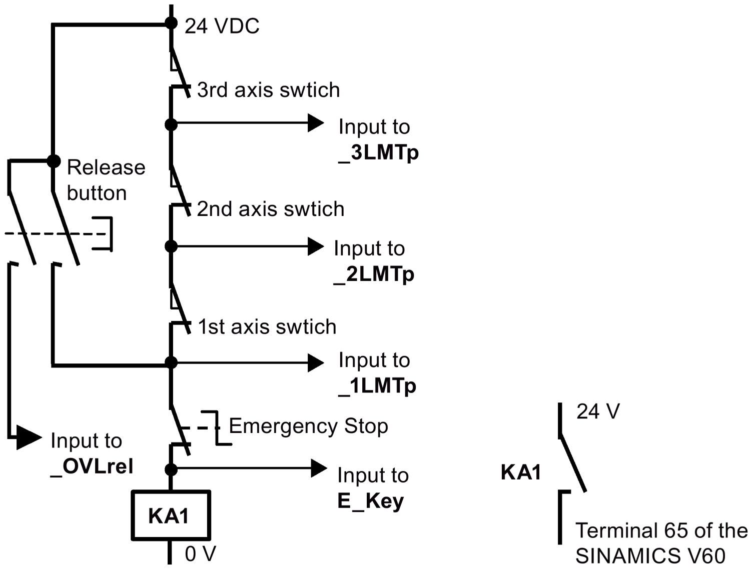
- PLC solution (MD14512 [18] bit 6 = 0)

  Each feed axis has one (MD14512 [18] bit 7 = 1) or two (MD14512 [18] bit 7 = 0) hardware limit switches. This subroutine activates the NCK hardware limit function via the NCK interface DB380x.DBX1000.0 or DB380x.DBX1000.1 according to the configurations of the hardware limit switches, and thus makes the NCK produce a feed stop signal to an over-distance axis.

  Furthermore, you can also connect the output **OVlmt** of this subroutine with the input **HWL_ON** of subroutine 33 to activate the Emergency Stop automatically once the hardware limit of any axis has been reached.

- Hardware solution (MD14512 [18] bit 6 = 1)

  This solution is independent of the PLC and thus is much safer:



Encoding the hardware limit switches					**Result**
E_Key	**_1LMTp**	**_2LMTp**	**_3LMTp**	**Direction**	
0	1	1	1	-	EMERGENCY STOP active
0	0	1	1	DB3900.DBX4.7	1st + over limit
0	0	1	1	DB3900.DBX4.6	1st - over limit
0	0	0	1	DB3901.DBX4.7	2nd + over limit
0	0	0	1	DB3901.DBX4.6	2nd - over limit
0	0	0	0	DB3902.DBX4.7	3rd + over limit
0	0	0	0	DB3902.DBX4.6	3rd - over limit

In the hardware solution above, the feed stop signals for all axes can be activated via the hardware limit switches when any of the hardware limits is reached or an EMERGENCY STOP happens. You can check the information of the PLC diagnostics from the encoding of the hardware limit switches shown in the table above, and identify the cause (Emergency Stop button or a hardware limit switch of an axis) of the EMERGENCY STOP signal.

Note

When using the hardware solution, you must take below information into consideration:

- You must assign the axes one by one; for example, X axis, Z axis, spindle or X axis, Y axis, Z axis, spindle. You must not assign the axes like X axis, Y axis, spindle, Z axis.
- You must set constant "1" (i.e. SM0.0) to the input signals of the hardware limits for undefined axes; otherwise, the hardware limits of the undefined axes can be activated.

Local variable definition

Inputs

Name	Type	Description
nodef	WORD	Reserved
NC_Ready	BOOL	NC being in the cyclic state and able to enable the drive
_1LMTp	BOOL	Positive hardware limit switch of 1st axis (NC) 1)
_1LMTn	BOOL	Negative hardware limit switch of 1st axis (NC)
_1REF	BOOL	Reference cam of 1st axis (NO)
_2LMTp	BOOL	Positive hardware limit switch of 2nd axis (NC) 1)
_2LMTn	BOOL	Negative hardware limit switch of 2nd axis (NC)
_2REF	BOOL	Reference cam of 2nd axis (NO)
_3LMTp	BOOL	Positive hardware limit switch of 3rd axis (NC) 1)
_3LMTn	BOOL	Negative hardware limit switch of 3rd axis (NC)
_3REF	BOOL	Reference cam of 3rd axis (NO)
_5REF	BOOL	Reference Cam of 5th axis (NO)

1) The hardware limit + is used for the input if there is only one hardware limit switch or when the hardware solution is used.

Outputs

Name	Type	Description
OVlmt	BOOL	Any of the axis over hardware limits

Assigned global variables

SP_CMD	M138.1	Spindle start command (CW or CCW)

Relevant PLC machine data

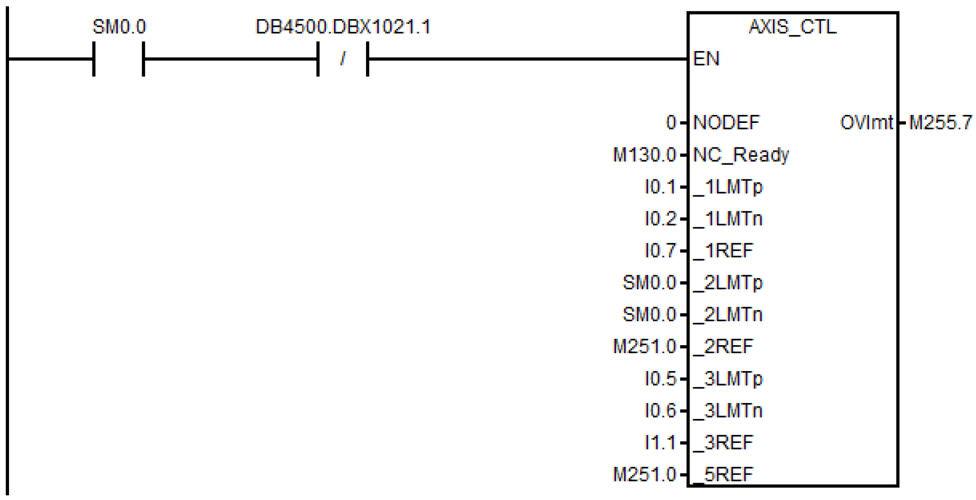
No.	Value	Description
14512 [18].6	1	Overtravel employs the hardware solution
	0	Overtravel employs the PLC solution
14512 [18].7	1	Each axis has only one hardware limit switch
	0	Each axis direction has an hardware limit switch
14512 [20].1	0	Disable by pressing the spindle stop key
	1	Disable when detecting the standstill speed 1)
14512 [21].1	0	Set I0.0 to I2.7/Q0.0 to Q1.7 as the standard I/O wiring in the default PLC
	1	Set I6.0 to I8.7/Q4.0 to Q5.7 as the standard I/O wiring in the default PLC

1) When setting bit 1 to **1**, make sure that the speed control mode is active.

Note

By default, the value of MD30350 is **0**, indicating that the NC will run in the real axis mode. When performing the axis control related operations on a stand-alone controller without any connection to the motor or drive, you need to set MD30350 to **1** for each axis, which indicates that the axis will run in the simulated state and thus the PLC will not detect the drive ready signal; otherwise, an alarm will be thrown out, indicating axis enable missing.

Example for calling subroutine 40



6.6.15 Subroutine 41 - MINI_HHU (handwheel on hand-held unit)

Purpose

Subroutine 41 is used to support the customer's handheld units. With a handheld unit, you can assign the handwheels to X axis, Y axis and Z axis, and select incremental override X1, X10, X100 at the same time. You can then use the handwheels to control the movements of your machine.

Local variable definition

Inputs

Variable	Type	Description
nodef	BYTE	Reserved
X_Sel	BOOL	Select X axis
Y_Sel	BOOL	Select Y axis
Z_Sel	BOOL	Select Z axis
_4th_Sel	BOOL	Select 4th axis
INC1	BOOL	Select INC 1
INC10	BOOL	Select INC 10
INC100	BOOL	Select INC 100
HHU_EN	BOOL	HHU enable signal
HHU_EmgStop	BOOL	Emgency stop in HHU
Key_Tp	BOOL	+direction move key
Key_Tn	BOOL	-direction move key

Outputs

Variable	Type	Description
X1_LED	BOOL	Inc 1 is active
X10_LED	BOOL	Inc 10 is active
X100_LED	BOOL	Inc 100 is active
HHU_ACT_LED	BOOL	HHU is active

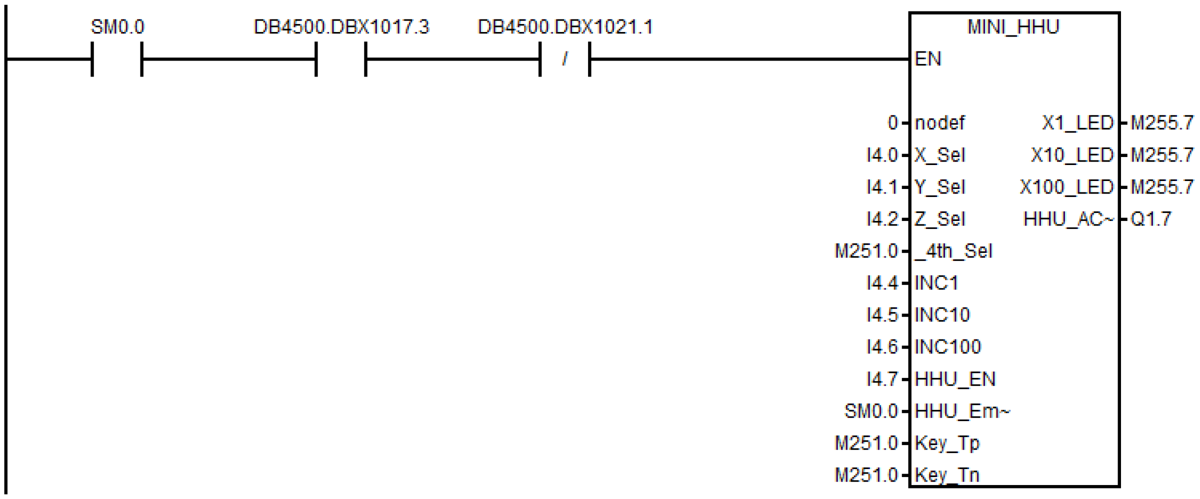
Assigned global variables

None

Relevant PLC machine data

No.	Value	Description
14512 [17].3	1	Choose to use a hand-held unit
	0	Choose to use a handwheel
14512 [21].1	0	Set I0.0 to I2.7/Q0.0 to Q1.7 as the standard I/O wiring in the default PLC
	1	Set I6.0 to I8.7/Q4.0 to Q5.7 as the standard I/O wiring in the default PLC

Example for calling subroutine 41



6.6.16 Subroutine 42 - SPINDLE (spindle control)

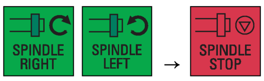
Purpose

Subroutine 42 is used for spindle control, including the spindle braking function and spindle speed selection.

Spindle braking function

When the braking function is activated (MD14512 [19].1 = 1), the spindle brakes in the following cases:

- In "JOG" mode, after you perform the following operations:

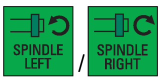


- In "AUTO" or "MDA" mode, when the spindle changes the rotating direction or is stopped with M05/M02 during rotation

When the spindle brakes, the corresponding output becomes active; meanwhile, the spindle does not accept any rotary command until the braking completes.

Spindle speed selection in "JOG" mode

You can define the spindle speed selection when the spindle is activated with the following spindle control keys in "JOG" mode via MD14512[19].4:



- MD14512[19].4 = 0 (default): the spindle runs with the speed set in MD32020.
- MD14512[19].4 = 1: the spindle runs with the speed set last time. In this case, if the spindle runs for the first time after the control system powers on, then you must specify a spindle speed in "MDA" mode or the "T, S, M" window.

Local variable definition

Inputs

Name	Type	Description
DELAY	WORD	Spindle brake delay time (unit: 0.1 s)
DrvEn	BOOL	Drive enable
SP_EN	BOOL	Condition for spindle operation (1: allowed; 0: not allowed)
IsBrake	BOOL	Brake for spindle (1: enabled; 0: forbidden)

Outputs

Name	Type	Description
SP_brake	BOOL	Spindle brake contactor
SP_LED	BOOL	Spindle operating status LED

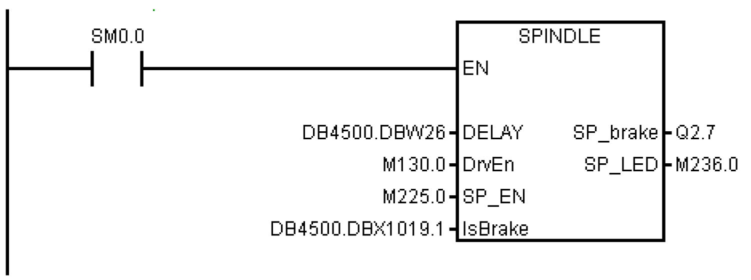
Assigned global variables

SP_B_CMD	BOOL	Spindle braking command
T11	TIMER	Spindle braking timer

Relevant PLC machine data

No.	Type	Description
14510 [13]	BOOL	Spindle braking duration (unit: 0.1 s)
14512 [19].1	BOOL	Selection of spindle braking function (1: enabled; 0: forbidden)
14512 [19].4	BOOL	Selection of the spindle speed in "JOG" mode (0: select the speed set in MD32020; 1: select the speed set last time)

Example for calling subroutine 42



6.6.17 Subroutine 43 - MEAS_JOG (measurement in JOG mode)

Purpose

Subroutine 43 is used to process the measuring probe signal and realize the "measuring in JOG mode" function. You can use this subroutine to calibrate the probe and measure a tool.

The precondition for calling this subroutine is to call subroutine MCP_NCK (SBR37) in the main program. The "measuring in JOG mode" function is automatically deactivated if you have changed the operating mode when the function becomes active.

Local variable definition

Inputs

Name	Type	Description
T_ACT	DWORD	Transfer the active tool into interface

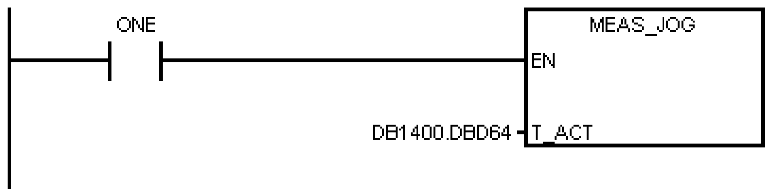
Assigned global variables

MEAS_OPAUT	M240.0	Measuring in AUTO mode
CHL_HMI	M240.2	From HMI signals: mode changes during measurement
NO_KEY	M240.3	No JOG key available for the axes
FDI_MEASJOG	M240.5	Meas_JOG forbidden for feed
ON_MEASJOG	M240.6	Meas_JOG activated
PROBE_ON	M240.7	Probe signal released
JOG_MEASJOG	M241.0	Operating mode manually output to Meas_JOG
AUT_MEASJOG	M241.1	Operating mode manually output to Meas_JOG
CHL_MEASJOG	M241.2	Operating mode change forbidden to Meas_JOG
KEY_MEASJOG	M241.3	JOG key Meas_JOG
RES_MEASJOG	M241.4	Reset Meas_JOG
ESC_MEASJOG	M241.5	Interrupt Meas_JOG
DRY_MEASJOG	M241.6	Dry run Meas_JOG
SBL_MEASJOG	M241.7	Single block Meas_JOG

Relevant PLC machine data

None

Example for calling subroutine 43



6.6.18 Subroutine 44 - COOLING (cooling control)

Purpose

Subroutine 44 is used to start/stop cooling using the buttons on the MCP in JOG mode, or to start (using the auxiliary function M07/M08 in the part program) or to stop (using the M09 in the part program) cooling in AUTO/MDA mode. Cooling is forbidden in case of EMERGENCY STOP, cooling motor overload, program test or under the simulation mode.

This subroutine can activate the following alarms:

- Alarm 700018: motor overload for the cooling pump
- Alarm 700019: low coolant level

Local variable definition

Inputs

Name	Type	Description
nodef	BYTE	Reserved
C_key	BOOL	Switch key (holding signal)
OVload	BOOL	Cooling motor overload (NC)
C_low	BOOL	Coolant level low (NC)

Outputs

Name	Type	Description
C_out	BOOL	Cooling control output
C_LED	BOOL	Cooling output status display

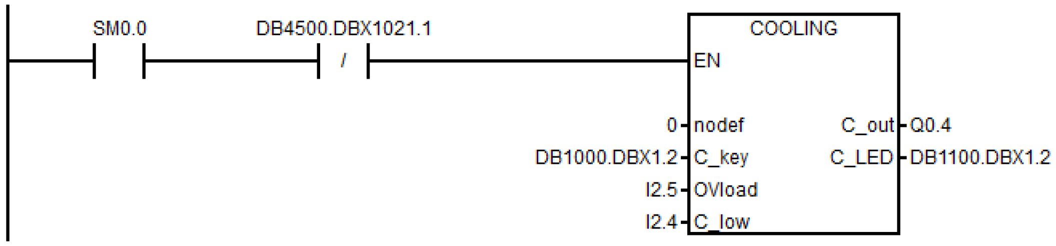
Assigned global variables

COOLon	MB150.0	Coolant on/off status

Relevant PLC machine data

No.	Description
14512 [21].1	Switch of the I/O interface (0: set I0.0 to I2.7/Q0.0 to Q1.7 as the standard I/O wiring in the default PLC; 1: set I6.0 to I8.7/Q4.0 to Q5.7 as the standard I/O wiring in the default PLC)

Example for calling subroutine 44



6.6.19 Subroutine 45 - LUBRICAT (control of lubricate)

Purpose

Subroutine 45 is used to control the lubrication according to specific time interval and duration (independent of the distance that the axis has travelled). Meanwhile, a manual button is available to start the lubrication, and you can configure that the lubrication starts automatically each time that the machine is powered up. Normally, lubricating starts automatically and cyclically according to specified time interval **Lintv**, and operates for a specific time **Ltime** at each cycle. Lubrication stops in case of an Emergency Stop, lubrication motor overload, low lubricant level.

This subroutine can activate following alarms:

- Alarm 700020: lubrication motor overload
- Alarm 700021: low lubricant level

Local variable definition

Inputs

Name	Type	Description
Lintv	WORD	Lubricating time interval
Ltime	WORD	Lubricating output time
L_key	BOOL	Manual lubricating key
L1st	BOOL	Lubricating by 1 PLC cycle (Power on)
Ovload	BOOL	Lubricating motor overload (NC)
L_low	BOOL	Lubricant level low (NC)

Outputs

Name	Type	Description
L_out	BOOL	Lubricating output
L_LED	BOOL	For lubricating status display

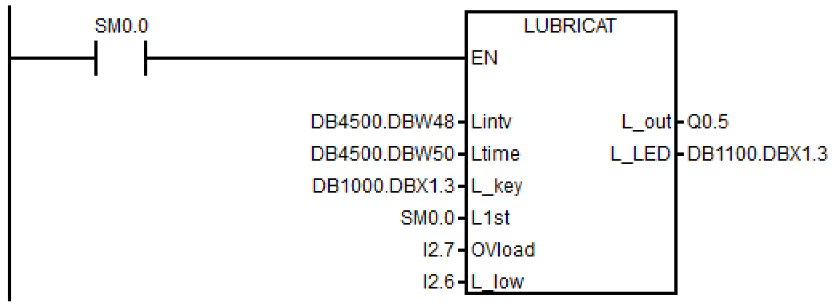
Assigned global variables

L_interval	C24	Timer for the lubricating time intervals (unit: min)
L_time	T27	Timer for very lubricating time duration (unit: 0.01s, max. 327.67 s)

Relevant PLC machine data

No.	Unit	Range	Description
14510 [24]	Min.	-	Lubricating time interval
14510 [25]	0.01 s	100 to 2,000	Lubricating time duration

Example for calling subroutine 45



6.6.20 Subroutine 46 - PI_SERVICE

Purpose

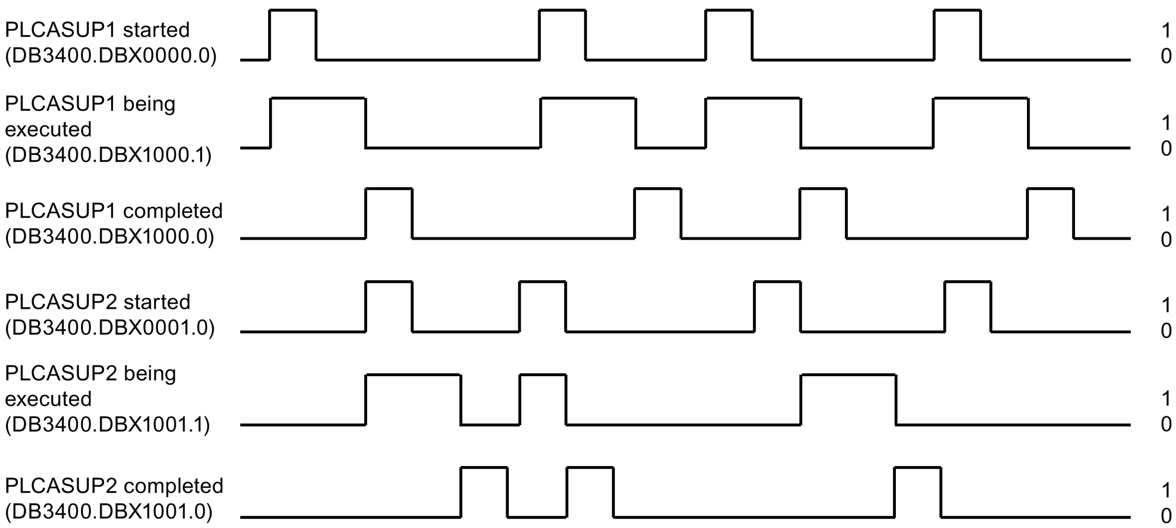
Subroutine 46 is for realizing functions like ASUP (Asynchronous Subroutine Program) and deleting a password.

- **ASUP function**

The ASUP function means the execution of PLCASUP1.SPF or PLCASUP2.SPF called by the PLC. The two ASUPs cannot be simultaneously executed, and the PLCASUP1.SPF has a higher priority over the PLCASUP2.SPF.

In a program, firstly you can initialize the ASUP1 and ASUP2 by setting "PI index" (DB1200.DBB4001) and "NCK read/write start" (DB1200.DBX4000.0), and then use a rising edge to trigger "ASUP1 start" (DB3400.DBX0.0) and "ASUP2 start" (DB3400.DBX1.0).

Timing diagram



The control system provides two default ASUPs for the PLC. ASUP1 is used for manual tool change and ASUP2 is used for the manual machine of the workpiece on a turning machine with the Manual Machine Plus function.

You can also use your own ASUPs as required. To do so, you must first place your programs (PLCASUP1.SPF and PLCASUP2.SPF) in the manufacturer cycle directory (N:\CMA), and then set "PI index" (DB1200.DBB4001) to 1 (ASUP1)/2 (ASUP2).

- **Deleting a password**

To use this function, you need to only execute the PI service. Here, no initialization of the PI service is required.

By default, MD14512 [19].2 = 0, which indicates that the control system will automatically delete the password after NC restarts. If you want the control system to remember the last used password every time the NC restarts, you need to set MD14512 [19].2 = 1.

Local variable definition

Inputs

Name	Type	Description
nodef	BYTE	Reserved
ASUP1_trigger	BOOL	Start ASUP1 (rise edge)
ASUP2_trigger	BOOL	Start ASUP2 (rise edge)

Outputs

Name	Type	Description
ASUP1Run	BOOL	Indicates whether ASUP1 is running
ASUP2Run	BOOL	Indicates whether ASUP2 is running
Err1	BOOL	ASUP1 error
Err2	BOOL	ASUP2 error

Occupied global variables

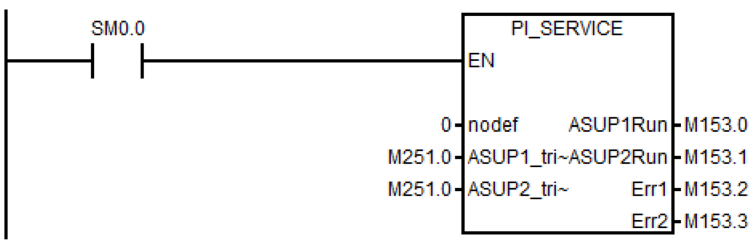
IniASUP1	M229.0	Mark of ASUP1 initialization
IniASUP2	M229.1	Mark of ASUP2 initialization
DelPswStart	M228.0	Start to delete password
DelPswSel	M228.1	Delete password select

Relevant machine data

No.	Name
10702	IGNORE_SINGLEBLOCK_MASK
11602	ASUP_START_MASK
11604	ASUP_START_PRIO_LEVEL
20116	IGNORE_INHIBIT_ASUP

No.	Value	Description
14512 [19].2	1	The control system will not delete the password after NC restart
	0	The control system will delete the password after NC restart

Example for calling subroutine 46



6.6.21 Subroutine 47 - PLC_Select_PP (PLC selects a subroutine)

Purpose

Subroutine 47 is used to select a part program.

You firstly need to create a PLC program-calling table, and assign a program index to each part program in this table. In subroutine 47 you can assign DB1700.DBB1000 to the "Program index" to select the corresponding part program.

Local variable definition

Inputs

Name	Type	Description
PP_num	BOOL	Part program number, 1-100: user; 101-200: OEM; 201-255: Siemens

Outputs

Name	Type	Description
Finish	BOOL	PLC selects a part program successfully
Error	BOOL	PLC selects a part program incorrectly

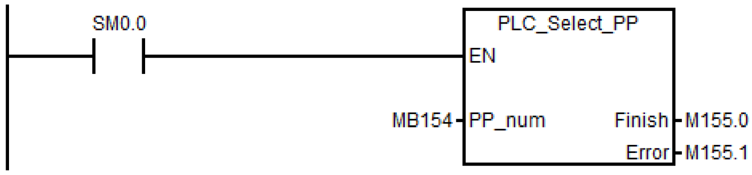
Assigned global variables

SelPP_FinOm	BOOL	M239.6	Indicates that a part program has been selected
SelPP_ErrOm	BOOL	M239.7	Indicates that an error occurs when selecting a part program

Relevant PLC machine data

None

Example for calling subroutine 47



6.6.22 Subroutine 48 - ServPlan (service planner)

Purpose

To use subroutine 48, you must have created a service plan on the control system. When the pre-alarm time arrives, the machine outputs a notification message. When the final alarm time arrives, the machine outputs an alarm message.

Note

To perform a service plan on the PLC, you need to download DB9903 (SP_INI) and DB9904 (SP_ACT).

Local variable definition

Inputs

Name	Type	Description
nodef	BYTE	Reserved
Deact0	BOOL	Deactivate 1st service plan
AckMsg0	BOOL	Acknowledge message of 1st service plan

Outputs

Name	Type	Description
HintMsg0	BOOL	Hint message for 1st service plan
Alarm0	BOOL	Alarm message for 1st service plan

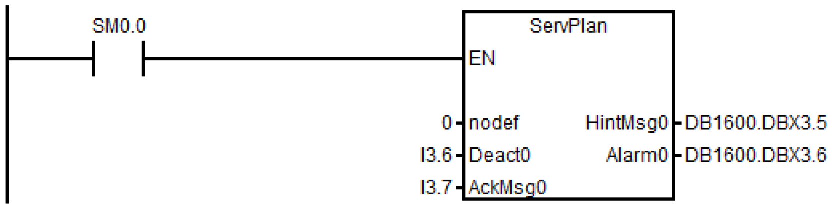
Assigned global variables

ServPlan_msg0	BOOL	Notification message of the first service plan
ServPlan_alm0	BOOL	Alarm message for 1st service plan

Relevant PLC machine data

None

Example for calling subroutine 48



6.6.23 Subroutine 49 - GearChg1_Auto (automatic spindle gear change)

Purpose

Subroutine 49 is used to automatically change the gear for the analog spindle with 2-level gear detection signals.

During a gear change, the spindle oscillates and the PLC outputs the gear change signal. When the PLC detects that the desired gear level has been reached, the gear change has been completed.

You cannot use this subroutine together with subroutine 50.

Local variable definition

Inputs

Name	Type	Description
D_CHG	WORD	Delay time for gear changing
D_MON	WORD	Monitor time for gear-change in position
D_S0	WORD	Delay time for the spindle to come to standstill
T_GC	WORD	Monitor time for the whole gear change process, must > D_CHG + D_MON + D_S0
S_hold	BOOL	Spindle stopped (NO)
S_alarm	BOOL	Spindle alarm (NO)
LGi	BOOL	Low gear level in position (NO)
HGi	BOOL	High gear level in position (NO)

Outputs

Name	Type	Description
LGo	BOOL	Low gear level output
HGo	BOOL	High gear level output
LG_LED	BOOL	Low gear level in-position indicator
HG_LED	BOOL	High gear level in-position indicator

Assigned global variables

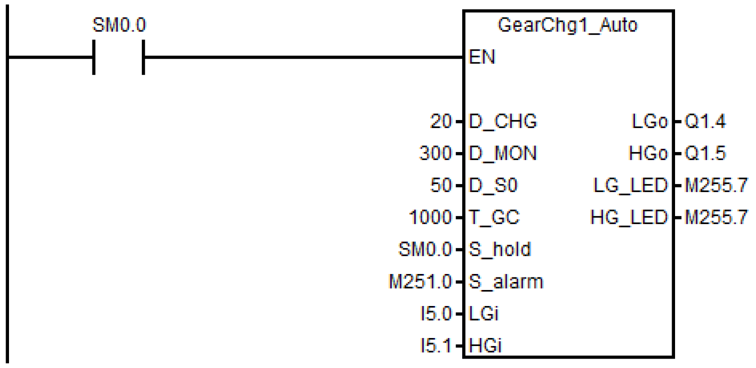
HGom	BOOL	M248.0	Signal indication of high gear stage output
LGom	BOOL	M248.1	Signal indication of low gear stage output
HGcmd	BOOL	M248.2	High gear level command
LGcmd	BOOL	M248.3	Low gear level command
SPhold	BOOL	M248.4	Spindle stops and ready for oscillation

Dstill	BOOL	M248.5	Signal for spindle stop
Dchg	BOOL	M248.6	Spindle gear change delay
Dmon	BOOL	M248.7	Monitoring for the gear change
Req_SP_G_CH G	BOOL	M244.0	Request for spindle gear change
Req_Low_G	BOOL	M244.1	Request to change to the low gear stage
Req_Hign_G	BOOL	M244.2	Request to change to the high gear stage
D_S0	TIMER	T13	Spindle stop delay
Td_GearChg	TIMER	T24	Gear change delay
Tm_GearChg	TIMER	T25	Delay for monitoring the gear change

Relevant PLC machine data

None

Example for calling subroutine 49



6.6.24 Subroutine 50 - GearChg2_Virtual (virtual spindle gear change)

Purpose

Using subroutine 50, you can requests the system to switch to the corresponding gear after changing the gear manually. The corresponding gear is set when M41-M45 are executed.

This subroutine must not be used together with GearChg1_Auto (SBR 49).

Local variable definition

Outputs

Name	Type	Description
HL_gear	BOOL	:=0, low gear level; :=1, high gear level

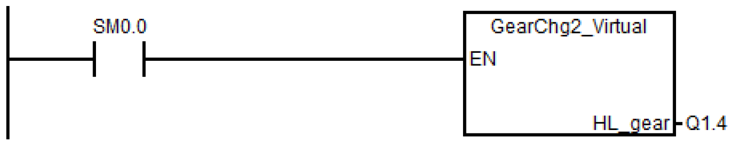
Assigned global variables

None

Relevant PLC machine data

None

Example for calling subroutine 50



6.6.25 Subroutine 51 - Turret1_HED_T (turret with Hall effect device position sensor)

Purpose

Subroutine 51 is used to control the turret with a Hall effect device positioning sensor, and the turret motor is controlled by the PLC.

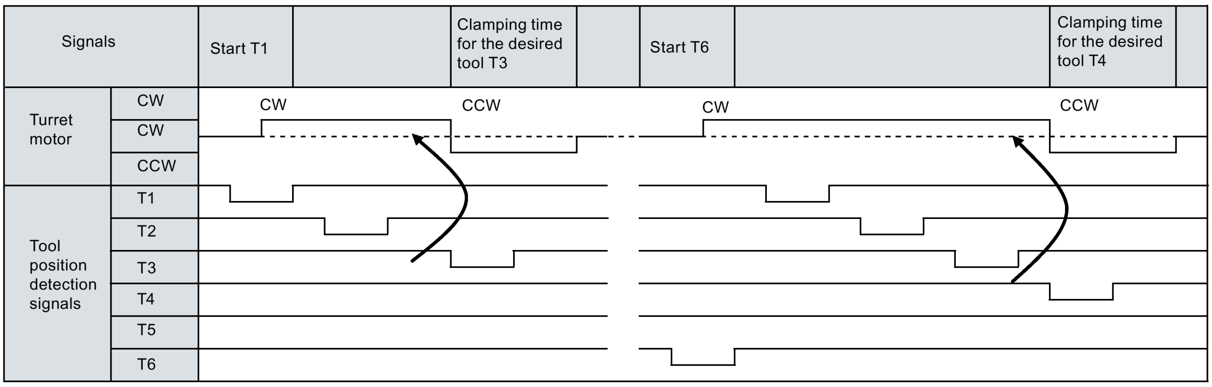
The turret rotates clockwise to search for a tool, and rotates counter-clockwise after positioning the desired tool to clamp it (the turret CCW rotation time can be adjusted). An alarm occurs if the turret fails to position the desired tool after the duration expires. The subroutine verifies the time that the turret rotates CCW, and sets a limit of maximum 3 seconds for this rotation time to prevent the turret motor from being broken.

In AUTO and MDA modes, the T function starts a tool change operation. In JOG mode, a short press on the MCP key changes a turret position.

During a tool change, the NC interface signals "Read-in disable" (DB3200.DBX6.1) and "Feedhold" (DB3200.DBX6.0) are set; this means that the part program can only continue to run after the tool change.

The turret positioning is prohibited in the case of an Emergency Stop, turret motor overload or program test/simulation.

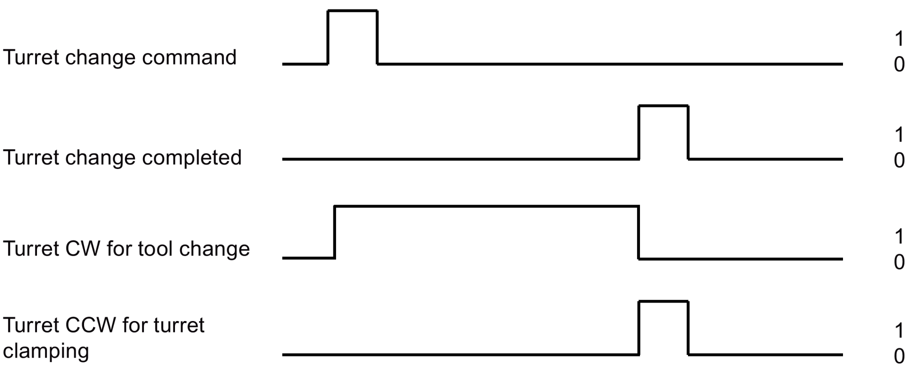
The timing diagram for positioning a tool in the turret using the Hall effect device positioning sensor is shown as follows:



This subroutine can activate the following alarms:

- Alarm 700022: Turret motor overload
- Alarm 700023: Programmed tool number higher than the max. tool number of the turret
- Alarm 700024: Wrong setting of the max. tool number for the turret
- Alarm 700025: No turret positioning signals available
- Alarm 700026: Tool positioning time out

Timing diagram



Local variable definition

Inputs

Name	Type	Description
Tmax	WORD	Number of tool on the turret, only 4, 6 are permitted
C_time	WORD	Turret clamping delay time (unit: 0.1 s)
M_time	WORD	Monitor time for searching for a tool (unit: 0.1s)
T_polar	BOOL	Tool position signal: NC/NO
T_key	BOOL	Manual tool change key
T_01 to T_06	BOOL	Tool position sensor (low active)
OVload	BOOL	Turret motor overload (NC)

Outputs

Name	Type	Description
T_cw	BOOL	Turret CW for tool change
T_ccw	BOOL	Turret CCW for turret clamping
T_LED	BOOL	Turret change status display
ERR1	BOOL	Error1: no turret position signal available
ERR2	BOOL	Error2: programmed tool exceeds turret range
ERR3	BOOL	Error3: tool searching time monitor time out
ERR4	BOOL	Error4: turret overload
ERR5	BOOL	Error5: max tool number setting error
ERR6	BOOL	Reserved

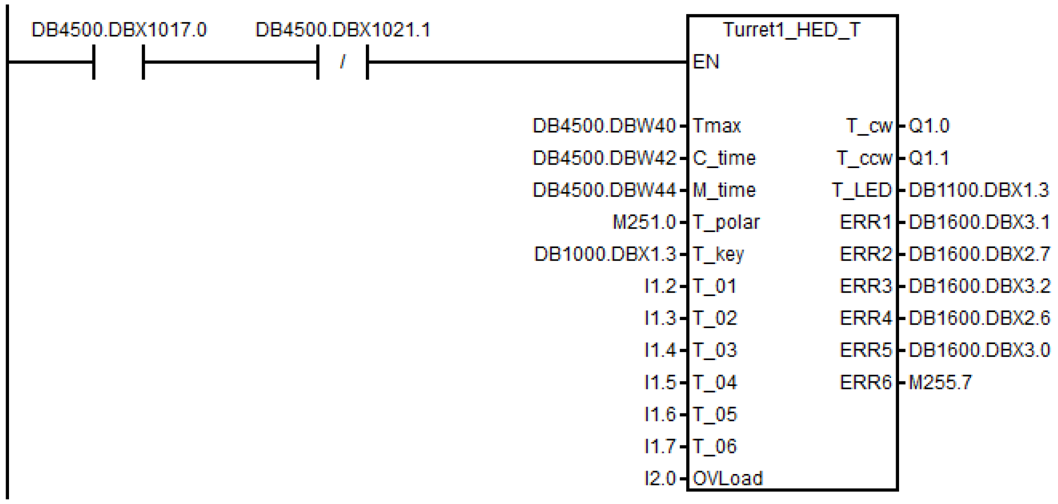
Assigned global variables

T_cw_m	M156.0	Position marking for turret CW rotation
T_ccw_m	M156.1	Position marking for turret CCW rotation
CcwDelay	M156.2	Turret CCW rotation delay
K_active	M156.3	Manual key active
Tpos_C	M156.4	Turret position changed
Tp_eq_Tc	M156.5	Programmed tool number equal to the current tool number
Tp_eq_0	M156.6	Programmed tool number equal to zero
T_P_INDX	MD160	Monitoring the tool change buffer zone in JOG mode
T_CHL	M168.4	Operating mode locked
Tm1_FindT	T15	Monitoring timer for tool searching
T_CLAMP	T13	Clamping timer for turret 1

Relevant PLC machine data

No.	Unit	Description
14510 [20]	-	Max. tool number (4 or 6)
14510 [21]	0.1 s	Turret clamping time
14510 [22]	0.1 s	Monitoring time for tool searching
14512 [17].0	-	Activating the turret function of a turning machine
14512 [21].1	-	Switch of the I/O interface (0: set I0.0 to I2.7/Q0.0 to Q1.7 as the standard I/O wiring in the default PLC; 1: set I6.0 to I8.7/Q4.0 to Q5.7 as the standard I/O wiring in the default PLC)

Example for calling subroutine 51



6.6.26 Subroutine 52 - Turret2_BIN_T (turret with binary coding function)

Purpose

Subroutine 52 is used to control the turret with encoder positioning signals and function of dual-direction adjacent tool change. Contact the turret vendor for the working theory and the timing diagram of a tool change.

During a tool change, the NC interface signals "Read-in disable" (**DB3200.DBX6.1**) and "Feedhold" (**DB3200.DBX6.0**) are set, so the part program can continue running only after the tool change action.

The turret position action is forbidden in case of an emergency stop, turret motor overload or program test/simulation.

This subroutine can activate the following alarms:

- Alarm 700022: Turret motor overload
- Alarm 700023: Programmed tool number higher than the max. tool number of the turret
- Alarm 700024: Wrong setting of the max. tool number for the turret
- Alarm 700026: Not able to find expected tool in monitor time
- Alarm 700011: Not able to lock tool in expected time

Local variable definition

Inputs

Name	Type	Description
Tmax	WORD	Total tools on the turret
Tm_Lck	WORD	Tool lock monitor time (unit: 0.01s)
Tm_Chg	WORD	Tool change monitor time (unit: 0.1s)
T_1	BOOL	T code A
T_2	BOOL	T code B
T_3	BOOL	T code C
T_4	BOOL	T code D
Parity	BOOL	Parity bit
Strobe	BOOL	Tool on position signal
OVload	BOOL	Turret motor overload (NC)
P_Indx	BOOL	Turret pre-indexing sensor
T_key	BOOL	Manual key for tool change

Outputs

Name	Type	Description
T_cw	BOOL	Turret CW rotation output
T_ccw	BOOL	Turret CCW rotation output
Magent	BOOL	Solenoid for clamping
T_LED	BOOL	Display for tool changing
ERR1	BOOL	Error1: turret motor overload
ERR2	BOOL	Error2: programmed tool no. > max tool no.
ERR3	BOOL	Error3: max tool no. setting error
ERR4	BOOL	Error4: not able to find pre-indexing signal in expected time
ERR5	BOOL	Error5: not able to lock in expected time

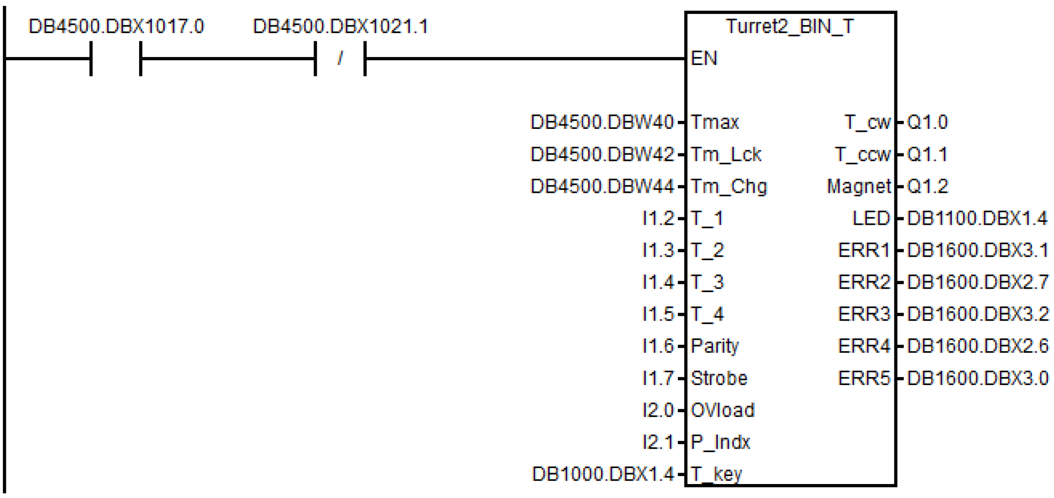
Assigned global variables

T_CURRENT	VD14000064	Current tool (retentive data)
T_cw_m	M156.0	Position marking for turret CW rotation
T_ccw_m	M156.1	Position marking for turret CCW rotation
T_P_INDX	MD160	Monitoring the tool change buffer zone in JOG mode
T_DES	M164	Desired tool number
T_DIR	M168.0	Direction of adjacent tool change
T_POS	M168.1	Turret tool positioning finished
T_LOCK	M168.2	Turret clamping command
T_MAG	M168.3	Turret magnetic clamping

Relevant PLC machine data

No.	Unit	Description
14510 [20]	-	Max. tool number (4 or 6)
14510 [21]	0.1 s	Turret clamping time
14510 [22]	0.1 s	Monitoring time for tool searching
14512 [17].0	-	Activating the turret function of a turning machine
14512 [21].1	-	Switch of the I/O interface (0: set I0.0 to I2.7/Q0.0 to Q1.7 as the standard I/O wiring in the default PLC; 1: set I6.0 to I8.7/Q4.0 to Q5.7 as the standard I/O wiring in the default PLC)

Example for calling subroutine 52



6.6.27 Subroutine 53 - Turret3_CODE_T (tool change control for turret with coding function)

Purpose

Subroutine 53 is used to control the turret with coded tool positions and function of adjacent tool change. The difference between the subroutine 52 and the subroutine 53 is that the subroutine 52 uses binary tool position codes while the subroutine 53 uses tool position codes made according to a specific common turret.

During a tool change, the NC interface signal "Feedhold" (DB3200.DBX6.0) is set; this means that the part program can only continue to run only after the tool change.

The turret positioning is prohibited in the case of an Emergency Stop, turret motor overload or program test/simulation.

Local variable definition

Inputs

Name	Type	Description
M_time	WORD	Monitor time for searching for a tool
T_key	BOOL	Tool change key
A	BOOL	Tool position code 1
B	BOOL	Tool position code 2
C	BOOL	Tool position code 3
D	BOOL	Tool position code 4
Strobe	BOOL	Tool on position signal
Lock_i	BOOL	Lock tool signal
OVload	BOOL	Turret overload

Tool position	Tool position code A	Tool position code B	Tool position code C	Tool position code D
1	0	1	0	0
2	0	0	0	1
3	1	0	0	0
4	0	0	1	0
5	1	1	1	0
6	1	0	1	1
7	1	1	0	1
8	0	1	1	1

Outputs

Name	Type	Description
T_UNCLAMP	BOOL	Turret release
T_CLAMP	BOOL	Turret clamping
T_CW	BOOL	Turret CW rotation
T_CCW	BOOL	Turret CCW rotation
T_LED	BOOL	Status display during the tool change

Assigned global variables

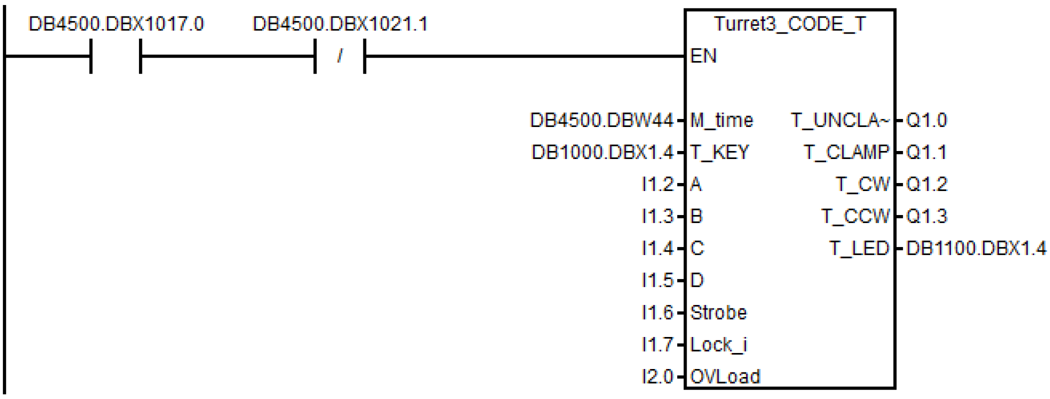
Tpos_C	BOOL	M156.4	Tool searching finished
T_cwm	BOOL	M235.6	Mark for turret CW rotation
T_ccwm	BOOL	M235.7	Mark for turret CCW rotation
TK_act	BOOL	M236.4	Mark for manual tool change
Tc_ne_0	BOOL	M237.0	Current tool number is not 0

T_dir	BOOL	M237.1	Direction for searching for an adjacent tool

Relevant PLC machine data

No.	Unit	Description
14510 [22]	0.1 s	Monitoring time for searching for a tool
14512 [21].1	-	Switch of the I/O interface (0: set I0.0 to I2.7/Q0.0 to Q1.7 as the standard I/O wiring in the default PLC; 1: set I6.0 to I8.7/Q4.0 to Q5.7 as the standard I/O wiring in the default PLC)

Example for calling subroutine 53



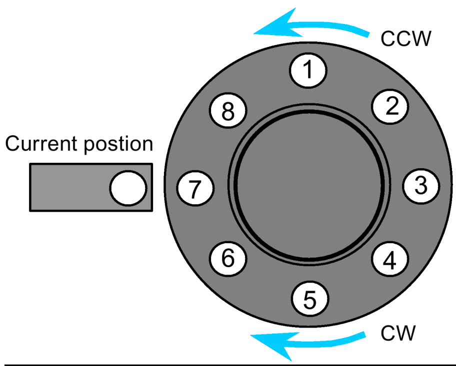
6.6.28 Subroutine 54 - Turret2_3_ToolDir (tool change direction)

Purpose

Subroutine 54 is used to find out the direction of searching for an adjacent tool and the pre-indexing position (that is, the previous position of the desired tool in the direction of an adjacent tool). To find out the direction, you need to know the maximum tool number of the turret and the programmed tool number.

You can use this subroutine to control the turret to search for an adjacent tool on a turning machine or a machine center. The turret tool position ranges from 2 to 64.

For example:



Tool position number	Current position	Programmed tool number	Pre-indexing position	Direction
1	7	2	1	CCW
2	7	5	6	CW
3	3	8	1	CW
4	1	4	3	CCW
5	6	8	7	CCW

Local variable definition

Inputs

Name	Type	Description
Tmax	DWORD	Possible positions of the turret
Pnum	DWORD	Programmed tool number
Tcurr	DWORD	Current tool number

Outputs

Name	Type	Description
P_INDXo	DWORD	Pre-indexing position: the previous tool position of the desired tool in the direction of an adjacent tool
DIR	BOOL	Direction for tool change 1: for turret CW; 0: for turret CCW

Assigned global variables

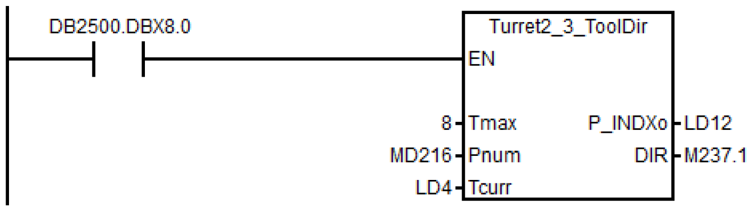
None

Relevant PLC machine data

None

Example for calling subroutine 54

This subroutine is called by subroutine 52 and subroutine 53.



6.6.29 Subroutine 55 - Tail_stock_T (Tailstock control program for turning machines)

Purpose

Subroutine 55 is used to control forward or backward movement of the tailstock on a turning machine.

In JOG mode, press the "Tailstock" key to move the tailstock forward or backward. Pressing "Tailstock" moves the tailstock forward, and one more pressing moves the tailstock backward.

In AUTO mode, you can use M20 or M21 to control the forward or backward movement of the tailstock.

Local variable definition

Inputs

Name	Type	Description
nodef	BYTE	Reserved
TailCtrl_K	BOOL	Tailstock control key: press 1st time, advance; 2nd time, retract
SP_status	BOOL	Spindle status

Outputs

Name	Type	Description
TailAdv_O	BOOL	Tailstock advance output
TailRet_O	BOOL	Tailstock retract output
AdvRet_LED	BOOL	Tail advance/retract flag

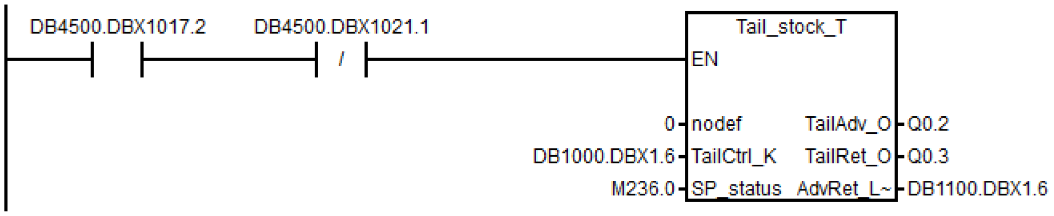
Assigned global variables

SP_RUNm	BOOL	M236.0	Indicate that the spindle is running
TailAdv_m	BOOL	M229.2	Indicates that the tailstock is moving forward
TailRet_m	BOOL	M229.3	Indicates tailstock is moving backward

Relevant PLC machine data

No.	Value	Description
14512 [17].2	1	Enable tailstock in turning
	0	Disable tailstock in turning
14512 [21].1	0	Set I0.0 to I2.7/Q0.0 to Q1.7 as the standard I/O wiring in the default PLC
	1	Set I6.0 to I8.7/Q4.0 to Q5.7 as the standard I/O wiring in the default PLC

Example for calling subroutine 55



6.6.30 Subroutine 56 - Lock_unlock_T (clamping control for turning machine)

Purpose

Subroutine 56 is used to control the clamping or release for the chuck for a turning machine.

In JOG mode, press the "**External/Inside clamping**" key to select either external clamping or inside clamping, and press "Clamp" or "Unclamp" key to clamp or release the chuck. Furthermore, you can also use the "Foot switch" to clamp or release the chuck. Pressing the "Foot switch" for once release the chuck, and one more pressing clamps the chuck.

In AUTO mode, you can execute M10/M11 to control the clamping or release of the chuck.

Note

The chuck status should be kept when clamping outputs are zero.

Local variable definition

Inputs

Name	Type	Description
Delay	WORD	Delay if no in position sensor
LckRel_k	BOOL	Lock/release toggle signal
ExtIn_k	BOOL	External/internal lock key
S_velo	BOOL	Spindle velocity 0: 0 speed; 1: spindle running
Foot_switch	BOOL	Foot switch for clamp/unclamp chuck

Outputs

Name	Type	Description
Lck1_O	BOOL	Clamping output 1
Lck2_O	BOOL	Clamping output 2
Lck_LED	BOOL	Clamping output indicate
ExtIn_LED	BOOL	External/internal lock LED

Name	Type	Description
Err1	BOOL	Error 1: clamp/unclamp not possible while spindle is operating

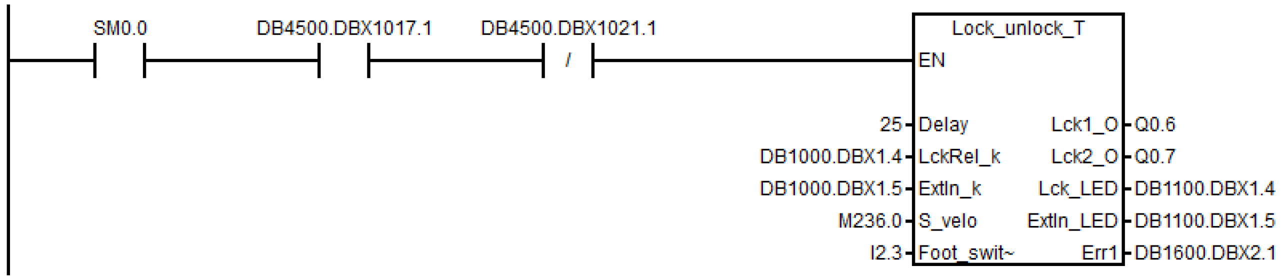
Assigned global variables

ChuckLcked	BOOL	M229.4	Chuck clamped
ChuckLckLED	BOOL	M239.2	Chuck at released state
ExtInLED_Om	BOOL	M239.5	External/inside clamping state
TR_Status	BOOL	M237.6	Chuck release command

Relevant PLC machine data

No.	Value	Description
14512 [17].1	1	Enable chuck in turning
	0	Disable chuck in turning
14512 [21].1	0	Set I0.0 to I2.7/Q0.0 to Q1.7 as the standard I/O wiring in the default PLC
	1	Set I6.0 to I8.7/Q4.0 to Q5.7 as the standard I/O wiring in the default PLC

Example for calling subroutine 56



6.6.31 Subroutine 58 (MM_MAIN)

Purpose

To use subroutine 58, you must have licensed the optional Manual Machine Plus function for the SINUMERIK 808D ADVANCED T (Turning). The subroutines 46, 58 and 59 must be used together. This subroutine is used to control the manual machine function after the manual machine interface is activated.

Local variable definition

Inputs

Name	Type	Description
TK_X_P	BOOL	Traverse key X plus
TK_X_M	BOOL	Traverse key X minus
TK_Z_P	BOOL	Traverse key Z plus
TK_Z_M	BOOL	Traverse key Z minus
RAPID	BOOL	Rapid traverse key
SP_CW	BOOL	Start signal spindle CW
SP_CCW	BOOL	Start signal spindle CWW
SP_STOP	BOOL	Stop signal spindle
NC_START	BOOL	NC start signal
NC_STOP	BOOL	NC stop signal
AUTO_ENABLE	BOOL	Switching to AUTO is enabled in Manual Machine Mode
MDA_ENABLE	BOOL	Switching to MDA is enabled in Manual Machine Mode
ROV	BOOL	ROV in Manual Machine Mode

Outputs

Name	Type	Description
AL_03	BOOL	Not approaching the reference point on axis X (user alarm 03)
AL_04	BOOL	Not approaching the reference point on axis Z (user alarm 04)
AL_09	BOOL	Incorrect start in the spindle direction (user alarm 09)
AL_11	BOOL	JOG program timeout (user alarm 11)
AL_12	BOOL	Spindle rate not 100% (user alarm 12)
AL_13	BOOL	Spindle not being started (user alarm 13)
AL_14	BOOL	Feed rate 0% (user alarm 14)
AL_16	BOOL	Spindle direction change in a thread not allowed (user alarm 16)

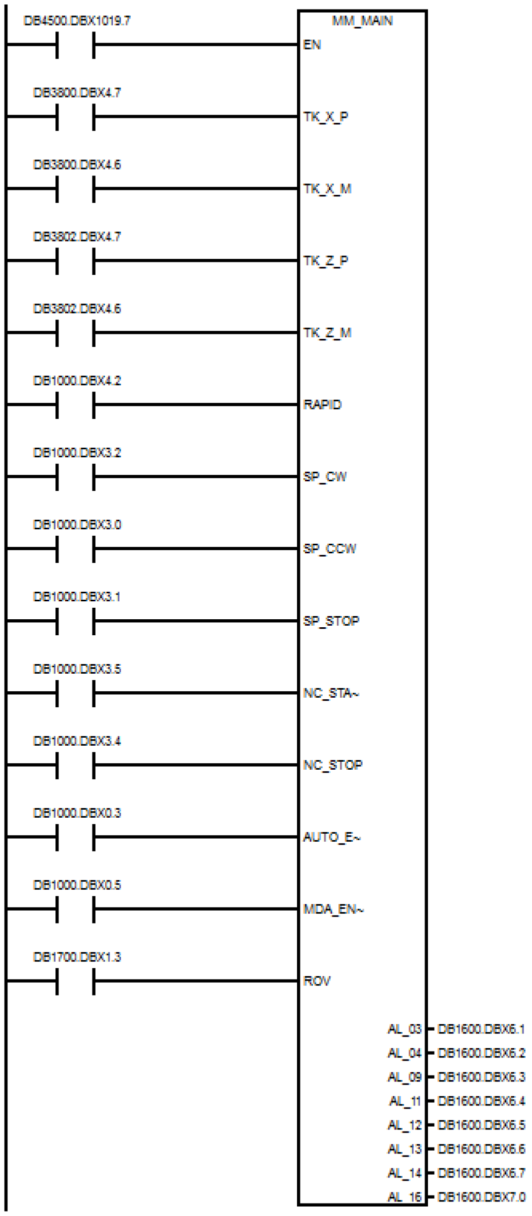
Assigned global variables

Byte	Signal	Byte 7	Byte 6	Byte 5	Byte 4	Byte 3	Byte 2	Byte 1	Byte 0
MB170	HMI<->MM						Request for MM HMI startup	MM HMI enabled	MM HMI started
MB171	HMI<->MM								
MB172	HMI<->MM								
MB173	HMI<->MM								
MB174	HMI<->MM	Cone angle 270°-360°	Cone angle 270°	Cone angle 180°-270°	Cone angle 180°	Cone angle 90°-180°	Cone angle 90°	Cone angle 0°-90°	Cone angle 0°
MB175	HMI<->MM						Direction key enabled		Spindle rotated
MB176	HMI<->MM		Working step enabled	Groove enabled	Thread chaining enabled	Drilling enabled	Arc enabled	Cutting enabled	Thread enabled
MB177	HMI<->MM								
MB178									
MB179									
MB180							Recutting canceled	Recutting performed	Recut the thread or not?

Relevant PLC machine data

No.	Unit	Range	Description
MD14512[19].7	-	-	1: to enable the manual machine function 0: to disable the manual machine function

Example for calling subroutine 58



6.6.32 Subroutine 59 (MM_MCP_808D)

Purpose

To use subroutine 59, you must have licensed the optional Manual Machine Plus function for the SINUMERIK 808D ADVANCED T (Turning). The subroutines 46, 58 and 59 must be used together. Normally, the spindle will be stopped after you press the NC reset key. However, when a manual machine is started, you do not want to stop the spindle after pressing the NC reset key. In this case, call subroutine 59 (MM_MCP_808D) after executing subroutine 37 (MCP_NCK). Then you do not need to rewrite subroutine 37 (MCP_NCK).

Local variable definition

Inputs

Name	Type	Description
SP_STOP_K	BOOL	Spindle stop

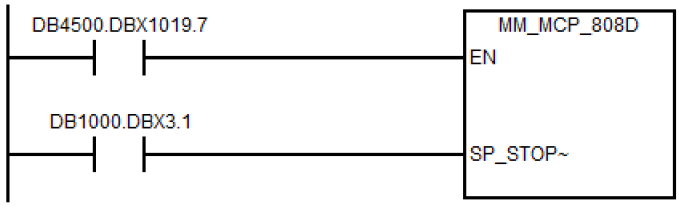
Assigned global variables

None

Relevant PLC machine data

No.	Unit	Range	Description
MD14512[19].7	-	-	1: to enable the manual machine function 0: to disable the manual machine function

Example for calling subroutine 59



6.6.33 Subroutine 60 - Disk_MGZ_M (disk-style tool magazine used for milling)

Purpose

You can use subroutine 60 to control the disk-style tool magazine on a milling machine.

In the reference point mode, initialize the tool magazine by pressing the "Original position of the tool magazine" key.

In the manual mode, you can rotate the tool magazine clockwise or counter-clockwise, and enable the tool magazine to reach the spindle or tool change position respectively through the "Clockwise rotation of the magazine", "Counter-clockwise rotation of the magazine", "Tool magazine reaching the spindle", and "Tool magazine reaching the tool change position" keys.

In AUTO mode, you need to execute M06 to call the tool change subroutine when compiling a part program. Subroutine 60 and the tool change subroutine must be used together during the tool change process. Three operations are involved in the tool change control, that is, tool return, tool retrieval, and tool change.

1. The tool return operation is to return the tool on the spindle back to the tool magazine disk when compiling T0 and a tool is located on the spindle.
2. The tool retrieval operation is to get the desired tool from the tool magazine disk and install it on the spindle when compiling Tx (x ≠ 0) and no tool is on the spindle.
3. The tool change operation is to first return the tool on the spindle back to the tool magazine disk and then get the desired tool from the tool magazine disk when compiling Tx (x ≠ 0; x ≠ number of the tool on the spindle).

For details, please refer to the tool change subroutine.

When setting 14512[19].3 to 1, the maintenance mode is enabled, in which you can perform the following operations:

- When the tool magazine is in the spindle position, axis Z only moves upward to the tool change position.
- When axis Z is under the tool change position, the tool magazine cannot move to the spindle position.
- When the tool magazine is rotating, the tool magazine needs to go home if the emergency stop button is pressed.

The following machine data is involved in this subroutine:

MD10715: M_NO_FCT_CYCLE[0]

MD10716: M_NO_FCT_CYCLE_NAME[0]

MD22550: TOOL_CHANGE_MODE

MD22560: TOOL_CHANGE_M_CODE

Local variable definition

Inputs

Name	Type	Description
nodef	BYTE	Reserved
MgzCnt	BOOL	Magazine counter
MgzRef_k	BOOL	Set current tool no. to 1 in magazine via this key
MgzCW_k	BOOL	Magazine CW rotate key
MgzCCW_k	BOOL	Magazine CCW rotate key
MgzSp_k	BOOL	Magazine enter spindle position key
MgzOrg_k	BOOL	Magazine original position key
MgzSp_pos	BOOL	Magazine reaches SP position
MgzOrg_pos	BOOL	Magazine reaches original position
T_rel_pos	BOOL	Spindle releases tool position
T_lck_pos	BOOL	Spindle locks tool position
T_rel_k	BOOL	Spindle release-tool key
T_rel_EnK	BOOL	Release-tool enable key

Outputs

Name	Type	Description
MgzCW_o	BOOL	Magazine CW rotate output
MgzCCW_o	BOOL	Magazine CCW rotate output
MgzSp_o	BOOL	Magazine approaching spindle position output
MgzOrg_o	BOOL	Magazine original position output
SpRelT_o	BOOL	Spindle releases a tool
RelT_En_o	BOOL	Release tool enable lamp
MgzSp_LED	BOOL	Magazine reaches spindle position
MgzOrg_LED	BOOL	Magazine reaches original position
MgzRef_LED	BOOL	Set current tool no. to 1 in mag. output

Assigned global variables

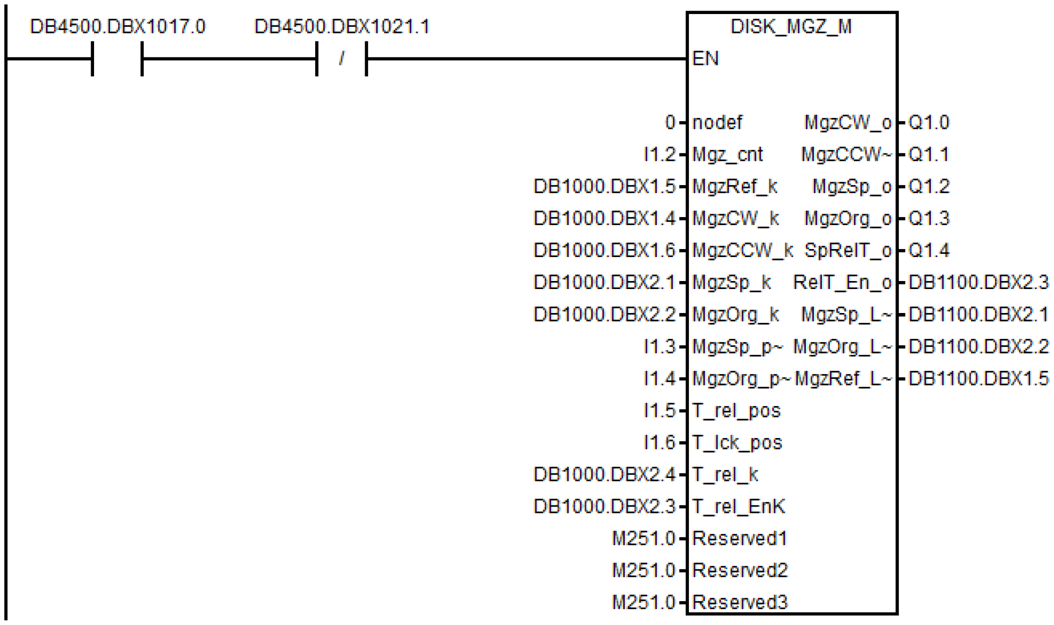
MgzCW_cmd	BOOL	M230.0	Command for clockwise rotation of the tool magazine
MgzCCW_cmd	BOOL	M230.1	Command for counter-clockwise rotation of the tool magazine
Mgz_rot_CMD	BOOL	DB4900.DBB24	Tool change command from the tool change subroutine

Relevant PLC machine data

No.	Unit	Range	Description
14512 [19].3	-	-	1: to enable the maintenance mode 0: to enable the normal mode
14512 [21].1	-	-	Switch of the I/O interface (0: set I0.0 to I2.7/Q0.0 to Q1.7 as the standard I/O wiring in the default PLC; 1: set I6.0 to I8.7/Q4.0 to Q5.7 as the standard I/O wiring in the default PLC)
14514 [2] 1)	-	-3.40e38 to 3.40e38	Tool magazine: tool change position of axis Z

1) For the first-time commissioning, set MD14514 [2] to an appropriate value so that axis Z can move freely during the commissioning. When the commissioning is finished, set MD14514 [2] to the normal value.

Example for calling subroutine 60



6.6.34 Subroutine 62 - Trg_key_OR

Purpose

Subroutine 62 is used for the override control via trigger user keys in the following MCP variants:

- Vertical MCP with a reserved slot for the handwheel: for spindle override control only
- Horizontal MCP with a reserved slot for the handwheel (applicable to turning machines only): for spindle override, feedrate override, and rapid traverse override control.

Subroutine 62 for turning application

Set the following PLC machine data for different MCP variants:

MCP variants	PLC machine data setting		Description
	14512 [20].0	14512 [21].4	
Horizontal MCP with a reserved slot for the handwheel	0	1	Spindle override, feedrate override, and rapid traverse override * controlled via trigger keys
Vertical MCP with a reserved slot for the handwheel	1	0	Spindle override controlled by trigger user keys
Horizontal/vertical MCP with two override switches	0	0	Spindle override and feedrate override controlled by gray coded switch

* To use the rapid traverse override of 25%, you must set the machine data 12050[8] = 0.25.

Local variable definition

Inputs

Name	Type	Description
noder	WORD	Reserved
IncS_Key	BOOL	Increase key of spindle override
DecS_Key	BOOL	Decrease key of spindle override
S_100_Key	BOOL	Spindle override 100% key
IncF_Key	BOOL	Increase key of feedrate override
DecF_Key	BOOL	Decrease key of feedrate override

Name	Type	Description
F_100_Key	BOOL	Feedrate override 100% key
RapidOvr_1	BOOL	Rapid override 1%
RapidOvr_25	BOOL	Rapid override 25%
RapidOvr_50	BOOL	Rapid override 50%
RapidOvr_100	BOOL	Rapid override 100%
Noder1	BYTE	Reserved

Outputs

Name	Type	Description
LED1_S	BOOL	Lights, spindle override < 100%; flashing, 50%
LED2_S	BOOL	Lights, spindle override 100%
LED3_S	BOOL	Lights, spindle override 105-115%; flashing, 120%
LED1_F	BOOL	Lights, feedrate override < 100%; flashing, 0%
LED2_F	BOOL	Lights, feedrate override 100%
LED3_F	BOOL	Lights, feedrate override 105-115%; flashing, 120%

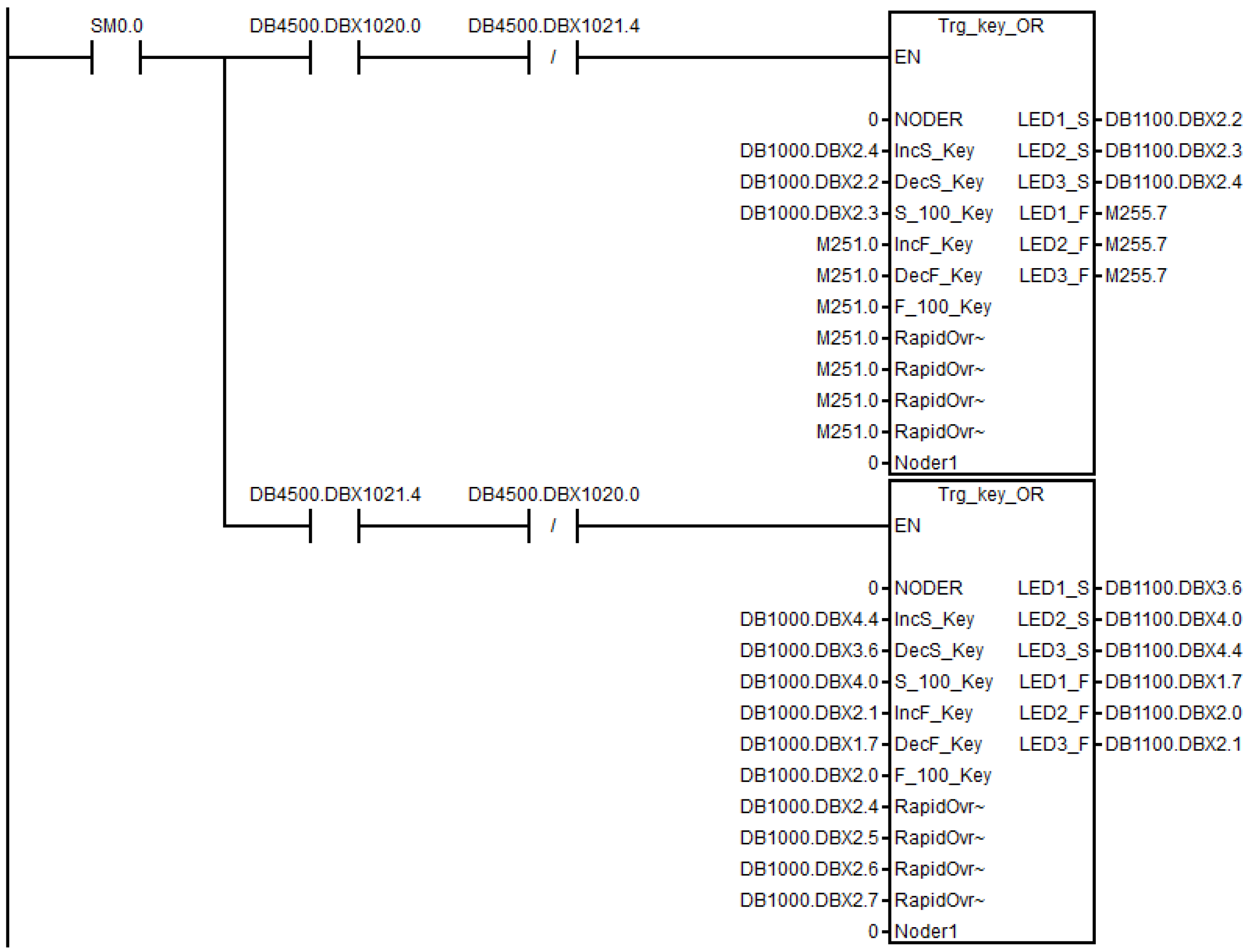
Assigned global variables

SP_OV_Switch	BYTE	MB202	Spindle override switch buffer
USB_MCP_SP_OV	BYTE	MB209	USB MCP signal: spindle override
FD_OV_Switch	BYTE	MB201	Feedrate override switch gray code
USB_MCP_FD_OV	BYTE	MB208	USB MCP signal: feedrate override
USB_MCP_Ra_OV	BYTE	MB220	USB MCP signal: rapid feedrate

Relevant PLC machine data

No.	Unit	Range	Description
14510 [15]	0.1 s	0.5 s to 3 s	Spindle override 50% key holding on time defined
14510 [16]	0.1 s	0.1 s to 3 s	Spindle override 100% key holding on time defined
14510 [17]	0.1 s	0.5 s to 3 s	Feedrate override 0% key holding on time defined
14510 [18]	0.1 s	0.1 s to 3 s	Feedrate override 100% key holding on time defined
14512 [20]	-	-	Bit 5: define the spindle override startup value (0: the startup spindle override is always 100%; 1: recode the spindle override value of the last machine turn off for the next startup)
			Bit 6/7: define the spindle override shift speed • bit 6 = 0, bit 7 = 0 Standard speed. The steps are 50%, 55%, 60%, 65%, 70%, 75%, 80%, 85%, 90%, 95%, 100%, 105%, 110%, 115%, 120% • bit 6 = 1, bit 7 = 0 Two times the standard speed. The steps are 50%, 60%, 70%, 80%, 90%, 100%, 110%, 120% • bit 6 = 0, bit 7 = 1 About three times the standard speed. The steps are 50%, 60%, 70%, 85%, 100%, 110%, 120% • bit 6 = 1, bit 7 = 1 About four times the standard speed. The steps are 50%, 60%, 80%, 100%, 120%
14512 [21]	-	-	Bit 5: define the feedrate override startup value (0: the startup feedrate override is always 100%; 1: recode the feedrate override value of the last machine turn off for the next startup)

Example for calling subroutine 62



Subroutine 62 for milling application

Set the following PLC machine data for different MCP variants:

MCP variants	PLC machine data setting 14512 [20].0	Description
Vertical MCP with a reserved slot for the handwheel	1	Spindle override controlled by trigger user keys
Horizontal/vertical MCP with two override switches	0	Spindle override and feedrate override controlled by gray coded switch

Local variable definition

Inputs

Name	Type	Description
noder	WORD	Reserved
IncS_Key	BOOL	Increase key of spindle override
DecS_Key	BOOL	Decrease key of spindle override
S_100_Key	BOOL	Spindle override 100% key
Noder1	BYTE	Reserved
Noder2	BYTE	Reserved

Outputs

Name	Type	Description
LED1_S	BOOL	Lights, spindle override < 100%; flashing, 50%
LED2_S	BOOL	Lights, spindle override 100%
LED3_S	BOOL	Lights, spindle override 105-115%; flashing, 120%

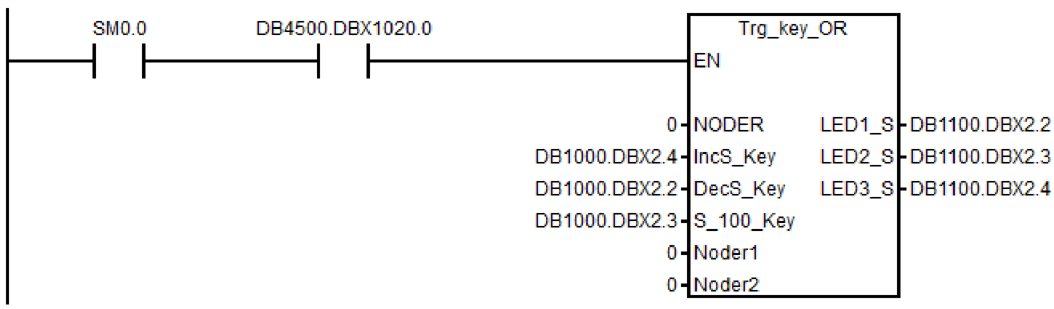
Assigned global variables

SP_OV_Switch	BYTE	MB202	Spindle override switch buffer
USB_MCP_SP_OV	BYTE	MB209	USB MCP signal: spindle override

Relevant PLC machine data

No.	Unit	Range	Description
14510 [15]	0.1s	0.5 s to 3 s	Spindle override 50% key holding on time defined
14510 [16]	0.1s	0.1 s to 3 s	Spindle override 100% key holding on time defined
14512 [20]	-	-	Bit 5: define the spindle override startup value (0: the startup spindle override is always 100%; 1: recode the spindle override value of the last machine turn off for the next startup)
			Bit 6/7: define the spindle override shift speed • bit 6 = 0, bit 7 = 0 Standard speed. The steps are 50%, 55%, 60%, 65%, 70%, 75%, 80%, 85%, 90%, 95%, 100%, 105%, 110%, 115%, 120% • bit 6 = 1, bit 7 = 0 Two times the standard speed. The steps are 50%, 60%, 70%, 80%, 90%, 100%, 110%, 120% • bit 6 = 0, bit 7 = 1 About three times the standard speed. The steps are 50%, 60%, 70%, 85%, 100%, 110%, 120% • bit 6 = 1, bit 7 = 1 About four times the standard speed. The steps are 50%, 60%, 80%, 100%, 120%

Example for calling subroutine 62



6.6.35 Subroutine 63 - TOGGLES

Purpose

Two types of switches are provided in subroutine 63, more specifically, a hold switch for switching a circuit on (press) and off (press again), and a delay switch for switching on a circuit and automatically switching it off after a certain time period. A total of six hold switches and two delay switches are available in this subroutine, with the delay duration being configurable. The key inputs or outputs of the subroutine can be connected with any physical inputs or outputs. The inputs and outputs of all idle switches are respectively "ZERO" and "NULL_b" (M255.7).

Local variable definition

Inputs

Name	Type	Description
Delay7	WORD	For switch 7; unit: 10 ms; max delay = 5 min
Delay8	WORD	For switch 8; unit: 10 ms; max delay = 5 min
Ki_1…Ki_6	BOOL	Input of hold switch 1...input of hold switch 6
Ki_7…Ki_8	BOOL	Inputs of delay switches 7 and 8

Outputs

Name	Type	Description
Ko_1…Ko_8	BOOL	Output of switch 1...output of switch 8

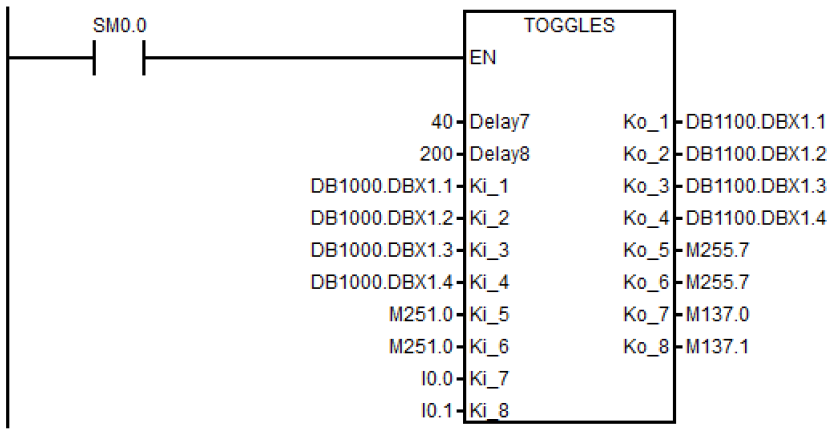
Assigned global variables

K1st1 … K8st1	MB245	State 1 of the hold switch
K1st2 … K8st2	MB246	State 2 of the hold switch
K1on … K8on	MB247	"On" state of the hold switch

Relevant PLC machine data

None

Example for calling subroutine 63



6.6.36 Subroutines 0 to 19, 34 to 36, 57, and 61

Explanation

Subroutines 0 to 19, 34 to 36, 57, and 61 are reserved for users.

6.7 PLC Programming Tool

6.7.1 Overview of PLC Programming Tool

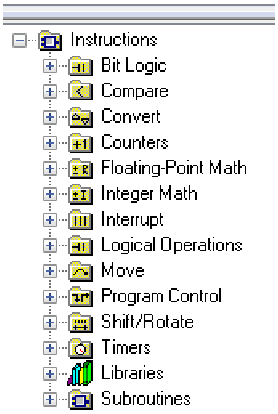
In order to edit the PLC program, use PLC Programming Tool V3.2.4 or higher.

By using PLC Programming Tool, you can perform the following operations:

- Creating the PLC program
- Editing the PLC program
- Making a connection between the programming tool and the system
- Compiling the PLC program
- Downloading the PLC program
- Uploading the PLC program
- Monitoring the PLC

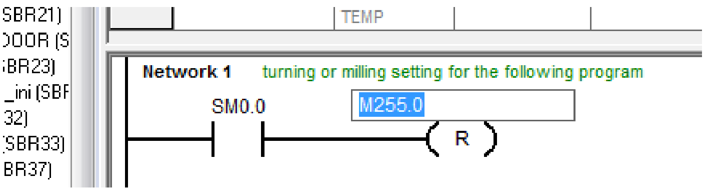
PLC instructions

Various instructions are available in PLC Programming Tool. You can view them in the instruction branch of the instruction tree.



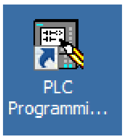
You can select an instruction and press the F1 key to view its help information.

The address of each instruction can be edited at any time by highlighting the instruction.



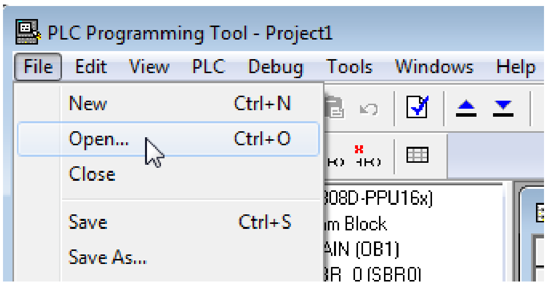
6.7.2 Renaming the default program

PLC Programming Tool contains a default PLC program. You can give this program a new name by performing the following operations:

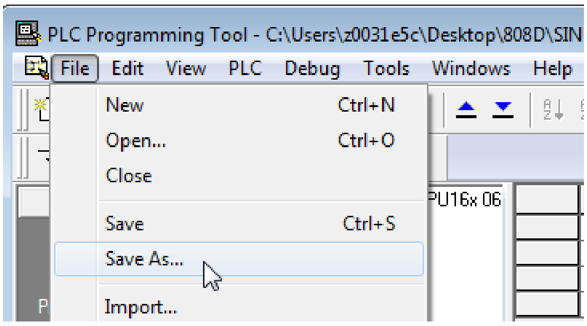


1. Start the software by double-clicking the icon on your desktop.

2. Click the  button in the toolbar or select from the main window menu as follows to select and open the default PLC program from the Toolbox:



3. Select the following menu command to save this file under a new name to a desired folder so that the default program will not be overwritten:

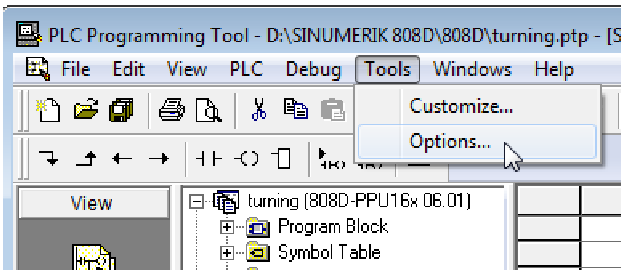


6.7.3 Changing the display language

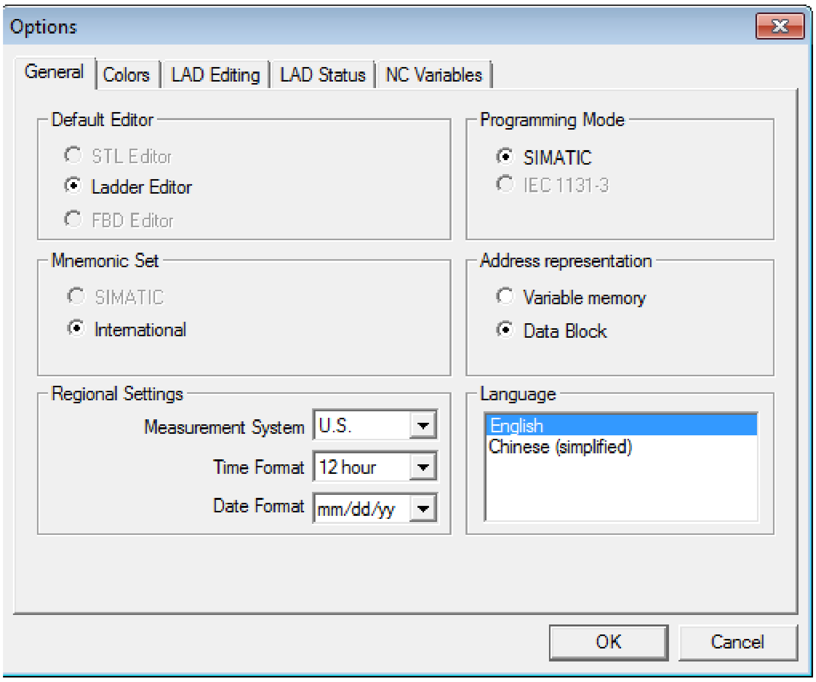
You can select the languages to be installed when installing the software. Then you can change the display language as desired in PLC Programming Tool.

Perform the following steps to change the display language.

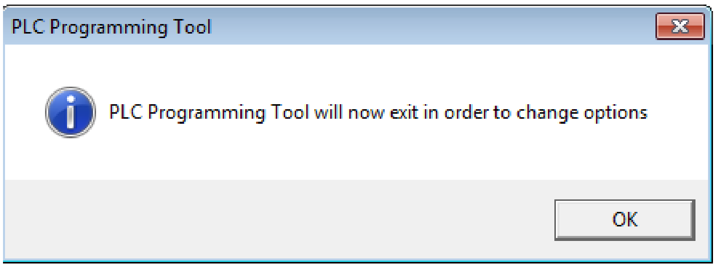
1. Choose from the main menu as follows:



2. In the appeared dialog box, select the desired display language, and then click this button to confirm.



3. Click this button in the following dialog box to close the software.



4. Start the software again to make the language setting effective.

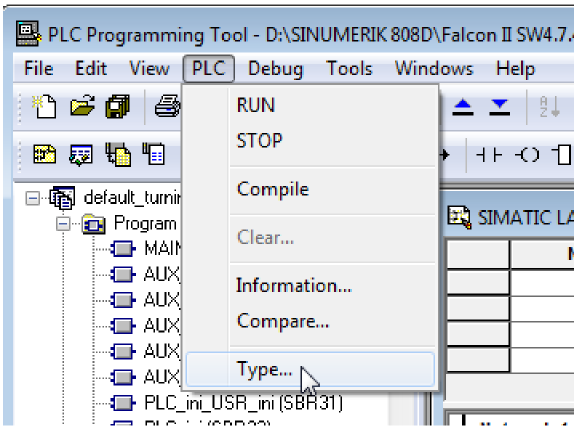
6.7.4 Selecting a target system

In PLC Programming Tool, you can select the PLC type as preset. In the instruction tree, the instructions that cannot be used for the target system are marked with a red × (for example,).

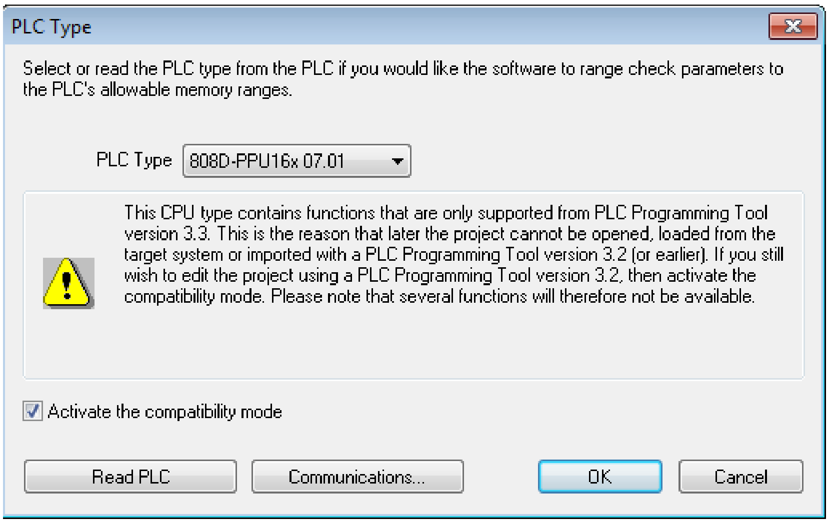
After the PLC type is preset, an error check of the program takes place when the program is written.

Operating sequence

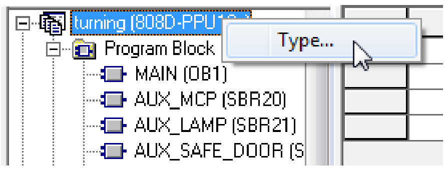
1. Start PLC Programming Tool on your PC.
2. Choose from the main screen menu as follows:



Then the following dialog box opens:



You can alternatively call this dialog by right-clicking the project name in the project tree and choosing from the shortcut menu.



3. Select a desired target system from the drop-down list in the dialog box.

   If an active communication has been established between PLC Programming Tool and the control system, you can alternatively click the following button to read the information directly from the target system:

Note that the compatibility mode must not be activated to use the CNC lock function of the control system.

4. Click this button to confirm and close the dialog box.

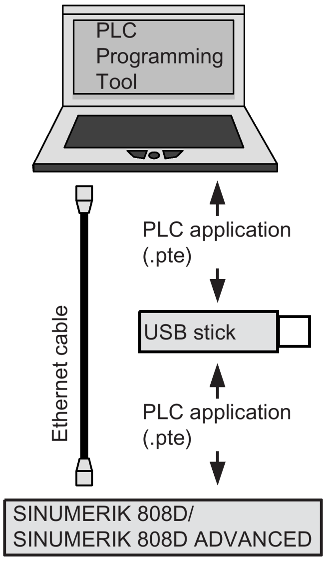
6.7.5 Downloading/uploading/comparing PLC applications

You can save, copy, or overwrite a PLC project on the control system by using the following:

- PLC Programming Tool
- USB memory stick
- Network drive

The **PLC project** contains the PLC user program, including all of the important information (symbols, comments, ...).

You can upload/download a PLC project from/to the control system with PLC Programming Tool. Also with this tool, you can import/export the PLC project in the "**.pte**" format. Additionally, you can read/write the PLC project in the "**.pte**" format from/to a USB memory stick or the connected network drive directly on the control system.

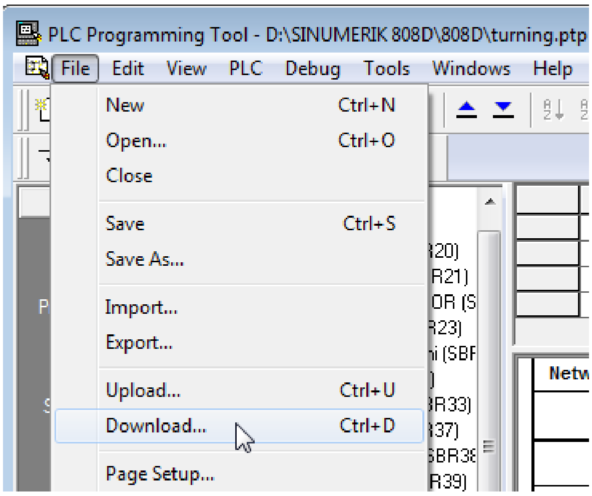


Downloading a PLC project to the control system

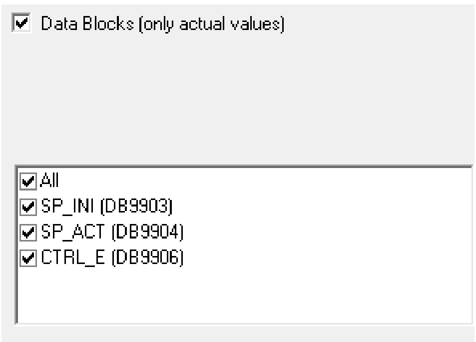
You can write the transferred data into the permanent memory (load memory) of the control system with PLC Programming Tool, a USB memory stick, or the network drive.

To download a PLC project with PLC Programming Tool, proceed as follows:

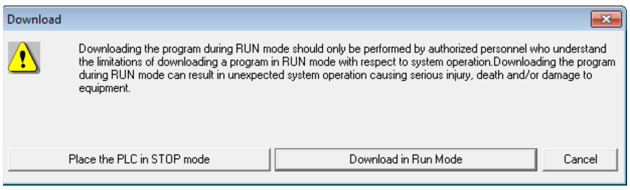
1. Establish the communication between the control system and PLC Programming Tool. For more information, see Section "Connecting with PLC Programming Tool (Page 42)".
2. Open the desired PLC project in PLC Programming Tool.
3. Select from the main screen menu as follows or click the toolbar button  to start the download:



4. Click this button on the download dialog box to proceed directly. You can also select the following checkbox for data blocks to include the actual values of the data blocks, and then click this button.



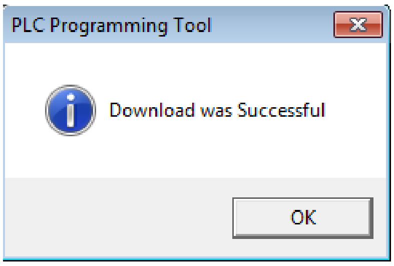
5. Choose to download the PLC project when the PLC is in the **run** mode or in the **stop** mode.



Caution: You are recommended to download the PLC project when the PLC is in the **stop** mode. Downloading in the **run** mode can cause machine damages or even human injuries.

6. Start the download which will take several seconds.

7. The download finishes when the following message appears. Then click this button to end your operations.

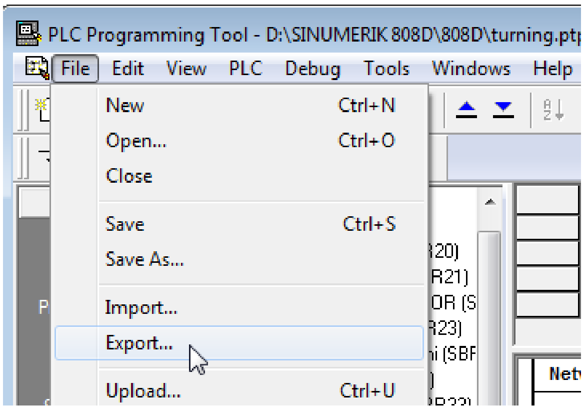


Note

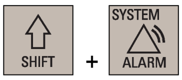
If you have chosen to download when the PLC is in the **stop** mode, you can place the PLC at the **run** mode again with PLC Programming Tool (click the button).

To download a PLC project with a USB memory stick or the network drive, proceed as follows:

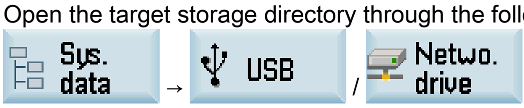
1. Open the desired PLC project in PLC Programming Tool.
2. Select from the main screen menu as follows to export the PLC project and save it as a .pte file (for example, plc_app.pte) on your computer:



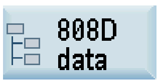
3.
   - To download the PLC project via USB, store the .pte file in a USB memory stick and insert the USB memory stick into the USB interface at the front of the PPU.
   - To download the PLC project via network drive, store the .pte file in a shared folder (network drive) on your computer and connect the network drive via Ethernet connection (Page 231).



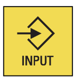
4. Select the system data operating area on the PPU.
5. Open the target storage directory through the following softkey operations:



6. Select the .pte file and then press this softkey to copy the file.

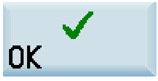


7. Press this softkey to open the system data window.



8. Move the cursor to select the following folder and press this key to open it:

9. Press this softkey to paste the copied .pte file.



10. A warning note appears warning you that the original .pte file will be overwritten. Press this softkey to confirm.

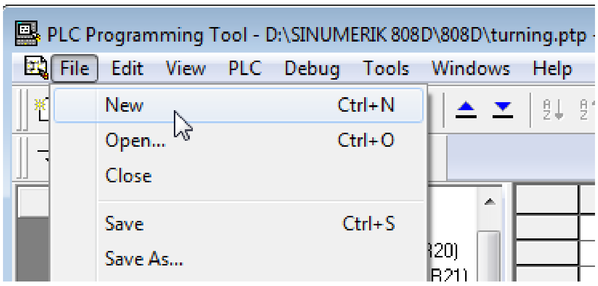
    The download has been completed when the progress bar disappears.

Uploading a PLC project from the control system

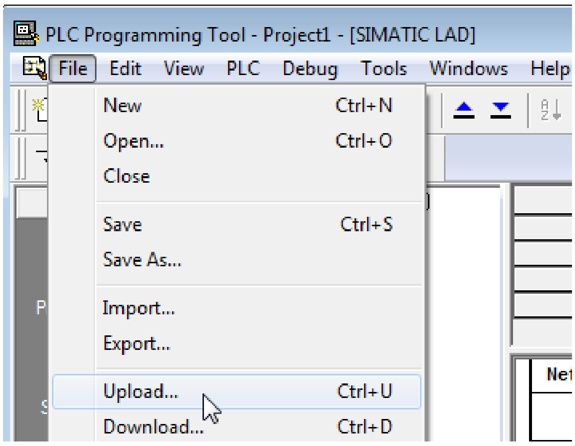
You can back up a PLC project from the permanent memory of the control system using PLC Programming Tool, a USB memory stick, or the network drive.

To upload a PLC project using PLC Programming Tool, proceed as follows:

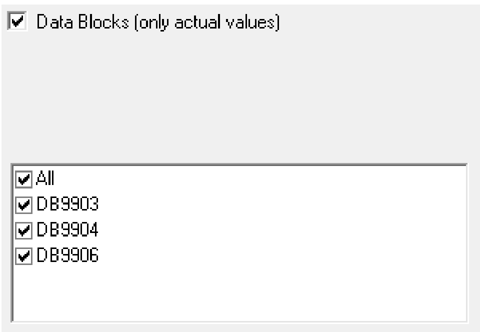
1. Establish the communication between the control system and PLC Programming Tool. For more information, see Section "Connecting with PLC Programming Tool (Page 42)".
2. Select from the main screen menu as follows or click the toolbar button to create a new and empty PLC project:



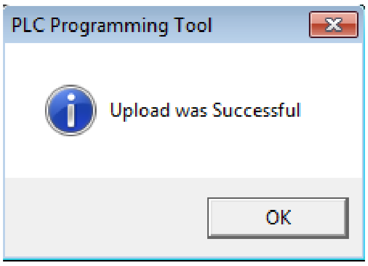
3. Select from the main screen menu as follows or click the toolbar button to start the upload:



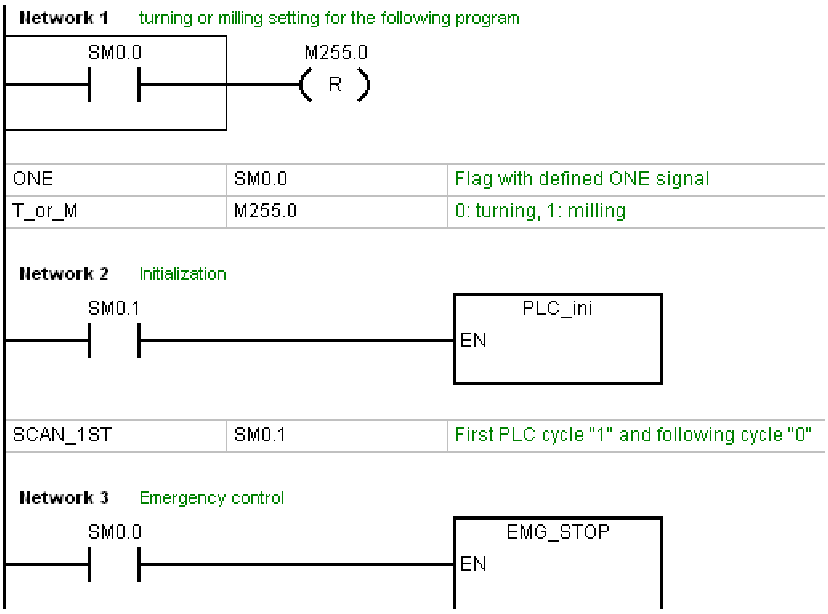
4. Click this button to proceed directly. You can also select the checkbox for data blocks to include the actual values of the data blocks, and then click this button.



5. The upload has been completed when the following message appears.

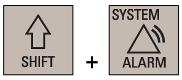


6. Click this button and you can view the upload results.



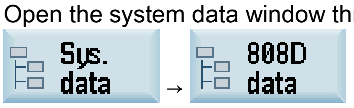
To upload a PLC project using a USB memory stick or the network drive, proceed as follows:

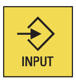
1.
   - To upload the PLC project via USB, insert the USB memory stick into the USB interface at the front of the PPU.
   - To upload the PLC project via network drive, connect the network drive via Ethernet connection (Page 231).



2. Select the system data operating area on the PPU.

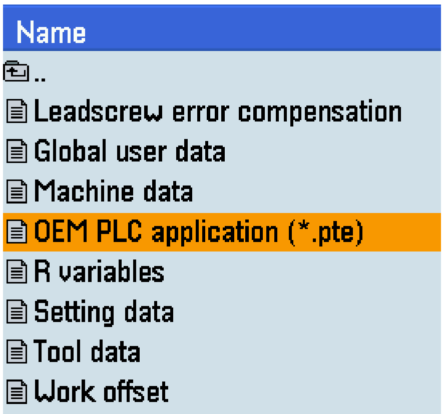
3. Open the system data window through the following softkey operations:





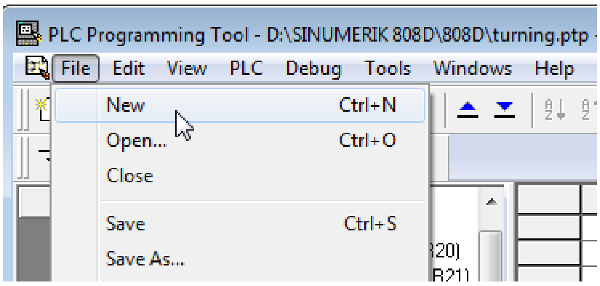
4. Move the cursor to select the following folder and press this key to open it:

5. Select the machine manufacturer's PLC project file (.pte) and press this softkey to copy.

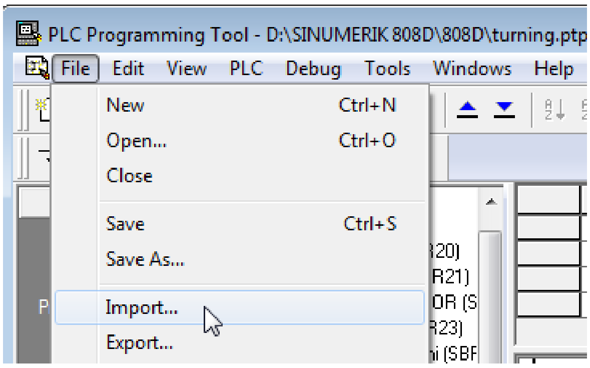


6. Paste the copied file into the desired storage directory through the following softkey operations:

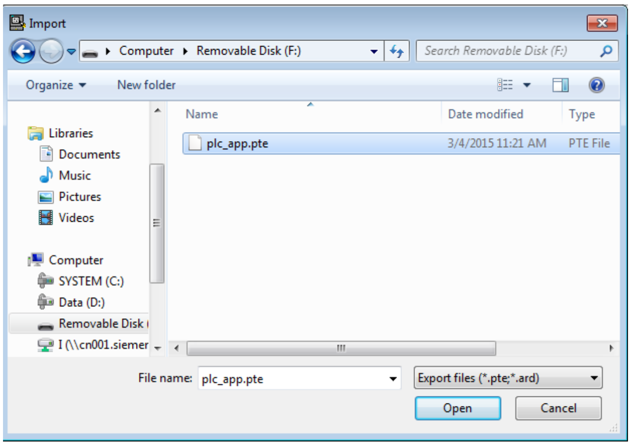
7. Select from the main screen menu of PLC Programming Tool as follows or click the toolbar button to create a new and empty PLC project:



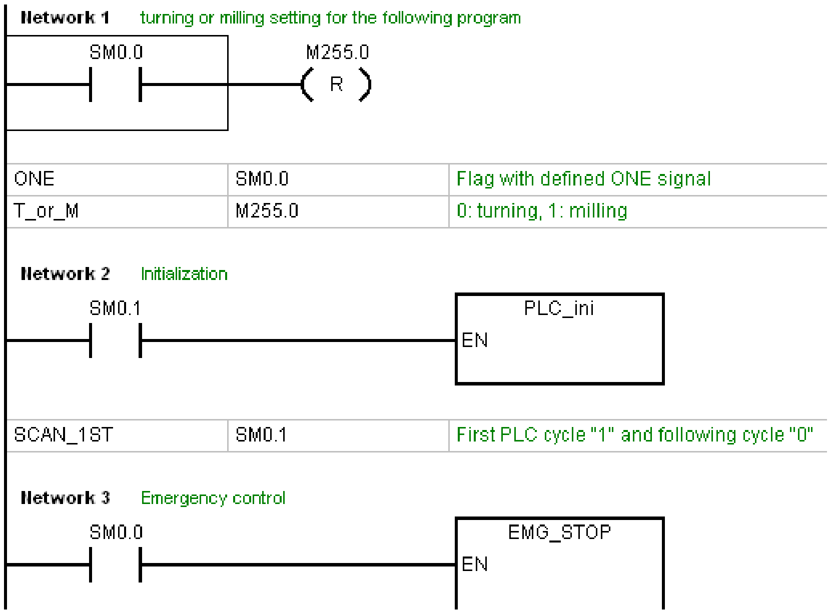
8. Import the **.pte** file from the USB memory stick or the network drive by selecting from the main screen menu as follows:



9. Click this button or double-click the **.pte** file in the following dialog box. It will take several seconds to import the **.pte** file.



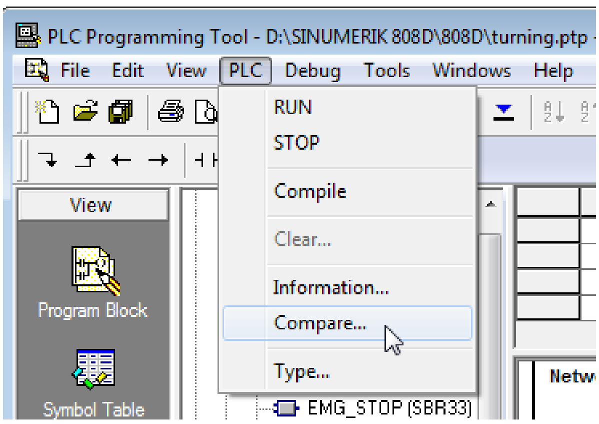
10. After successfully importing the PLC project, you can view the import results.



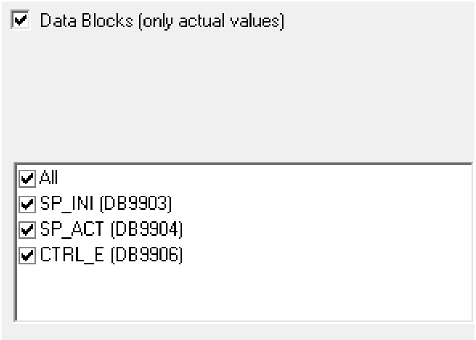
Comparing the PLC projects

You can compare the project opened in PLC Programming Tool with that stored on the control system by proceeding through the following steps:

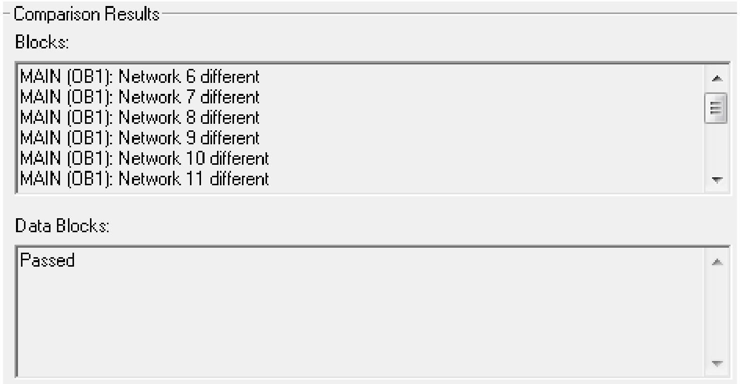
1. Select from the main screen menu as follows:



You can also select the checkbox for data blocks to include the actual values of the data blocks.

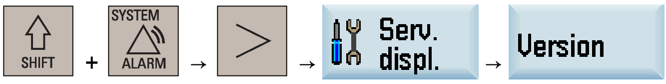


2. Click this button and the comparing begins. Wait for a few seconds, and then you can view the compare results.

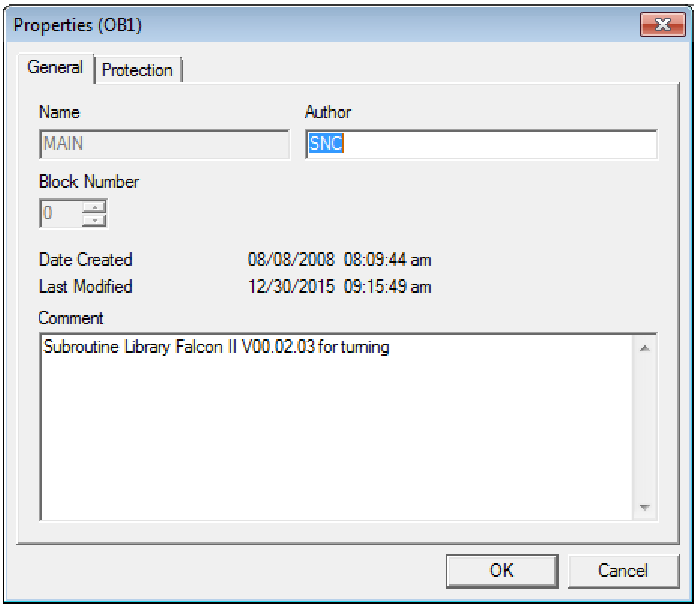


Version display

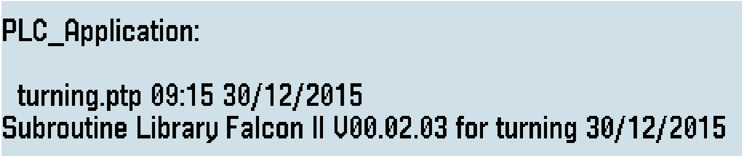
The transferred PLC application will be active in the working memory of the control after the system is started up. Then you can view the detailed information about the currently active PLC application in the version display through the following softkey operations:



In PLC Programming Tool, right-click the OB1 block and choose "Properties". In the comment text box of the opened OB1 property dialog, you can add your own additional information for the PLC application.



Then in the version display on the control, the added information is visible.

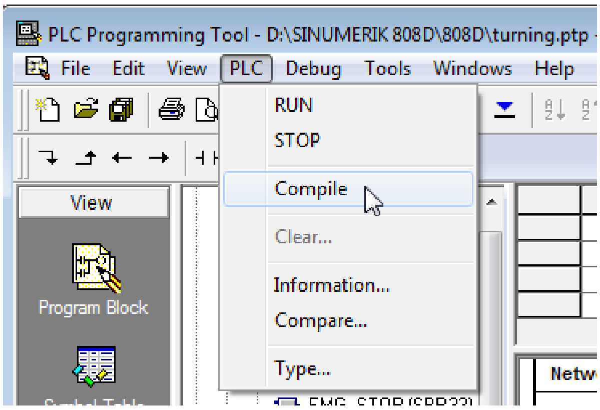


6.7.6 Compiling and monitoring programs

Compiling PLC programs

You can check for syntax errors after editing or modifying a PLC project using the compile function of PLC Programming Tool. Proceed through the following steps to compile the PLC programs:

1. Open an existing or a new PLC project in PLC Programming Tool, and save it after editing.
2. Start compiling by clicking the toolbar button or choosing from the main screen menu as follows:



3. Wait for several seconds until the compiling finishes. Then you can check the results in the message window at the bottom of the main screen.

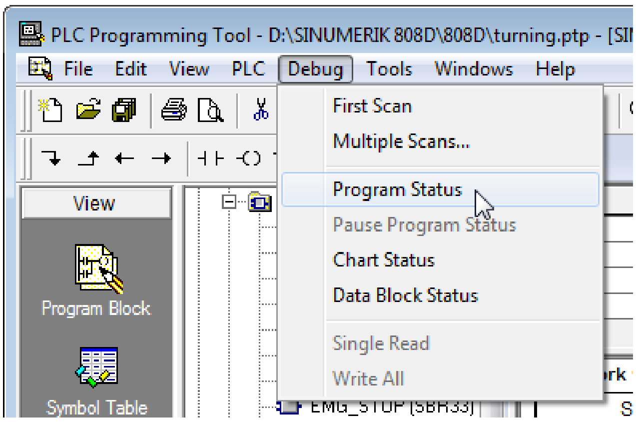
Monitoring the program status

Prerequisite:

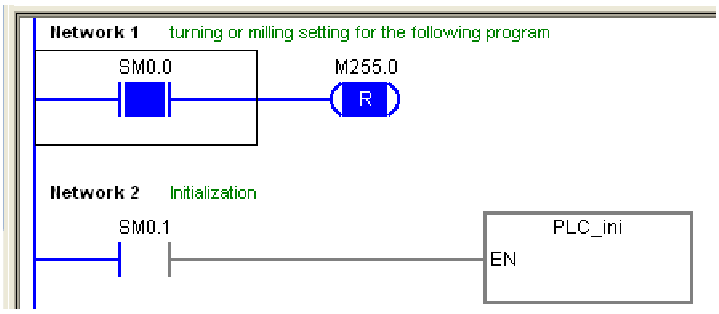
Before you can collect status to monitor or debug your program, make sure you have performed the following operations:

- Successfully compiling your program
- Establishing communication between PLC Programming Tool and the control system
- Successfully downloading your program to the control system

You can use the toolbar button or the following menu command to monitor the online status of your PLC program when the PLC is in the run mode (toolbar button).

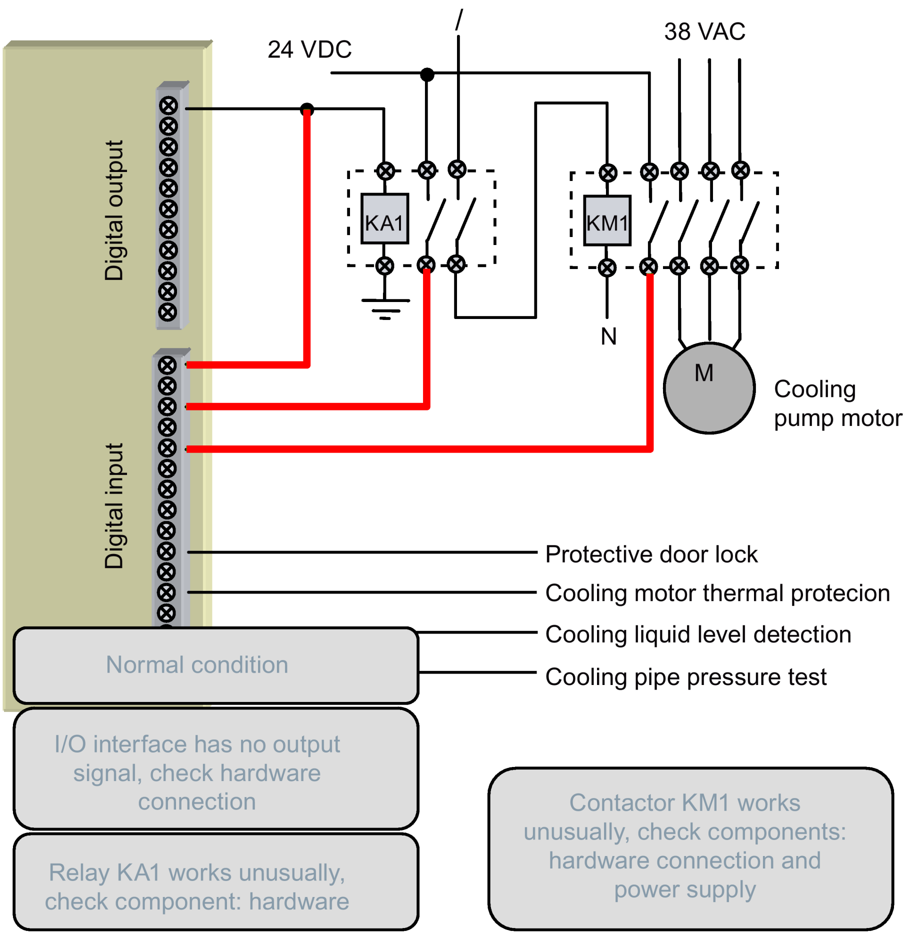


The blue color in the program editing window indicates the online connection status.



6.8 PLC alarms

Diagnosing of the machine is important. Complete diagnosis of the external electrics can help users understand the cause and location of breakdown immediately.



User alarms in the PLC subroutines

System provides users with 128 PLC user alarms. Every user alarm has a corresponding NCK address bit: DB1600.DBX0.0 to DB1600.DBX15.7. The address bit "1" can activate the corresponding alarm, and reset “0” can cancel the alarm.

In the PLC cross reference, you can find the reason for the PLC alarm through looking up reference addresses to make the corresponding modification.

Some user alarms are activated in a subroutine. In the case that such an alarm is generated, you can search the following list for the subroutine wherein the alarm is activated.

Alarm No.	Interface Address	Alarm Description	From SBR
700010	DB1600.DBX1.2	Handheld unit active	SBR41: MINI_HHU
700011	DB1600.DBX1.3	Tool clamping timeout	SBR53: Turret3_CODE_T
700012	DB1600.DBX1.4	Spindle being braked	SBR42: SPINDLE
700013	DB1600.DBX1.5	Operation not allowed: chuck unclamped	SBR56: Lock_unlock_T
700014	DB1600.DBX1.6	Gear stage change timeout	SBR49: GearChg1_Auto
700015	DB1600.DBX1.7	Gear position signal error	
700016	DB1600.DBX2.0	Drives not ready	SBR33: EMG_STOP
700017	DB1600.DBX2.1	Chuck operation not allowed: spindle/prog. running	SBR56: Lock_unlock_T
700018	DB1600.DBX2.2	Cooling motor overload	SBR44: COOLING
700019	DB1600.DBX2.3	Coolant level too low	
700020	DB1600.DBX2.4	Lubricating motor overload	SBR45: LUBRICAT
700021	DB1600.DBX2.5	Lubricant level too low	
700022	DB1600.DBX2.6	Turret motor overload	SBR51: Turret1_HED_T SBR52: Turret2_BIN_T SBR53: Turret3_CODE_T
700023	DB1600.DBX2.7	Prog. tool pos. number > max. tool pos. number	
700024	DB1600.DBX3.0	Max. tool position number illegal	
700025	DB1600.DBX3.1	No tool position signal from turret	
700026	DB1600.DBX3.2	Tool change timeout	
700028	DB1600.DBX3.4	Tool unclamped	SBR53: Turret3_CODE_T
700029	DB1600.DBX3.5	Warning: the 1st maintenance task will expire	SBR48: ServPlan
700030	DB1600.DBX3.6	Alarm: the 1st maintenance task has expired	
700031	DB1600.DBX3.7	Magazine not in spindle pos. or original pos.	SBR60: Disk_MGZ_M
700032	DB1600.DBX4.0	Magazine in spindle pos. and original pos.	SBR60: Disk_MGZ_M
700033	DB1600.DBX4.1	Magazine rot. failed: magazine/spindle not ready	SBR60: Disk_MGZ_M
700034	DB1600.DBX4.2	Blk search finds tool on spindle <> tool programmed	SBR60: Disk_MGZ_M
700035	DB1600.DBX4.3	Spindle positioning to unclamping position timeout	SBR60: Disk_MGZ_M
700036	DB1600.DBX4.4	Spindle positioning to clamping position timeout	SBR60: Disk_MGZ_M
700049	DB1600.DBX6.1	Reference point of X axis not reached	SBR58: MM_MAIN
700050	DB1600.DBX6.2	Reference point of Z axis not reached	SBR58: MM_MAIN
700051	DB1600.DBX6.3	Spindle direction illegal	SBR58: MM_MAIN
700052	DB1600.DBX6.4	Monitoring time for JOG operation exceeded	SBR58: MM_MAIN
700053	DB1600.DBX6.5	Spindle override not 100%	SBR58: MM_MAIN
700054	DB1600.DBX6.6	Spindle not started	SBR58: MM_MAIN
700055	DB1600.DBX6.7	Feed override = 0%	SBR58: MM_MAIN
700056	DB1600.DBX7.0	Spindle dir. change not allowed in thread mach.	SBR58: MM_MAIN
700059	DB1600.DBX7.3	NC start not possible: safety door not closed	SBR22: AUX_SAFE_DOOR
700060	DB1600.DBX7.4	PRT/AFL change not possible: channel not reset	SBR37: MCP_NCK
700061	DB1600.DBX7.5	Mgz. in maint. Read-in & rapid traverse disabled	SBR60: Disk_MGZ_M
700062	DB1600.DBX7.6	Tool on spindle <> tool prgd. mgz. must be referenced	SBR60: Disk_MGZ_M

6.8.1 Alarm cancel/reset and reaction

Conditions of alarm cancel/reset

After the cancel of an alarm, you need to press one of the following two keys to clear the alarm finally.

Then the alarm displayed will disappear by itself.

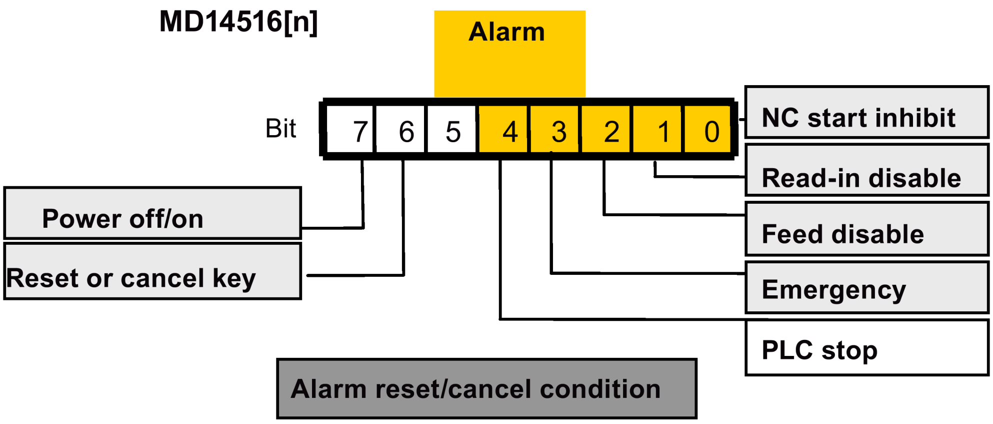
or


Alarm reaction

There are the following two ways for alarm reaction.

PLC reaction: the PLC program detects the reaction through the corresponding PLC interface, such as canceling the axis enable when giving an alarm.

NC reaction: every alarm has an eight-bit configuration MD14516[0] to [127]. You can set the cancelation condition and alarm reaction for every alarm according to the actual condition. The system then makes the corresponding reaction when the alarm begins.



6.8.2 Editing PLC alarm texts

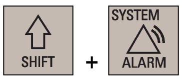
Creating or editing alarm texts correctly and reasonably can make users clearly realize and understand the reason of a PLC alarm and then locate and resolve breakdown.

You can edit a PLC user alarm by using the following two methods:

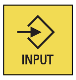
- Editing via a USB memory stick
- Editing directly on the HMI

Editing a PLC user alarm via a USB memory stick

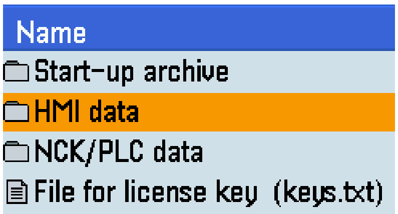
1. Insert the USB stick into the USB interface on the front panel of the PPU.
2. Select the system data operating area.

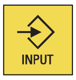


3. Press this softkey to open the system data window.

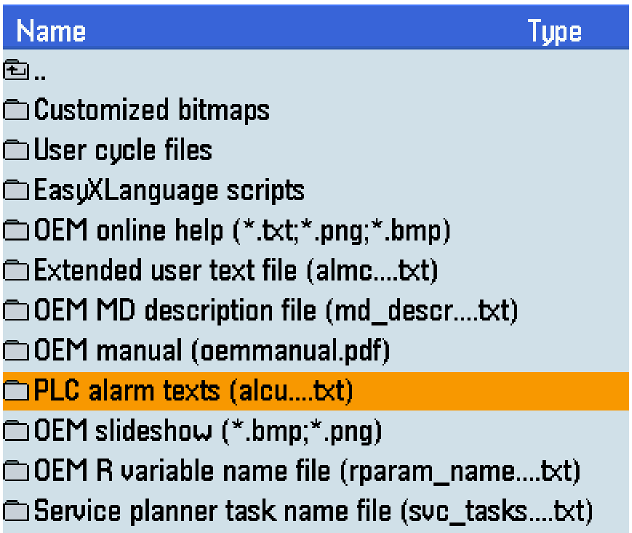


4. Select the HMI data folder and press this key to open it.

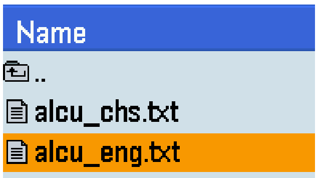




5. Move the cursor to the folder highlighted as follows and press this key to open it.



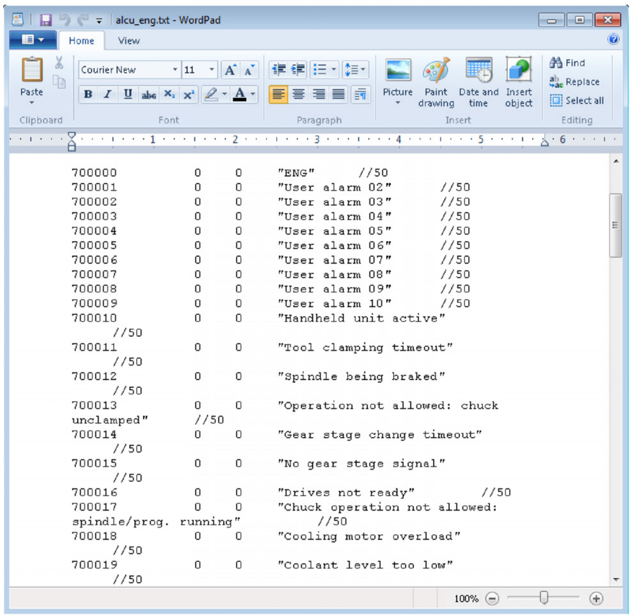
6. Press this softkey to copy the PLC alarm text file in the desired language.



7. Press this softkey to enter the USB storage directory.

8. Press this softkey to paste the copied alarm text file.

9. Connect the USB stick with your computer, find the PLC alarm text file copied from the NC, and open it with the WordPad.



```
700000      0   0   "ENG"     //50
700001      0   0   "User alarm 02"     //50
700002      0   0   "User alarm 03"     //50
700003      0   0   "User alarm 04"     //50
700004      0   0   "User alarm 05"     //50
700005      0   0   "User alarm 06"     //50
700006      0   0   "User alarm 07"     //50
700007      0   0   "User alarm 08"     //50
700008      0   0   "User alarm 09"     //50
700009      0   0   "User alarm 10"     //50
700010      0   0   "Handheld unit active"
    //50
700011      0   0   "Tool clamping timeout"
    //50
700012      0   0   "Spindle being braked"
    //50
700013      0   0   "Operation not allowed: chuck
unclamped"      //50
700014      0   0   "Gear stage change timeout"
    //50
700015      0   0   "No gear stage signal"
    //50
700016      0   0   "Drives not ready"      //50
700017      0   0   "Chuck operation not allowed:
spindle/prog. running"      //50
700018      0   0   "Cooling motor overload"
    //50
700019      0   0   "Coolant level too low"
    //50
```

10. Edit the alarm text as desired and then save and close the file.
11. Insert the USB stick into the USB interface on the front panel of the PPU.
12. Enter the USB storage directory through the following operations:

SHIFT + SYSTEM ALARM → Sys. data → USB

Copy

13. Locate the edited alarm text file and press this softkey to copy it.
14. Open the PLC alarm text folder as shown in Step 6 above.

Paste

15. Press this softkey to paste the edited alarm text file and overwrite the original one.
16. Then you can check the editing result through the following softkey operations:

PLC → Edit PLC alarm txt

Editing a PLC user alarm on the HMI

SHIFT + SYSTEM ALARM

1. Select the system data operating area.
2. Open the window for editing the PLC user alarm texts through the following softkey operations:

PLC → Edit PLC alarm txt

3. Use the cursor keys to select the alarm text you desire to edit.

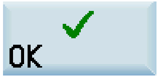
Edit text

4. Press this softkey to activate the input field at the bottom of the screen and enter the desired text, for example:

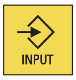
Note: Modify the PLC alarm texts if they are inapplicable.

700000 OVERHEAT

Note that the text of each PLC user alarm must be limited to 50 characters; otherwise, the alarm cannot display properly.



5. Confirm your entry with this softkey or the following key:

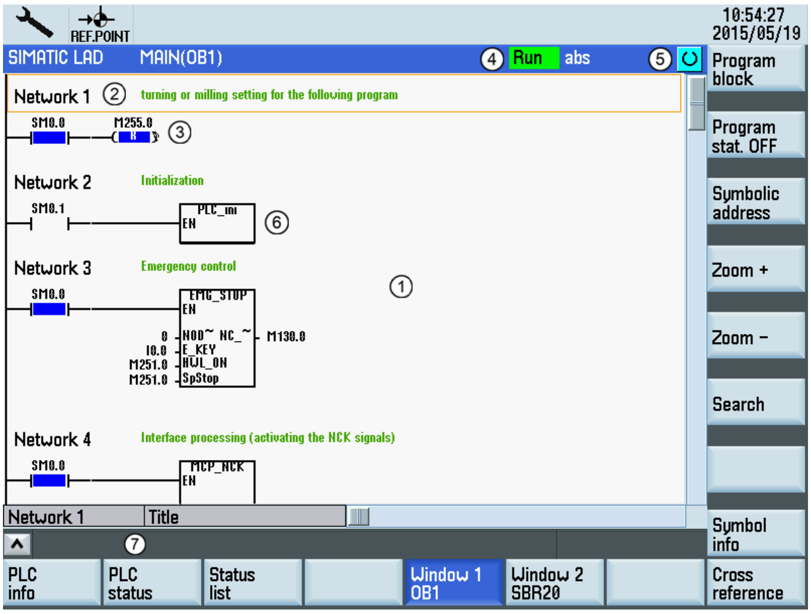


6.9 PLC diagnostics

A PLC user program consists to a large degree of logical operations to realize safety functions and to support process sequences. These logical operations include the linking of various contacts and relays. As a rule, the failure of a single contact or relay results in a failure of the whole system/installation.

To locate causes of faults/failures or of a program error, various diagnostic functions are offered in the system data operating area.

You can open the PLC program stored in the permanent memory of the control system through the following operations:



① Application area

② Supported PLC program language

③ Name of the active program block

Representation: Symbolic name (absolute name)

④
- **Program status**
  - Run: Program is running
  - Stop: Program is stopped
- **Status of the application area**
  - Sym: Symbolic representation
  - abs: Absolute representation

⑤ **Display of the active keys, e.g.**

⑥ **Focus**

Performs the tasks of the cursor

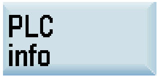
⑦ **Tip line**

Contains notes for searching

Two windows are available for you to view the program.

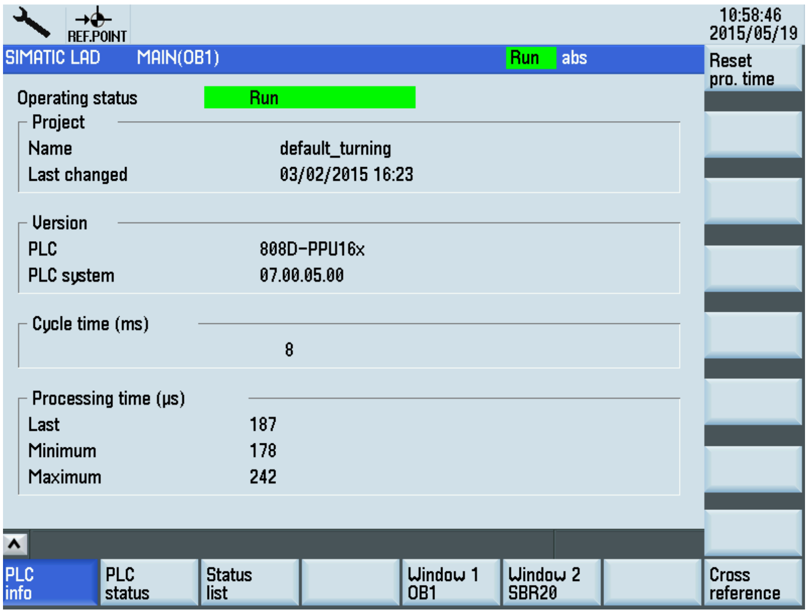
You can use this softkey to select the main program or a specific subroutine that you desire to display.

Displaying the PLC properties



You can use this softkey to check the following PLC properties:

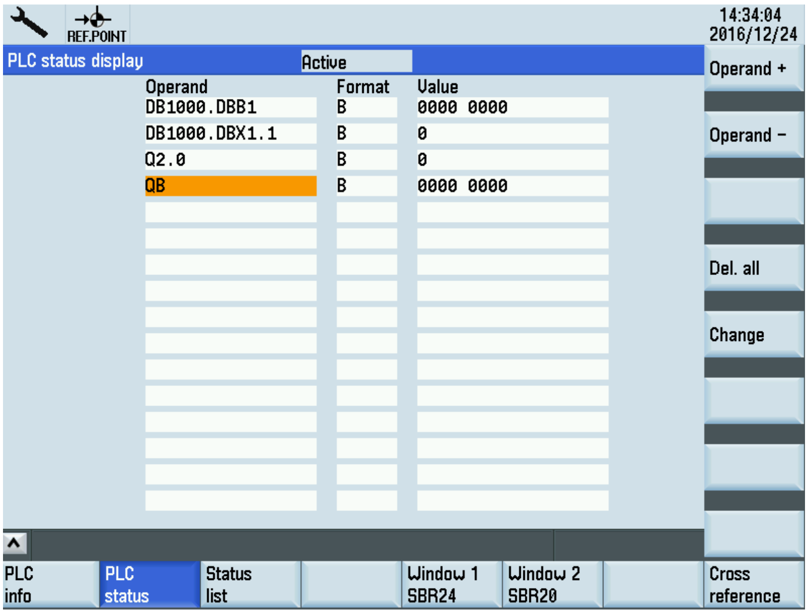
- Operating status
- Project name and change info
- PLC version and system info
- Cycle time
- Processing time of the PLC user program



Monitoring PLC status

PLC status

You can press this softkey to open the PLC status monitoring window, and check the current status of the desired PLC interface and I/O signals, for example:



The following softkey operations are possible in this window:

Operand +

Operand -

Use these softkeys to increase or decrease the bit of the operand.

Del. all

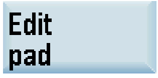
Pressing this softkey deletes all the entered operands.

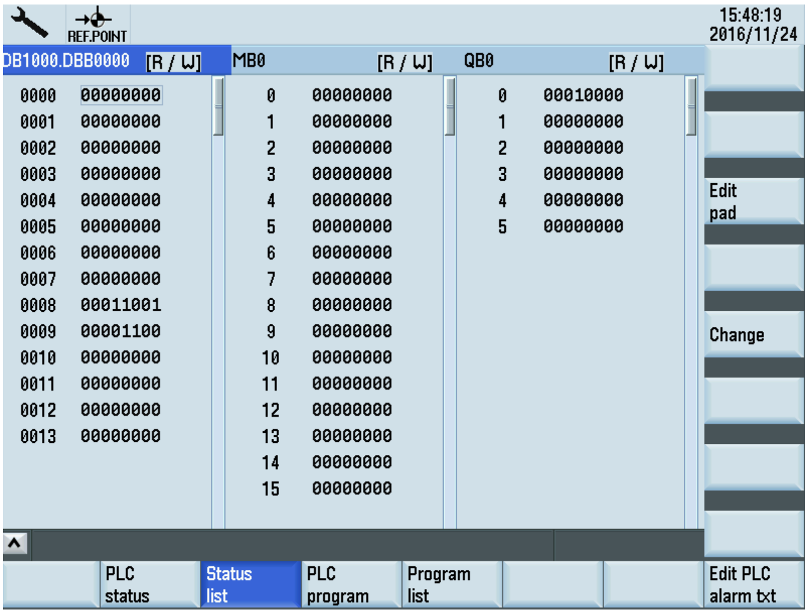
Change

You can press this softkey to change the status of the PLC interface or I/O signals by entering "0" (low) or "1" (high) in the corresponding value field.

You can alternatively monitor the PLC status in the form of lists.

You can press this softkey to open the status list window. Three lists in total are available for display. You can use the cursor keys to switch among the lists and the following softkey to specify the operand address for each list:

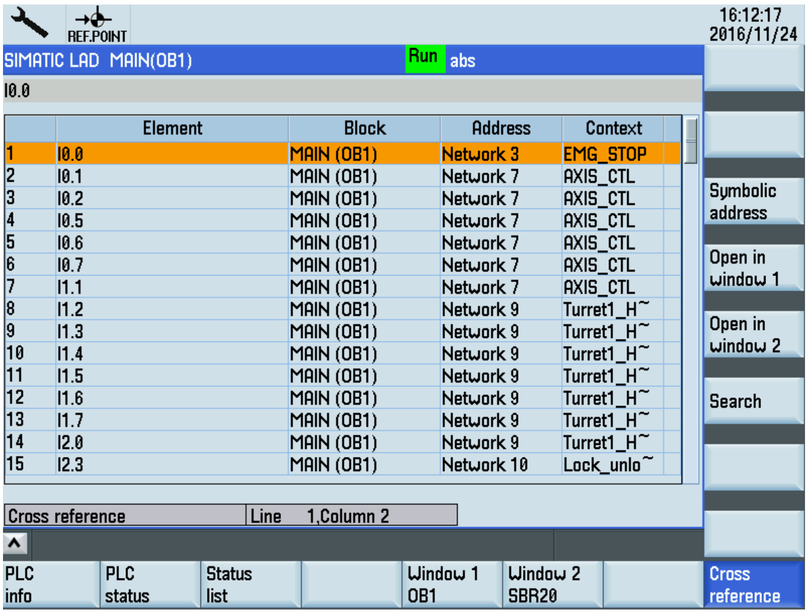




Displaying cross references

All operands used in the PLC project are displayed in the list of cross references. This list indicates in which networks an input, output, flag etc. is used.

You can press this softkey to display the list of cross references. The operands are displayed according to the absolute address by default, for example:



The following softkey operations are possible in this window:

Press this softkey to switch between the absolute and symbolic representation of the components.

You can open the selected program segment directly in the window using these softkeys.

Use this softkey to search for an operand in the cross reference list.

6.10 Handwheel assignment

Up to 2 handwheels can be connected. This means that up to 2 axes can be traversed by handwheel simultaneously and independently. A handwheel is assigned to the geometry or machine axes (WCS or MCS) via interface signals.

The axis to be moved as a result of rotating handwheel 1 to 2 can be set via the PLC user interface with IS "Activate handwheel 1 to 2":

- For machine axis (traverse in MCS): DB380x.DBX4.0/.1
- For geometry axis (traverse in WCS): DB3200.DBX1000.0/.1, DB3200.DBX1004.0/.1, and DB3200.DBX1008.0/.1.

The assignment is linked to the PLC interface through the PLC user program. Only here can several machine axes be assigned to one handwheel simultaneously.

You must also set the increment INC1, INC10, etc., which applies to handwheel travel, via axis signals DB380x.DBX5.x or channel signals (DB3200.DBX1001.x, DB3200.DBX1005.x, and DB3200.DBX1009.x). Note that the mode signals DB2600.DBX1.0 and DB3000.DBX2.x must not be active in this case.

7 Commissioning the prototype machine

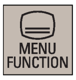
7.1 Overview on commissioning and operation wizards

The control system has two commissioning wizards and one operation wizard.

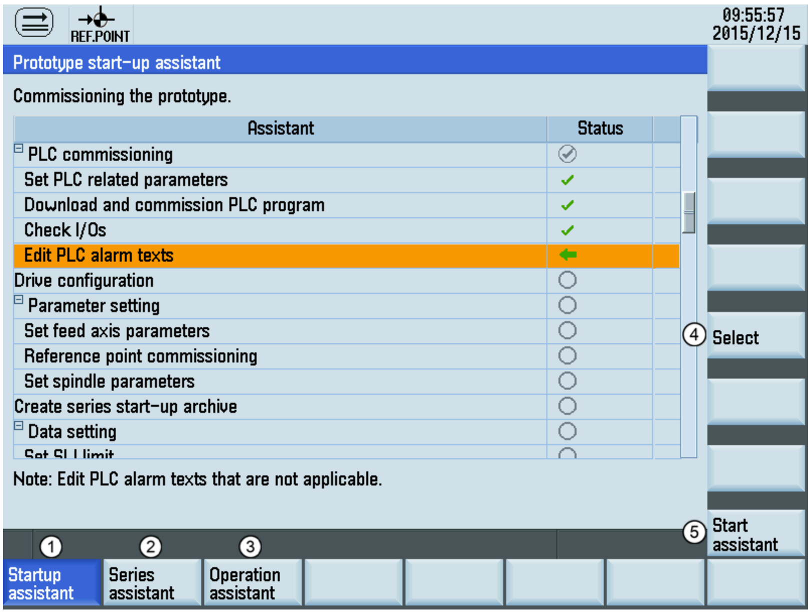
- The commissioning wizards require a manufacturer access level. They are designed to help you commission the basic machine tool functions on the prototype machine and series machines.
- The operation wizard requires an end-user access level. It is designed to help you learn about the basic operations of the machining process.

Three machine data areas are used in the wizards to commission the prototype machine: general machine data, axis machine data and NC basic list.

Softkey functions



Pressing this key on the PPU allows you to enter the main screen of the wizards.



① Calls the commissioning wizard for the prototype machine. This wizard consists of 14 commissioning steps.

② Calls the commissioning wizard for series machines. This wizard consists of six commissioning steps.

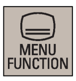
③ Calls the operation wizard

④ Enters the currently selected task.

Note: This softkey becomes active when you move the cursor key to a completed or current task.

⑤ Starts commissioning from the current task

When you are in the main screen of any wizard, pressing any operating area key on the PPU allows you to exit the wizard. After you enter the screen of a specific commissioning task, however, you need to press the following PPU key first to return to the main screen, and then press any operating area key to exit:



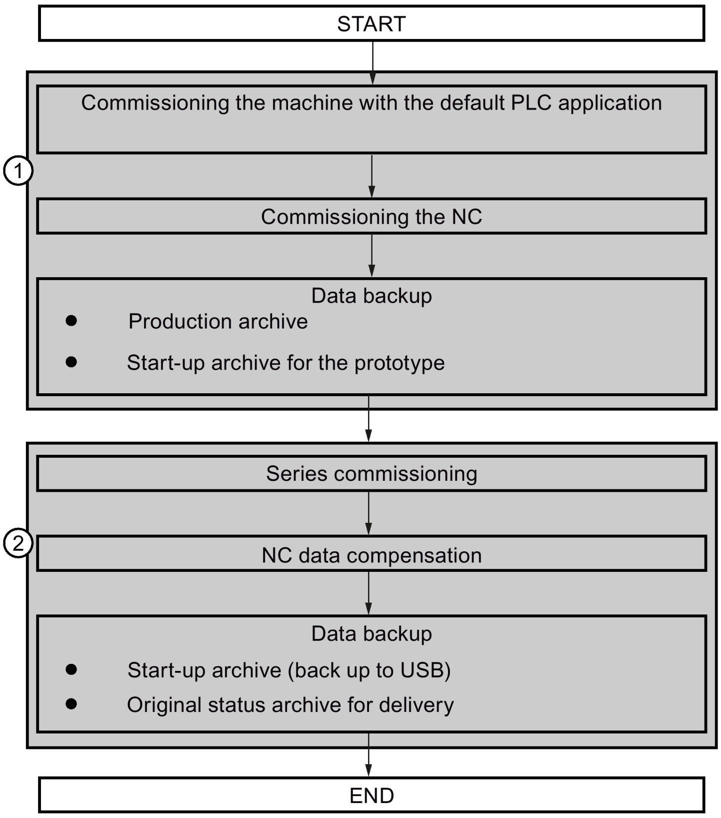
Commissioning status

You can check the commissioning status via the status symbols from the main screens of the commissioning wizards.

Status symbol	Meaning
	Completed task
	Current task
	Partially completed task group
	Uncompleted task

Commissioning diagram

The diagram below shows the general commissioning procedure for the NC.



① Commissioning the prototype machine ② Series production

Note

The control system constantly creates restoring points during operation. In case of data loss due to power failure or other problems, the control system automatically restores the last autosaved system data upon startup with an alarm appearing on the screen.

Note

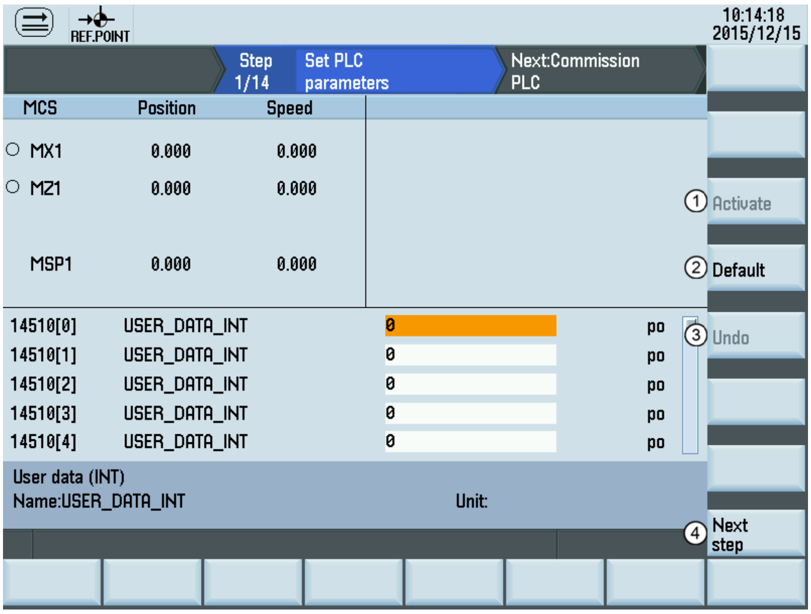
Before starting the machine commissioning with the commissioning wizard, make sure MD20050, MD20070, and MD35000 are set to defaults.

7.2 Commissioning the PLC

7.2.1 Setting PLC related parameters

Use either of the following softkeys on the main screen of prototype commissioning wizard to enter the window for setting the PLC related parameters:

Softkey functions



①	Activates the parameter changes. Note that the control system restarts to accept the new values.	③	Cancels the last change to the parameter
②	Resets the value of the selected parameter to default	④	Proceeds to the next step

For more information about setting the PLC related parameters, see Section "PLC machine data (Page 139)".

7.2.2 Downloading and commissioning PLC programs

Note

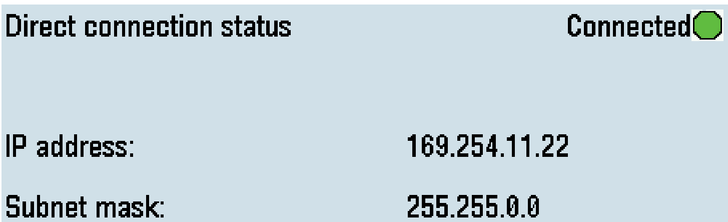
If you use the default PLC programs, you can skip this step and move to the next step.

To realize your own PLC functions, you can upload the default PLC program to your computer and edit it. With PLC Programming Tool installed on your computer, you can download customized PLC programs into the permanent memory of the control system. PLC Programming Tool is available in the Toolbox.

Operating sequence

1. Connect the controller to your computer with an Ethernet cable.

2. Press this softkey on the main screen of this commissioning step, and the following connection information displays:



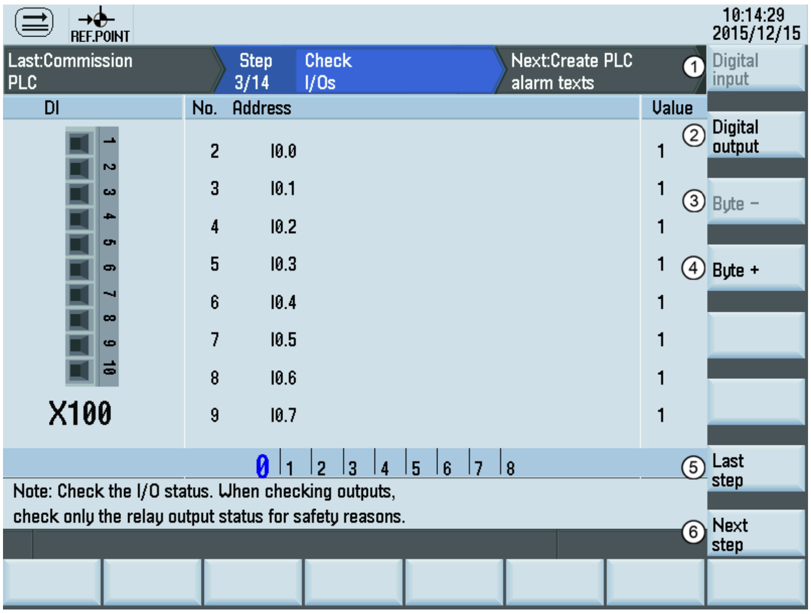
3. Start PLC Programming Tool on your computer and make corresponding communication settings. For more information about the communication settings for direct connection in PLC Programming Tool, see Section "Connecting with PLC Programming Tool (Page 42)".
4. After the connection is established successfully, you can upload the sample PLC application to your computer first, and then edit the PLC programs to achieve the required functionality.
5. When you finish the editing, you can download the modified PLC application into the control system. For more information about uploading/downloading the PLC applications, see Section "Downloading/uploading/comparing PLC applications (Page 186)".

6. After you finish commissioning the PLC programs, press this softkey to move on to the next step.

7.2.3 Checking I/O address assignment

You must check the I/O address assignment in this step to ensure correct wiring.

Softkey functions

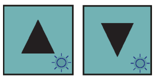


①	Selects the digital inputs	④	Shows the I/O addresses of the last byte
②	Selects the digital outputs	⑤	Returns to the previous step
③	Shows the I/O addresses of the next byte	⑥	Proceeds to the next step

7.2.4 Editing PLC alarm texts

PLC user alarms can be used as one of the most effective diagnosis methods. The control system provides 128 PLC user alarms (700xxx). You can edit the PLC alarm texts as required.

Operating sequence



1. Select the alarm text you desire to edit.

Edit text

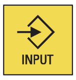
2. Press this softkey to activate the input field at the bottom of the screen and enter the desired text, for example:

   Note: Modify the PLC alarm texts if they are inapplicable.
   700000 OVERHEAT

   Note that the text of each PLC user alarm must be limited to 50 characters; otherwise, the alarm cannot display properly.

OK

3. Confirm your entry with this softkey or the following key:



Import

Export

4. You can also use these two softkeys to import/export the PLC user alarm texts from/to the following directories:

   - Start-up archive
   - OEM files
   - USB
   - User files

Next step

5. After you finish editing the alarm texts, press this softkey to move on to the next step.

Note

You can edit the alarm text either in English or in simplified Chinese. Editing in Chinese is only possible when the system language is simplified Chinese.

Pressing both the ALT key and the S key on the PPU calls the Chinese character editor.

You can find the PLC alarm text files in different languages in the HMI data area through the following operation:

SHIFT + SYSTEM ALARM → Sys. data → HMI data

If you use a system language rather than the default languages (Simplified Chinese and English), the PLC alarm text file in that language is visible only after you edit the PLC alarm texts.

You can copy and paste these files for backup or other customized purposes. For more information, see Section "Editing PLC alarm texts (Page 197)".

7.3 Configuring the drives

Note

This commissioning step is applicable to the standard axes only. For the drive configuration of additional axes, see Section "Configuring an additional feed axis (Page 234)".

Before starting the drive configuration, you must ensure the Drive Bus addresses are properly set (p0918) via the drive BOPs. For more information about setting the Drive Bus address, refer to Section "Configuring Drive Bus addresses (Page 119)".

Start config.

Press this softkey on the main screen of drive configuration, and the control system starts to identify the drives and motors connected. After the identification finishes, a drive list with motor information displays on the screen.

- If a V70 spindle drive is connected properly with the Drive Bus address set to 14, the control system identifies digital spindle and displays as follows:

Axis	Drive	Motor
MX1	11	not configured
MZ1	13	not configured
MSP1	14	not configured

- If an analog spindle drive is connected through the PPU interface X54 and no V70 spindle drive is connected, the control system identifies the analog spindle and displays as follows:

Axis	Drive	Motor
MX1	11	not configured
MZ1	13	ID:10009(0.4KW/1.3A/3000rpm/Without brake)
MSP1	Ana. spindle	not configured

Configuring the feed axes

Note

This procedure is required only for a feed axis driven by a motor with an incremental encoder. If the selected axis is configured with a motor with an absolute encoder, the motor ID is identified automatically.

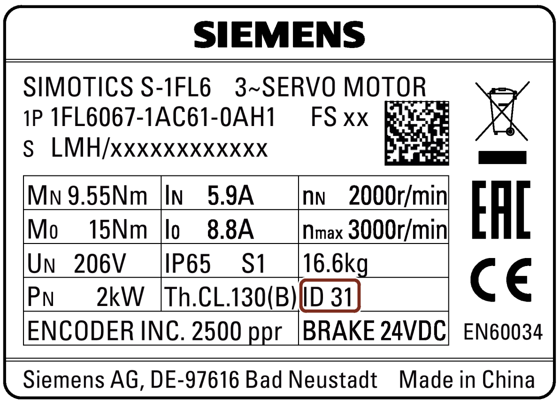
1. Select a feed axis using the cursor keys in the drive list window.

Motor config.

2. Press this softkey to open the motor configuration window.
3. Select the right motor ID with the cursor keys according to the motor rating plate.

Motor ID	Power	Current	Speed	Brake type
18	0.4KW	1.3A	3000rpm	Without brake
19	0.4KW	1.3A	3000rpm	With brake

For example, you can find the motor ID on the following motor rating plate:



4. Press this softkey to confirm your selection. The selected motor information then displays in the drive list.

Axis	Drive	Motor
MX1	11	ID:18(0.4KW/1.3A/3000rpm/Without brake)
MZ1	13	ID:10009(0.4KW/1.3A/3000rpm/Without brake)
MSP1	Ana. spindle	not configured

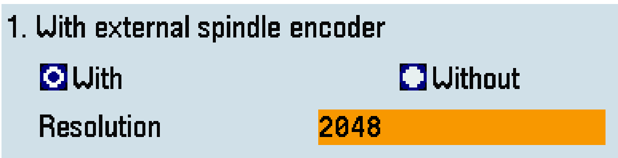
5. Repeat Steps 2 to 4 as above to complete the configuration of all feed axes.

Configuring the spindle

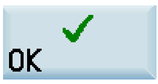
- **Configuring the digital spindle**

1. Use the cursor keys to select the spindle MSP1 in the drive list window.

2. Press this softkey to open the spindle configuration window.
3. Use the cursor keys on the PPU to configure the digital spindle to be with/without external spindle encoder and set the encoder resolution.



For more information about configuring a second encoder and activating the Dynamic Stiffness Control (DSC) function for the digital spindle, see Section "Configuring the DSC function for the digital spindle (Page 279)".



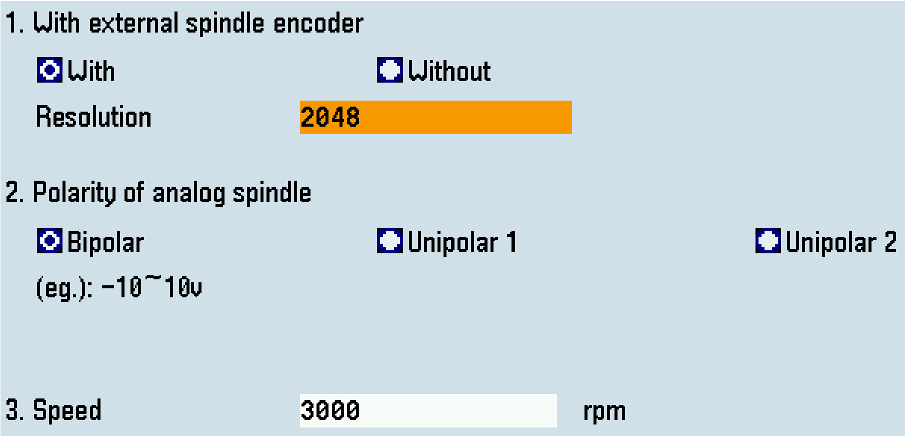
4. Press this softkey to confirm your settings and go to the motor configuration window.
5. Use the cursor keys to select the right motor ID according to the motor rating plate.

6. Press this softkey to confirm your selection and return to the drive list window.

- **Configuring the analog spindle**

Motor config.

1. Use the cursor keys to select the spindle MSP1 in the drive list window.
2. Press this softkey to open the spindle configuration window.
3. Use the cursor keys to make the desired selections in the following window according to the actual application, and enter relevant values where applicable:



For more information about the polarity of analog spindle, see Section "Analog spindle interface - X54, spindle encoder interface - X60 (Page 89)".

OK

4. Press this softkey to confirm your settings and return to the drive list window.

Next step

After you finish configuring all axes and the spindle, press this softkey to save the configuration results on both CNC and drives and proceed to the next step.

Note: The control system restarts after you press this softkey. In this case, for the drive connected to a motor with an incremental encoder, immediately after the "RDY" LED on the drive lights up green, the motor makes a short buzzing sound indicating that the motor is identifying the magnetic pole position of the rotor.

Note

Changing the motor direction of rotation

You can change the motor direction of rotation by setting the drive parameter p1821. The parameter p1821 is accessible on the PPU through the following operations:

SHIFT + SYSTEM ALARM → MD Mach. data → Drv basic list /(Expert list → Drive MD)

Before changing the parameter p1821, first set the drive parameter p10 = 3 when the drive is in "S OFF" state. Parameter p10 is accessible on the PPU through the following operations:

SHIFT + SYSTEM ALARM → MD Mach. data → Expert list → Drive MD

For detailed explanation about the drive parameters, you can call the online help by pressing the following key on the corresponding drive parameter screen:

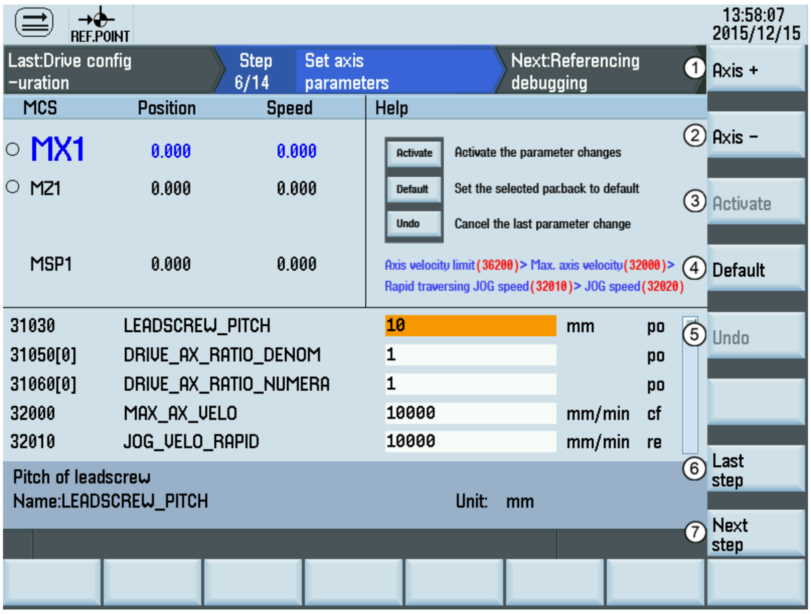
HELP

7.4 Setting basic parameters

7.4.1 Setting feed axis parameters

You can set the axis-specific machine data for each feed axis under this commissioning step.

Softkey functions



①	Selects the next axis	⑤	Cancels the last change to the parameter
②	Selects the previous axis	⑥	Returns to the last step
③	Activates the modified values	⑦	Proceeds to the next step
④	Resets the value of the selected parameter to default		

Axis-specific parameters

No.	Name	Unit	Range	Description
31030	LEADSCREW_PITCH	mm	≥ 0	Pitch of leadscrew
31050[0]	DRIVE_AX_RATIO_DENOM	-	1 to 2147000000	Number of the gearbox teeth at drive end (denominator of the deceleration ratio)
31060[0]	DRIVE_AX_RATIO_NUMERA	-	1 to 2147000000	Number of the gearbox teeth at leadscrew end (numerator of the deceleration ratio)
32000	MAX_AX_VELO	mm/min	-	Maximum axis velocity
32010	JOG_VELO_RAPID	mm/min	-	Rapid traverse in jog mode
32020	JOG_VELO	mm/min	-	Jog axis velocity
32100	AX_MOTION_DIR	-	-1 to 1	Traversing direction (not control direction) • = 1: Motor runs clockwise • = -1: Motor runs counter-clockwise
36200[0]	AX_VELO_LIMIT	mm/min	-	Threshold value for velocity monitoring

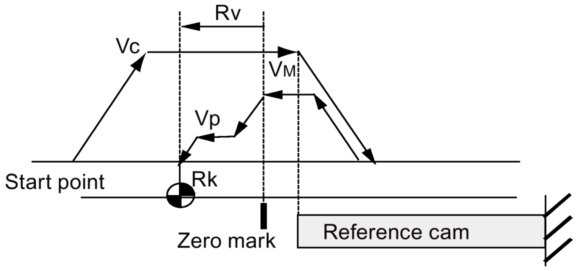
Note

The value of MD36200 should be 10% higher than that of MD32000; otherwise, alarm 025030 occurs.

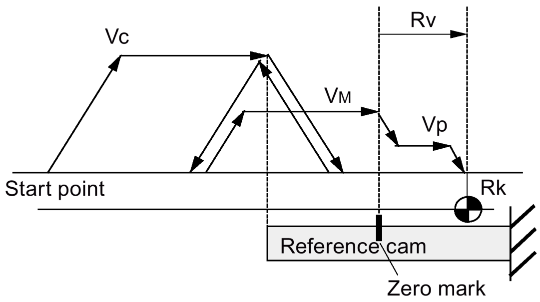
7.4.2 Commissioning the referencing function

Principles for referencing

- Zero mark is away from the reference cam (MD34050: REFP_SEARCH_MARKER_REVERS = 0)



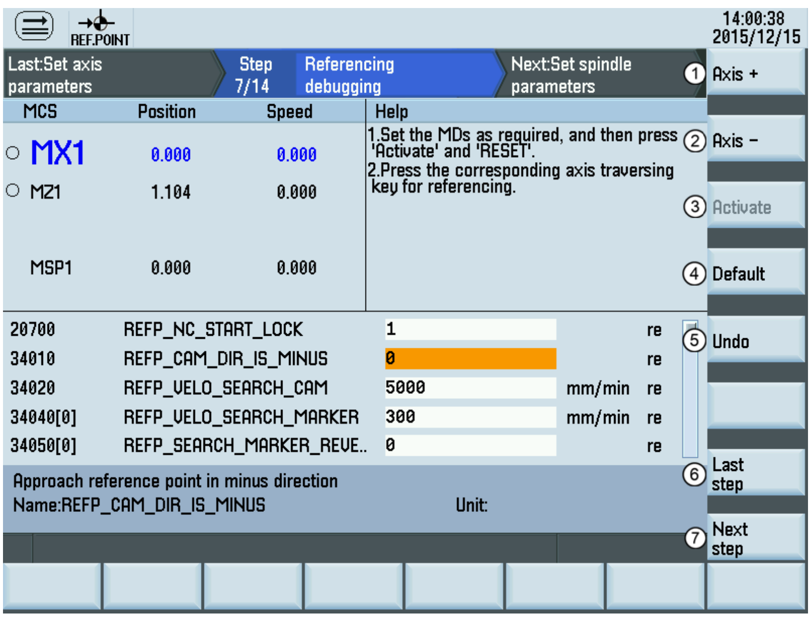
- Zero mark is above the reference point (MD34050: REFP_SEARCH_MARKER_REVERS = 1)



Vc	Velocity for searching for the reference cam (MD34020: REFP_VELO_SEARCH_CAM)
V_M	Velocity for searching for the zero mark (MD34040: REFP_VELO_SEARCH_MARKER)
Vp	Position velocity (MD34070: REFP_VELO_POS)
Rv	Shift of the reference point (MD34080: REFP_MOVE_DIST + MD34090: REFP_MOVE_DIST_CORR)
Rk	Set position of the reference point (MD34100: REFP_SET_POS [0])

Softkey functions

You can commission the axis referencing function and approach the reference point by setting relevant machine data in the following window:



① Selects the next axis

⑤ Cancels the last change to the parameter

② Selects the previous axis

③ Activates the modified values

④ Resets the value of the selected parameter to default

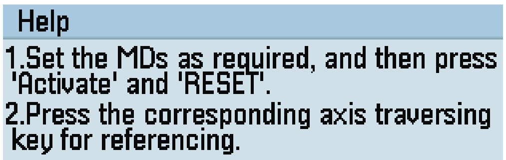
⑥ Returns to the last step

⑦ Proceeds to the next step

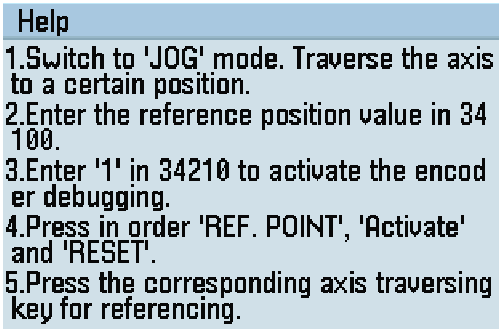
Approaching the reference point

To approach the reference point, you must follow the instructions on the screen:

- For an axis driven by a motor with an incremental encoder, the following instructions are provided:



- For an axis driven by a motor with an absolute encoder, the following instructions are provided:



If the axis is referenced, a symbol appears next to the axis identifier, for example:

Relevant machine data

No.	Name	Unit	Range	Description
20700	REFP_NC_START_LOCK	-	-	NC start disable without reference point
34010	REFP_CAM_DIR_IS_MINUS	-	-	Direction for approaching the reference point: • 0: + • 1: -
34020	REFP_VELO_SEARCH_CAM	mm/min	-	Velocity for searching for the reference cam
34040[0]	REFP_VELO_SEARCH_MARKER	mm/min	-	Velocity for searching for the zero mark
34050[0]	REFP_SEARCH_MARKER_REVERSE	-	-	Direction for searching for the zero mark: • 0: + • 1: -
34060[0]	REFP_MAX_MARKER_DIST	mm	-	Checking the maximum distance from the reference cam
34070	REFP_VELO_POS	mm/min	-	Positioning velocity for approaching the reference point
34080[0]	REFP_MOVE_DIST	mm	-	Reference point distance (with marker)
34090[0]	REFP_MOVE_DIST_CORR	mm	-	Correction of reference point distance
34092[0]	REFP_CAM_SHIFT	mm	-	Shift of the reference cam

No.	Name	Unit	Range	Description
34093[0]	REFP_CAM_MARKER_DIST	mm	-	Distance between the reference cam and the first zero mark
34100[0]	REFP_SET_POS	mm	-	Reference point position for incremental system
34200[0]	ENC_REFP_MODE	-	0 to 8	Referencing mode
34210[0]	ENC_REFP_STATE	-	0 to 3	Adjustment status of the absolute encoder
34220[0]	ENC_ABS_TURNS_MODULO	-	1 to 100000	Modulo range for the rotary absolute encoder
34230[0]	ENC_SERIAL_NUMBER	-	-	Encoder serial number

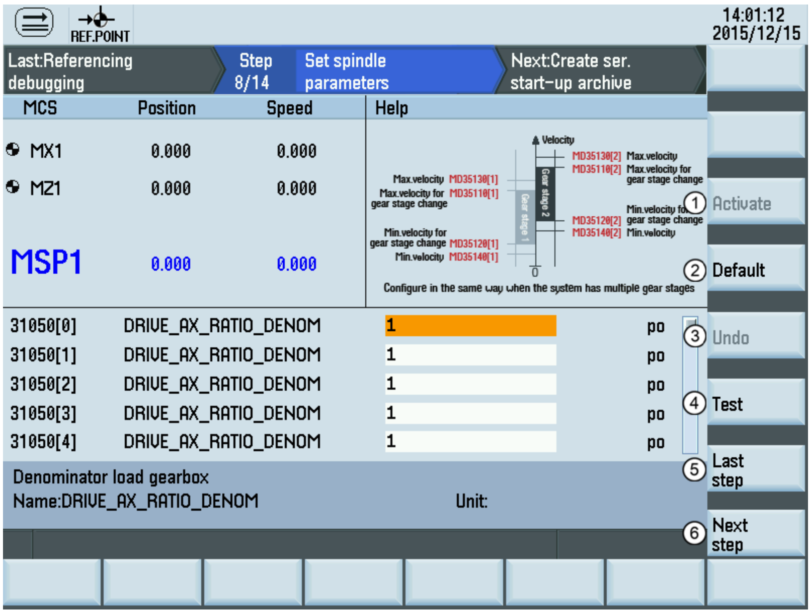
Note

You must set the length of the reference cam based on the velocity set by MD34020. An axis can stop above the cam after it approaches the cam at the velocity set by MD34020 and then decelerates to "0".

7.4.3 Setting spindle parameters

The control system controls one analog or digital spindle. You can commission the spindle by setting the relevant machine data under this commissioning step.

Softkey functions



①	Activates the modified values	④	Switches to "MDA" mode for program test
②	Resets the value of the selected parameter to default	⑤	Returns to the last step
③	Cancels the last change to the parameter	⑥	Proceeds to the next step

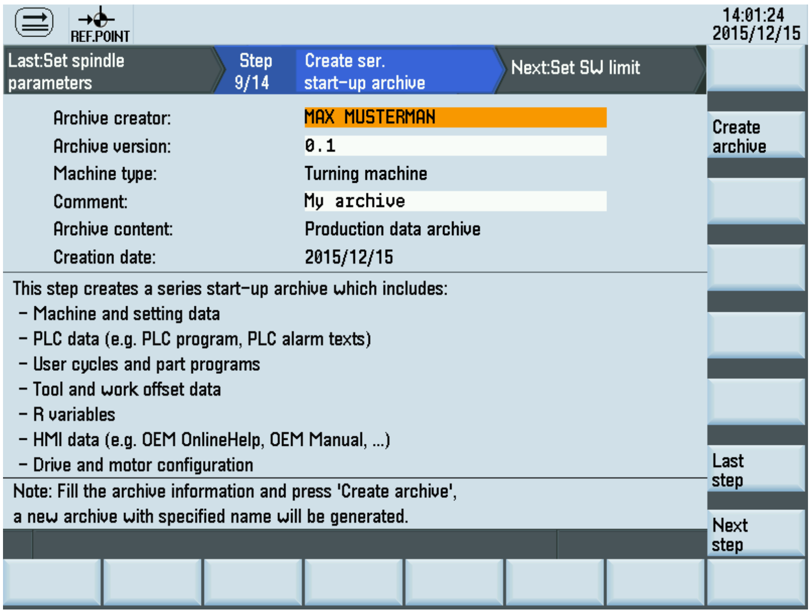
Relevant machine data

No.	Name	Unit	Range	Description
31050[1...5]	DRIVE_AX_RATIO_DENUM	-	1 to 2147000000	Denominator load gearbox
31060[1...5]	DRIVE_AX_RATIO_NUMERA	-	1 to 2147000000	Numerator load gearbox
32020	JOG_VELO	rpm	-	Jog axis velocity

No.	Name	Unit	Range	Description
32100	AX_MOTION_DIR	-	-1 to 1	Traversing direction (not control direction) • -1: Direction reversal • 0, 1: No direction reversal
32110[0]	ENC_FEEDBACK_POL	-	-1 to 1	Sign actual value (control direction)
35010	GEAR_STEP_CHANGE_ENABLE	-	-	Parameterize gear stage change
35100	SPIND_VELO_LIMIT	rpm	-	Maximum spindle speed
35110[1...5]	GEAR_STEP_MAX_VELO	rpm	-	Maximum speed for gear stage change
35120[1...5]	GEAR_STEP_MIN_VELO	rpm	-	Minimum speed for gear stage change
35130[1...5]	GEAR_STEP_MAX_VELO_LIMIT	rpm	-	Maximum speed of gear stage
35140[1...5]	GEAR_STEP_MIN_VELO_LIMIT	rpm	-	Minimum speed of gear stage
36200[1...5]	AX_VELO_LIMIT	rpm	-	Threshold value for velocity monitoring

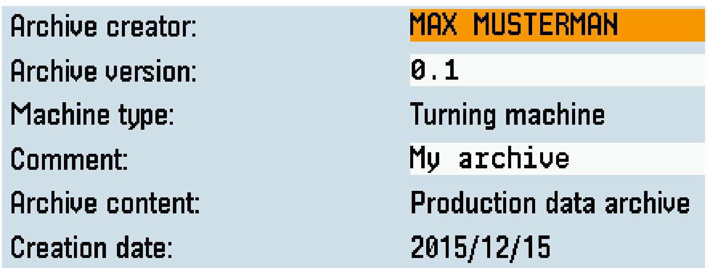
7.5 Creating series archives

Creating series startup archives is a prerequisite for series machine commissioning. The series startup archives contain data from the prototype machine commissioning which bring the series machine to the same state.

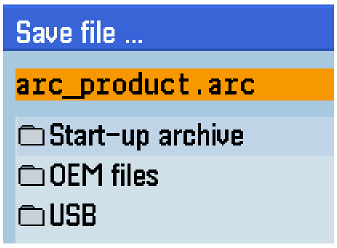


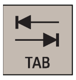
Operating sequence

1. Specify the properties of the archive as required:

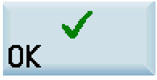


2. Press this softkey to open the window for saving the archive file. You must select a directory in this window. The default name of the data archive is "arc_product.arc". You can use your desired name for it. The file name extension ".arc" must be entered.





Note that you can press this key on the PPU to toggle between the file name input field and the directory selection area.



3. Press this softkey to create the archive.

Note

If you choose USB as the target directory, do not remove the USB stick during the data saving.

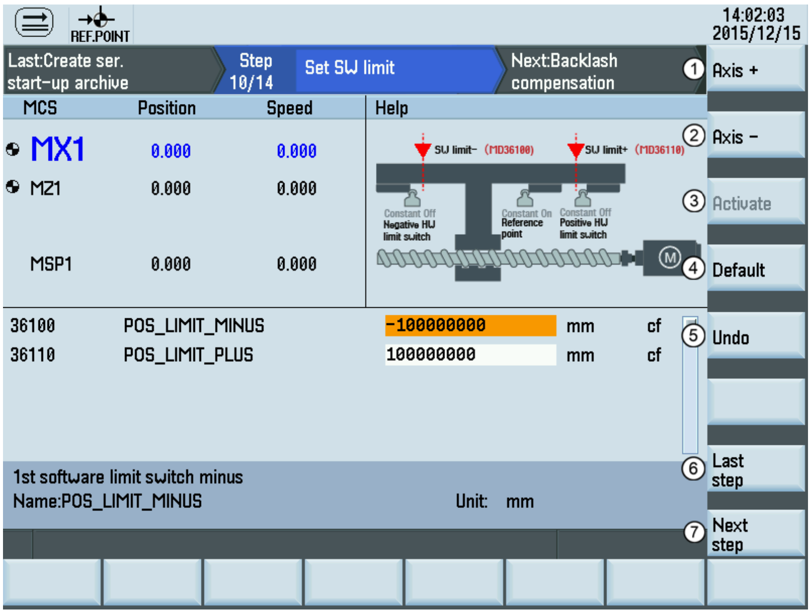
7.6 Setting compensation data

7.6.1 Setting software limit switch data

The software limit switches are used to limit the maximum traversing range on each individual axis.

You can set the software limit switches for each axis by configuring parameters 36100 and 36110 under this commissioning step.

Softkey functions



①	Selects the next axis	⑤	Cancels the last change to the parameter
②	Selects the previous axis	⑥	Returns to the last step
③	Activates the modified values	⑦	Proceeds to the next step
④	Resets the value of the selected parameter to default		

Setting parameters

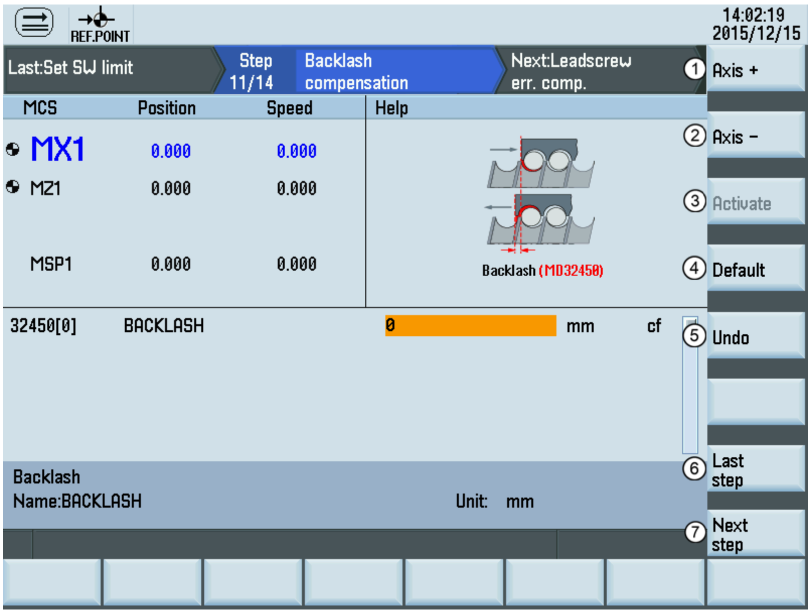
No.	Name	Unit	Range	Description
36100	POS_LIMIT_MINUS	mm	-	- software limit switch
36110	POS_LIMIT_PLUS	mm	-	+ software limit switch

7.6.2 Setting backlash compensation data

In the case of axes/spindle with indirect measuring systems, mechanical backlash results in corruption of the traverse path, causing an axis, for example, to travel too much or too little by the amount of the backlash when the direction of movement is reversed.

You can set the backlash compensation by configuring the parameter 32450[0].

Softkey functions



① Selects the next axis

② Selects the previous axis

③ Activates the modified values

④ Resets the value of the selected parameter to default

⑤ Cancels the last change to the parameter

⑥ Returns to the last step

⑦ Proceeds to the next step

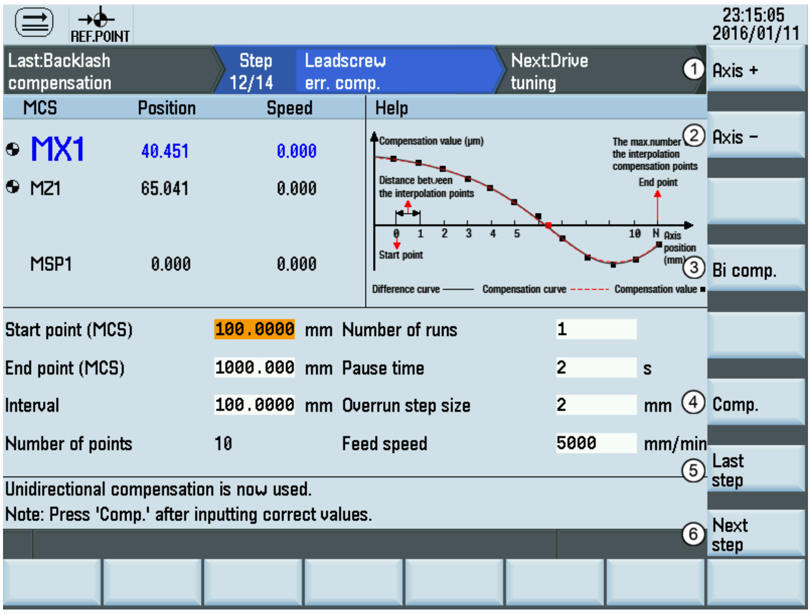
Setting parameter

No.	Name	Unit	Range	Description
32450[0]	BACKLASH	mm	-	Backlash compensation is active after reference point approach.

7.6.3 Setting leadscrew error compensation data

The principle of the leadscrew error compensation is to modify the actual value of the axis-specific position by the assigned compensation value at the particular compensation point and to apply this value to the machine axis for immediate traversal. A positive compensation value causes the corresponding machine axis to move in the negative direction.

Softkey functions



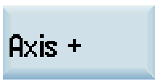
①	Selects the next axis	④	Opens the window for entering the compensation values
②	Selects the previous axis	⑤	Returns to the last step
③	Switches to bidirectional compensation (software license required)	⑥	Proceeds to the next step

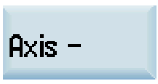
Operating sequence

1. You can press this softkey to switch to bidirectional compensation to realize more precise compensation, if required.

   The unidirectional compensation is used by default.

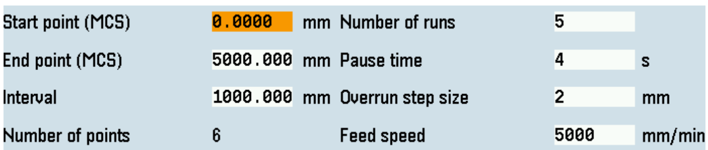
   Note: This softkey is active only if the optional bidirectional leadscrew error compensation has been activated with the license key. For more information about this software option, refer to the SINUMERIK 808D ADVANCED Function Manual.





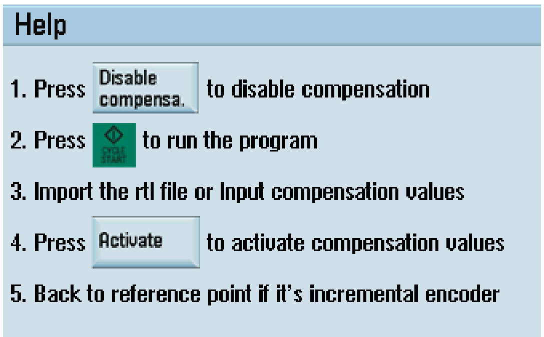
2. Use these softkeys to select an axis.

3. Specify the following parameters as desired.



4. Press this softkey to enter the compensation screen.

5. Follow the instructions in the help window to perform the compensation for the selected axis.



You can input the compensation values manually on the screen. Alternatively, you can also use this softkey to import a compensation file in rtl format (produced with RENISHAW measuring software) to input the compensation values automatically.

6. Press this softkey and repeat the above operations for the rest axis/axes until all axes are compensated.

7.7 Tuning drive performance

Note

This commissioning step is applicable to the standard axes only. For the drive tuning of additional axes, see Section "Configuring an additional feed axis (Page 234)".

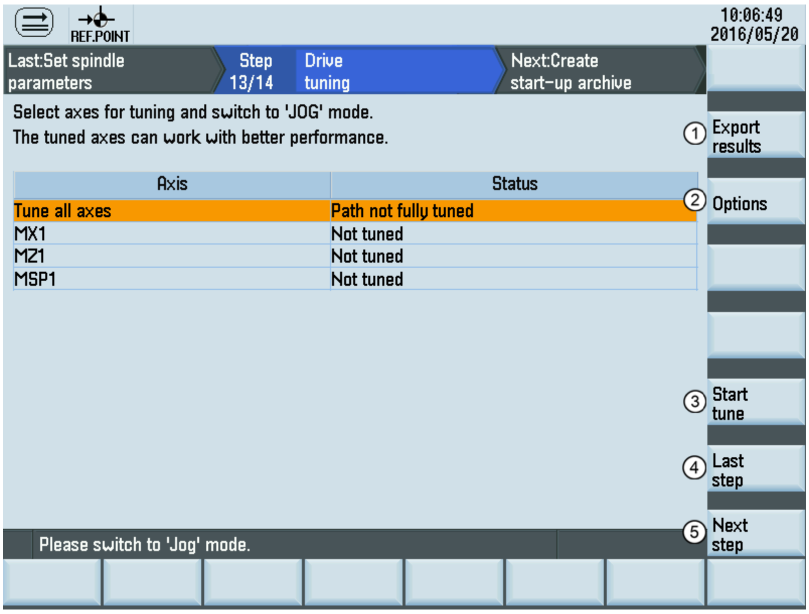
The drive performance must be tuned to adapt the electric and mechanical characteristics of the machine, so as to achieve the best machining results. The tuning process is sophisticated and generally performed by experienced engineers. The SINUMERIK 808D ADVANCED control system is integrated with the advanced function of auto drive tuning, which provides facilities to tune the drive performance for the feed axes or the digital spindle by automatically modifying the control loop parameters. The tuning is performed based on frequency response measurements of the dynamic response of the machine.

NOTICE
Machine damage due to tool collision The axes to be tuned traverse during the tuning process, which may cause damage to the machine in case of tool collision. Before starting the tuning, make sure there is no mechanical interference among the axes, and the limit protection is active on the machine, to avoid the collision of the machine tools.

Note

Before performing the drive tuning for a digital spindle configured with two measuring systems (see Section "Configuring the DSC function for the digital spindle (Page 279)"), make sure you set MD32110[0] = 1 and MD32110[1] = 1. Otherwise, the drive tuning process cannot be completed successfully.

Softkey functions



① Saves the trace files generated during the tuning process to a USB memory stick (if inserted)

② Enters the window for selecting the tuning strategy

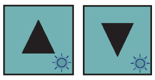
③ Starts the drive tuning process

④ Returns to the last step

⑤ Proceeds to the next step

Operating sequence

1. Switch to "JOG" mode. Note that the drive tuning can be performed in "JOG" mode only.



2. You can select all axes (including the spindle) or an individual axis/spindle for tuning.

3. Press this softkey to enter the window for selecting the tuning options.

4. Use this key to select a desired tuning objective. There are three objectives available for selection. You can select a suitable one according to your actual application by following the guidance on the PPU screen.
   - **Maximum responsiveness** (default setting)
     The speed and position controller gain (servo gain factor) is tuned with maximum values and minimum ruggedness. This setting is recommended for high-speed machining with maximum suppression of all disturbing forces. The machine must have a rigid design; the dynamic masses do not change significantly.
   - **Moderate responsiveness**
     This controller dynamic response is sufficient for the majority of machines and applications. The setting is more rugged than the default setting and is suitable for numerous applications.
   - **Conservative / robust**
     Only weak control gains are selected in order to ensure as high a level of ruggedness as possible. The speed controller is tuned so that it achieves maximum damping to prevent oscillations and to achieve good position controller gain. This setting is suitable for axes that react with oscillations, e.g. main spindles on turning machines or large axes with high load mass.

5. Move the cursor and select the desired measurement and interpolation options for each axis.

   For the first tuning, only the following measurement option is available, which enables a new measurement with all preliminary measurement steps.

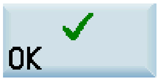
   New meas. with prelim. steps

   The following additional measurement options are available only if you have performed drive tuning for this axis:
   - Performs a new measurement without carrying out the preliminary steps:

   New meas. with no prelim. steps
   - Uses the existing measurement results:

   Retune with existing results

   Besides, you can also specify the axis/axes for interpolation path tuning by selecting the corresponding interpolation option.

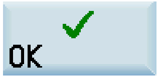


6. Press this softkey to confirm the selections and return to the main screen of drive tuning.

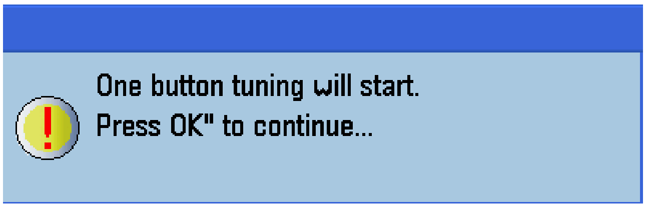
7. Press this softkey to enter the preparation screen before the tuning.
8. Use the axis traversing keys to move the axis/axes to be tuned to safe positions.

	Position	Direc.	Lim. -		Lim. +
MX1	0.000	+,-	-1e+08	↓	1e+08
MZ1	99.997	+,-	-1e+08	↓	1e+08

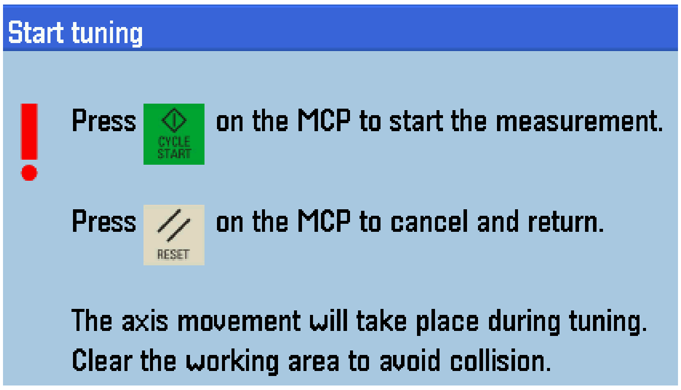
9. Press this softkey to initiate the drive tuning process.



10. Press this softkey to confirm and proceed to one-key auto tuning.



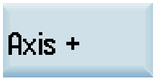
11. Press this key on the MCP and the drive tuning starts automatically. Since the axes traverse during the tuning process, make sure you take proper precautions to avoid personal injury or machine damage.



12. After the drive tuning finishes successfully, the tuning results appear on the screen in the form of a parameter list, for example:

MX1		
	Data before tuning	Data after tuning
P1433[0]	124.808594	125.117891
P1460[0]	0.178897	0.175722
MD32810[0]	0.001960	0.001994

Note: It may be the case that some parameters after tuning display the same values as those before tuning, since up to six decimal places can be displayed in the parameter list as above.



You can check the tuning results of other tuned axis/axes (if any) with these softkeys.

13. Press this softkey to save the tuning results and write the modified parameters into the drives.

Pressing this softkey aborts the tuning and deletes the results.

14. After it returns automatically to the main screen of drive tuning, press this softkey to proceed to the next step.

The following softkey operation is also available on this screen:

Saves the trace files during the tuning process to a USB flash disk (if inserted)

Note

For the machine data that are changeable only with a manufacturer password, the settings made during drive tuning cannot be restored after an NC restart in case of power failure or unexpected abortion of the tuning process.

Parameter adjustment after drive tuning

To ensure correct machining results of all interpolating axes, it is necessary to adjust the following axis-specific parameters after the drive tuning:

- Position controller gain
  - For the feed axes, set MD32200[0] to the minimum gain value of all interpolating axes.
  - For the interpolating spindle with no gear stage change, you must also set MD32200[1] to the minimum value; for the spindle with gear stage change, MD32200[2]~[5] corresponding to the gear stages must also be set to the same value.
- Feedforward control type

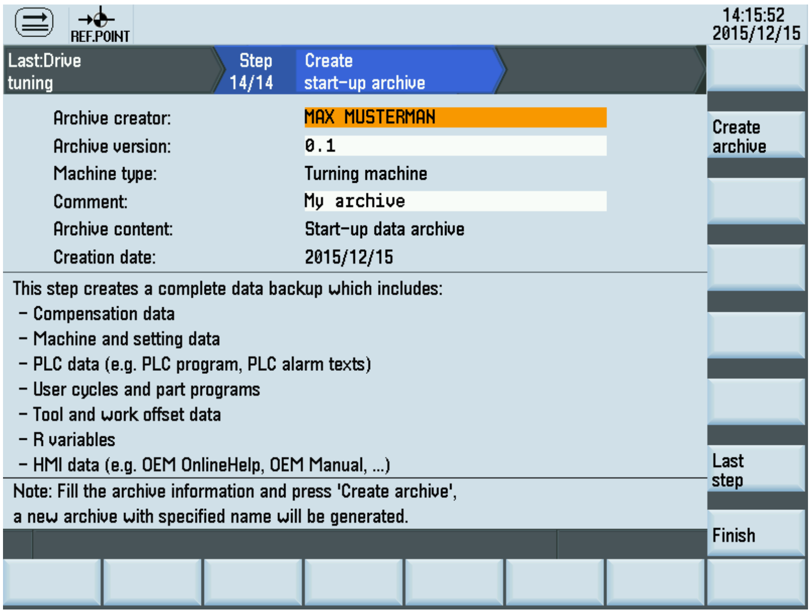
  Set the same feedforward control type for all axes by setting MD32620 (= 3: speed feedforward control; = 4: torque feedforward control).
- Equivalent time constant for feedforward control

  The equivalent times in MD32800 for torque feedforward control or in MD32810 for speed feedforward control must be set to the same value. Taking the torque feedforward control for example:
  - For the feed axes, set MD32800[0] to the maximum time of all interpolating axes.
  - For the interpolating spindle with no gear stage change, you must also set MD32800[1] to the maximum value; for the spindle with gear stage change, MD32800[2]~[5] corresponding to the gear stages must also be set to the same value.
- Natural frequency for the reference model of the speed controller

  With torque feedforward control, the reference model frequency in p1433 can be different for each axis. With speed feedforward control, however, p1433 must be set to the same value (which is the minimum frequency) for all interpolating axes (including the spindle).

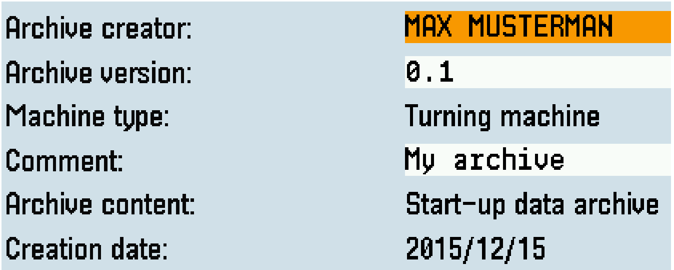
7.8 Creating prototype machine commissioning archives

After commissioning the prototype machine, you must also create a commissioning archive for the data backup of the prototype itself.

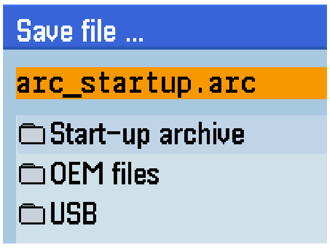


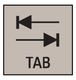
To create a start-up archive for the prototype machine, proceed as follows:

1. Specify the properties of the archive as required:

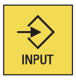


2. Press this softkey to open the window for saving the archive file. You must select a directory in this window. The default name of the data archive is "arc_startup.arc". You can use your desired name for it. The file name extension ".arc" must be entered.

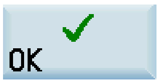




Note that you can press this key on the PPU to toggle between the file name input field and the directory selection area.

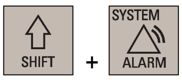


3. Press this key to open the selected directory.



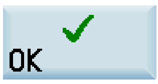
4. Press this softkey to create the archive.

5. After the archive is created successfully, press this softkey to finish commissioning the prototype machine and return to the main screen of the wizard.



6. Select the system data operating area.

7. Press this softkey to save data.



8. Press this softkey to complete the operation.

Note

If you choose USB as the target directory, do not remove the USB stick during the data saving.

---

8 Commissioning the turret/magazine

8.1 PLC subroutines for tool change

The following PLC subroutines are provided for the turret/magazine control on a turning or milling machine.

Subroutine No.	Name	Description	See also
SBR 51	Turret1_HED_T	HED turret control for turning machine	Subroutine 51 - Turret1_HED_T (turret with Hall effect device position sensor) (Page 164)
SBR 52	Turret2_BIN_T	Bi-direction turret (binary coded) control for turning machine	Subroutine 52 - Turret2_BIN_T (turret with binary coding function) (Page 166)
SBR 53	Turret3_CODE_T	Bi-direction turret (coded by turret supplier) control for turning machine	Subroutine 53 - Turret3_CODE_T (tool change control for turret with coding function) (Page 168)
SBR 60	Disk_MGZ_M	Disk tool magazine control for milling machine	Subroutine 60 - Disk_MGZ_M (disk-style tool magazine used for milling) (Page 175)

8.2 Calling cycles for tool change

You can call a user cycle with "M" or "T" code to perform the tool change operations.

Note

An "M" code and a "T" code for calling user cycles **must not** be in the same program block.

The following examples are given for the tool change on a milling machine.

Calling a tool change cycle with "M6"

Configure the parameters shown in the table below to activate an M code for calling a standard cycle:

Parameter	Name	Unit	Value	Description
22550	TOOL_CHANGE_MODE	-	1	Activating tool parameters with an M code
22560	TOOL_CHANGE_M_CODE	-	206	The M code for activating tool parameters
10715	M_NO_FCT_CYCLE[0]	-	6	Calling the standard cycle with M6
10716	M_NO_FCT_CYCLE_NAME[0]	-	"TOOL"	Name of the standard cycle

For the format of a standard cycle, refer to the example below:

```
%_N_TOOL_SPF                                 ;>>> Name of user cycle <<<
;$PATH=/_N_MPF_DIR                           ;>>> Path of user cycle <<<
PROC TOOL SAVE DISPLOF                       ;>>> Definition of user cycle <<<
IF $P_ISTEST GOTOF _END                      ;No tool change in "program test"
IF $P_SEARCH<>0 GOTOF _END                   ;No tool change in "program search"
IF $P_TOOLNO==$P_TOOLP GOTOF _NO             ;No tool change if programmed tool ($P_TOOLP) =
                                             currently active tool ($P_TOOLNO)
G500 D0                                      ;Work offset and tool offset OFF
G75 Z=0                                      ;Approach fixed point (tool change position) in Z
SPOS=$MN_USER_DATA_FLOAT[0]                  ;Spindle exact stop position is stored in
                                             MD14514[0]
MSG("Ready to change tool *** Original tool num-   ;A maximum of 127 characters can be displayed
ber: T"<<$P_TOOLNO)
;>>> User-defined M codes can be used to start the PLC logic for tool change after spindle position-
ing
;>>> PLC sets signal "Read-in disable" (DB3200.DBX6.1) to stop this standard cycle
;>>> PLC controls the action of tool magazine and turret
;>>> After the tool change, PLC resets signal "Read-in disable" to resume the cycle
M206                                         ;Activate tool parameters
STOPRE                                       ;Program processing stop
G153 G01 Z0 F2000                            ;G153 suppresses work offset including base frame,
                                             non-modal
MSG("Start to change tool *** New tool number:
```

```
T"<<$P_TOOLP)
GOTOF _END
_NO:
MSG("No action *** Reason: programmed tool num-
ber=spindle tool number")
_END:
M17                                                     ;>>> End of the standard cycle <<<
```

Calling a tool change cycle with "T"

Configure the parameters shown in below table to activate a T code for calling a standard cycle:

Parameter	Name	Unit	Value	Description
22550	TOOL_CHANGE_MODE	-	0	Activating tool parameters with a T code
10717	T_NO_FCT_CYCLE[0]	-	"TOOL"	Calling the standard cycle with T code

The format of the standard cycle is the same with that of M codes. The programmed tool numbers will be saved into system variable $C_T.

9 Series machine commissioning

Note

The control system constantly creates restoring points during operation. In case of data loss due to power failure or other problems, the control system automatically restores the last autosaved system data upon startup with an alarm appearing on the screen.

9.1 Loading series commissioning archives

You can use the series commissioning archive to commission the machines for series production. The series archive is created during the commissioning of the prototype machine. For more information about creating a series archive, refer to Section "Creating series archives (Page 217)".

Note

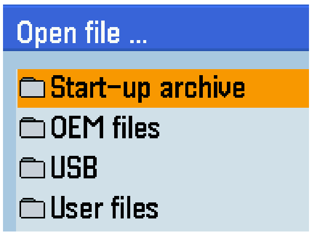
Before starting the series commissioning with the commissioning wizard, make sure MD20050, MD20070, and MD35000 are set to defaults.

Operating sequence

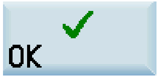
1. Press this horizontal softkey on the main screen of wizards to call the commissioning wizard for series machines.

2. Use either softkey to enter the window for loading the series commissioning archive.

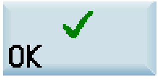
3. Press this softkey to open the dialog for loading the series archive.



4. Enter the backup directory and select the desired archive file.



5. Press this softkey to confirm your selection, and the archive information displays on the screen.



6. Check the archive information and press this softkey to start loading the series commissioning archive.

Note

Successful loading of the data archive can delete the password. You must set the password again before proceeding. For more information about setting a password, refer to Section "Setting the password (Page 123)".

9.2 Setting software limit switch data

Refer to Section "Setting software limit switch data (Page 218)".

9.3 Setting backlash compensation data

Refer to Section "Setting backlash compensation data (Page 219)".

9.4 Setting leadscrew error compensation data

Refer to Section "Setting leadscrew error compensation data (Page 220)".

9.5 Tuning drive performance

Refer to Section "Tuning drive performance (Page 221)".

9.6 Creating startup archives

Refer to Section "Creating prototype machine commissioning archives (Page 225)".

10 Network functions

10.1 Network configuration

Ethernet connections

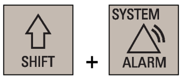
You can establish a network connection between the control system and a computer via the Ethernet interface X130. The following Ethernet connections are possible:

- Direct connection: connecting the control system directly to a computer
- Network connection: integrating the control system into an existing Ethernet network

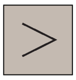
Establishing a direct connection

Proceed as follows to establish a direct connection between the control system and a computer:

1. Connect the control system with the computer using an Ethernet cable.

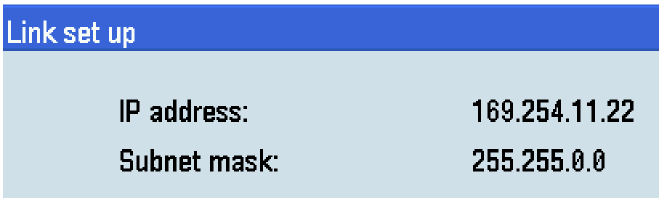


2. Select the desired operating area on the PPU.



3. Press this key to view the extended softkeys.
4. Set up a direct connection on the control system through the following softkey operations:

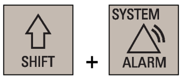
The following dialog pops up on the screen:



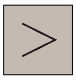
Establishing a network connection

Proceed as follows to establish a network connection:

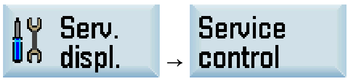
1. Connect the control system with the local network using an Ethernet cable.



2. Select the desired operating area on the PPU.



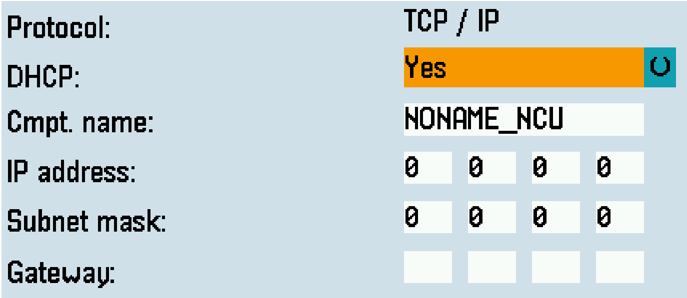
3. Press this key to view the extended softkeys.
4. Enter the main screen of the service control options through the following softkey operations:



5. Press this softkey to enter the window for the network configuration.

Note: make sure this vertical softkey is not selected.

6. Configure the network as required in the following window:



You can configure the DHCP with this key.

Note: if you select "No" for DHCP, you must enter the IP address (which must belong to the same network as that of your PC) and subnet mask manually.

7. Press this softkey to save the configuration. If you select "Yes" for DHCP, you also need to restart the control system to activate the network configuration.

10.2 Configuring the network drive

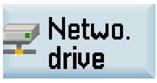
A connected network drive allows you to access a shared directory on your computer from the control system. The network drive functions based on the Ethernet connection between the control system and a computer. For more information about how to establish an Ethernet connection, see Section "Network configuration (Page 230)".

Creating and connecting a network drive

Proceed as follows to create and connect a network drive:

1. Share a directory on your local disk on your computer.

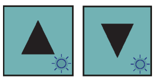
2. Select the program management operating area.



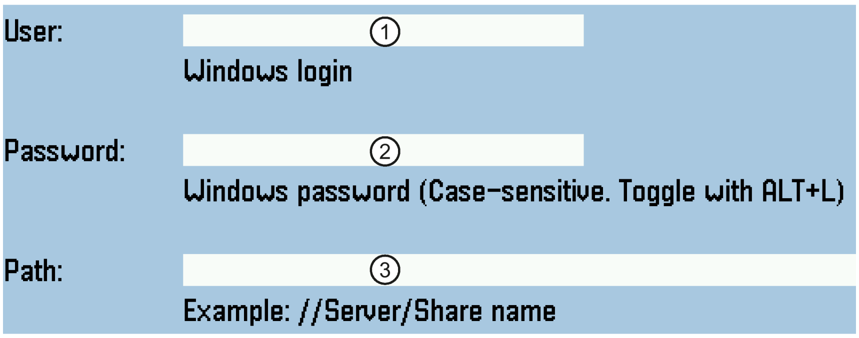
3. Press this softkey to go to the network drive directory.

4. Press this softkey to go to the window for configuring the network drives.

5. Press this key to select a drive identifier: N1, N2, or N3.



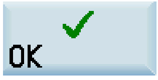
6. Move the cursor to the following input fields:



①: Enter the user name of your Windows account

②: Enter the logon password (case sensitive) of your Windows account

③: Enter the IP address of the server and the share name of the shared directory on your computer. Example: //140.231.196.90/808D



7. Press this softkey to confirm and the configured network drive appears on the screen as follows. The drive icon is yellow if the network drive is connected successfully; otherwise, the icon is gray.

You can delete a selected network drive using this softkey.

Note

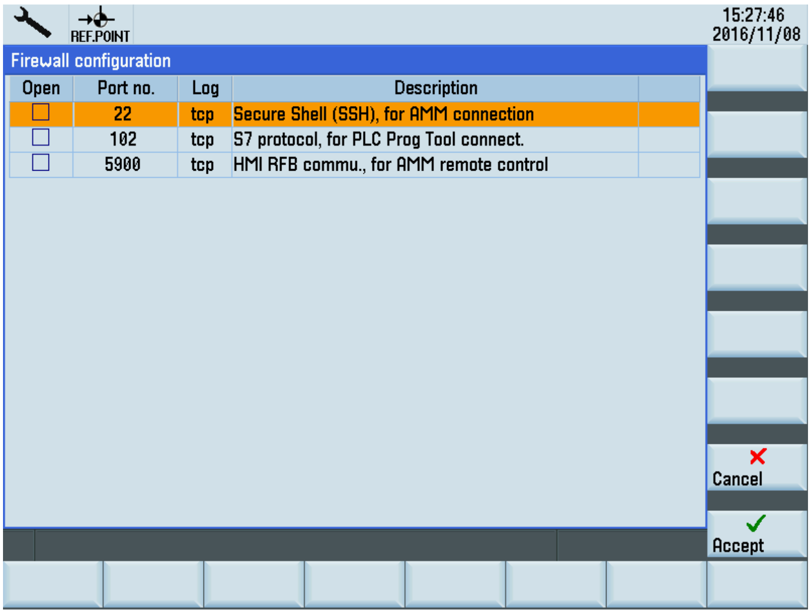
After you properly configure all the settings for the direct connection between the control system and the network drive, if the network drive connection is still invalid, contact your Windows system administrator for possible problems with your operating system configuration.

10.3 Configuring the firewall

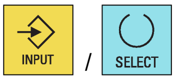
Configuring the firewall

Secure access and communication is achieved through the security function of the integrated firewall. You can open the window for firewall configuration through the following operations:

Configurable ports are listed in the following window:



The ports are disabled by default and can be enabled when necessary. To change the port status, select the relevant port using the cursor keys and press either of the following keys to enable or disable the port:



WARNING
Network security risks due to improper firewall configuration
Improper firewall configuration may cause network security risks, for example, data leakage, virus invasion, and hacker attack. This may lead to incorrect parameterization or machine malfunction, which in turn can result in death, severe injuries and/or property damage. • Do not use the control system inside a network infrastructure without an additional security product. • Make sure that you disable the unnecessary ports in the firewall configuration.

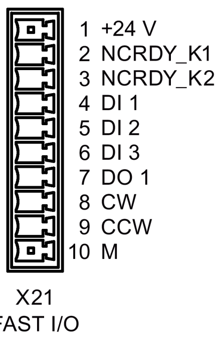
Note

After you disable a communication port, the existing connection established earlier via this port will not be disabled until you manually disconnect it or the control system restarts/powers off. Therefore, it is recommended that you disconnect the established connections or restart the control system after disabling the ports.

11 Measurement functions

11.1 Fast inputs and outputs

The fast input/output interface (X21) provides 3 digital inputs and 1 digital output:

Illustration	Pin	Signal	Variable	Description
	4	DI1	$A_IN[1]	Fast input with address DB2900.DBX0.0, for connection to probe 1
	5	DI2	$A_IN[2]	Fast input with address DB2900.DBX0.1, for connection to probe 2
	6	DI3	$A_IN[3]	Fast input with address DB2900.DBX0.2
	7	DO1	$A_OUT[1]	Fast output with address DB2900.DBX4.0

PLC interface address

DB2900	Signals from fast inputs and outputs [r] NCK → PLC interface							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0	Actual value for digital NCK inputs							
	Input 8	Input 7	Input 6	Input 5	Input 4	Hardware input		
4	Setpoint for digital NCK outputs							
	Output 8	Output 7	Output 6	Output 5	Output 4	Output 3	Output 2	Hardware output

- **Fast inputs**

  In the PLC application program, you can directly read each bit value from the address DB2900. In a part program, you can read the fast input value via system variable $A_IN[x].

- **Fast output**

  From the address DB2900.DBX4.0 you cannot assign a value to the fast output; otherwise, the PLC application program will stop with an error. However, you can assign a value to the fast output from address DB2800.DBX5.0 and DB2800.DBX6.0.

  In the PLC application program, you can trigger the address DB2800.DBX5.0 with a rising edge or a negative edge at the address DB2800.DBX6.0, and thus the address DB2900.DBX4.0 will vary with the address DB2800.DBX6.0.

11.2 Probe commissioning

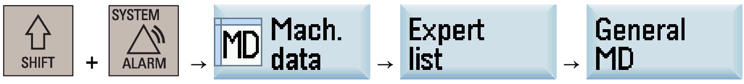
The first probe is connected to pin 4 (DI1) and the second probe to pin 5 (DI2) of interface X21. For the probe, use an external voltage (24 V) whose reference potential should be connected to X21 pin 10

Setting machine data

The following machine data should be checked and adjusted if necessary:

- MD13200[0] $MN_MEAS_PROBE_LOW_ACTIVE = 0 or 1
- MD13200[1] $MN_MEAS_PROBE_LOW_ACTIVE = 0 or 1
  - Value 0 = deflected state 24 V (default)
  - Value 1 = deflected state 0 V

You can access this machine data through the following operations:



Testing signal

You can test the measuring signal by checking the PLC interface status through the following operations:

Enter the interface address DB2700.DBB1 in the operand input field, and trigger the probe manually. In this case, the corresponding PLC status bit changes, which indicates the probe is properly connected.

12 Extended drive commissioning

12.1 Overview

The SINUMERIK 808D ADVANCED control system with PPU16x.3 supports up to three additional axes for the turning variant and two for the milling variant. You can configure an additional axis as either a standard NC axis (feed axis or spindle) or a positioning axis. The control system with PPU15x.3, however, supports one additional axis for the turning variant, which can be configured as a standard NC axis only. Before the configuration, you must first activate the option for additional axis (Page 127). However, you need to configure the additional axis manually as you cannot proceed with the wizards.

12.2 Configuring an additional feed axis

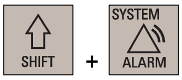
12.2.1 Setting parameters for the additional feed axis

You can configure an additional feed axis driven by SINAMICS V70 feed drive.

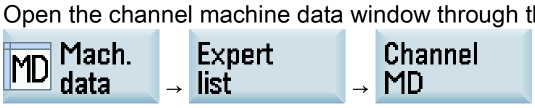
Prerequisites:

- The Drive Bus address (p0918) of the corresponding drive is properly set via the drive BOP. For more information, see Section "Configuring Drive Bus addresses (Page 119)".
- At least one additional axis is activated. For more information, see Section "Activating the optional functions (Page 127)".

Proceed as follows to set the parameters for an additional feed axis:



1. Select the system data operating area.
2. Open the channel machine data window through the following softkey operations:



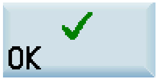
3. Set the machine data 20070 as follows:
    - For the turning variant: set 20070[3]/[4]/[5] = 5 or 6
    - For the milling variant: set 20070[4]/[5] = 5 or 6.

4. Press this key to return to the higher-level menu.

5. Open the basic machine data list.

6. Use this softkey or the cursor keys to search for "14512 USER_DATA_HEX[20]".

7. Select "Bit2" by using this key and the cursor keys.



8. Press this softkey to confirm your input.

9. Press this softkey to activate the value changes. Note that the control system restarts to accept the new values and the additional axis can be displayed in the system.

Note

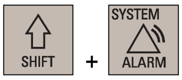
The factory default PLC program only supports one additional axis.

12.2.2 Configuring the drive system

Note

Before starting the drive configuration, make sure MD20050, MD20070, and MD35000 are set to defaults.

The following steps are also applicable to configuring the standard axes/spindle, if necessary.



1. Select the system data operating area.

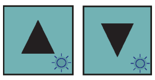
2. Press this horizontal softkey to open the window for drive configuration.

3. Press this softkey and the control system starts to identify the drives and motors connected.

    After the identification finishes, a drive list with motor information displays on the screen, for example:

Axis	Drive	Motor
MX1	11	ID:10009(0.4KW/1.3A/3000rpm/Without brake)
MZ1	13	ID:10009(0.4KW/1.3A/3000rpm/Without brake)
MSP1	Ana. spindle	Unipolar 2/3000rpm
MC1	15	not configured

    Note: For a motor with an absolute encoder, the motor ID is identified automatically. For a motor with an incremental encoder, however, you must configure the motor ID manually.



4. Select the additional axis using the cursor keys.

5. Press this softkey to enter the motor configuration window.

6. Select the right motor ID according to the motor rating plate with the cursor keys.

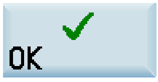
   Note: For a motor with an incremental encoder in this example, you need to select the right motor ID according to the motor rating plate.

Motor ID	Power	Current	Speed	Brake type
18	0.4KW	1.3A	3000rpm	Without brake
19	0.4KW	1.3A	3000rpm	With brake

7. Press this softkey to confirm your selection. The selected motor information then displays in the drive list.

8. After you finish the configuration, press this softkey to save the configuration results on both CNC and drive.

   Note: The control system restarts after you press this softkey.



9. Press this softkey when the following dialog appears to exit the drive configuration window.

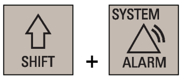
12.2.3 Tuning the drive performance

The control system provides facilities to tune the drive performance for both standard and additional axes by automatically modifying the control loop parameters. The tuning is performed based on frequency response measurements of the dynamic response of the machine. Note that an axis must be referenced first before the drive tuning.

Note

The drive tuning function currently does not support the sixth axis.

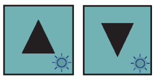
The following steps are also applicable to tuning the standard feed axes, if necessary.



1. Select the system data operating area.

2. Press this horizontal softkey to open the window for drive tuning.

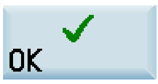
3. Switch to "JOG" mode. Note that the drive tuning can be performed in "JOG" mode only.



4. Select the additional axis using the cursor keys.

5. Press this softkey to enter the window for selecting the tuning options.

6. Use this key to select a desired tuning objective and measurement and interpolation options for the additional axis. For more information about the options, see section "Tuning drive performance (Page 221)".



7. Press this softkey to confirm the selections and return to the main screen of drive tuning.

Start tune

8. Press this softkey to enter the preparation screen before the tuning.

9. Use the axis traversing keys to move the axis to a safe position.

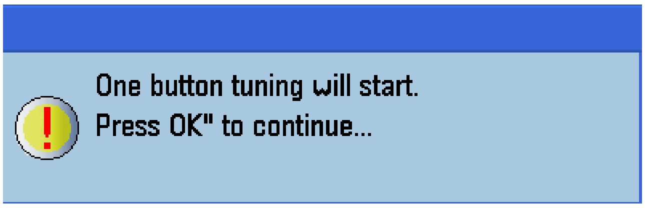
	Position	Direc.	Lim. -		Lim. +
MX1	32.757	+,-	-1e+08		1e+08
MZ1	65.040	+,-	-1e+08		1e+08
MC1	0.000	+,-	-1e+08		1e+08

Start tune

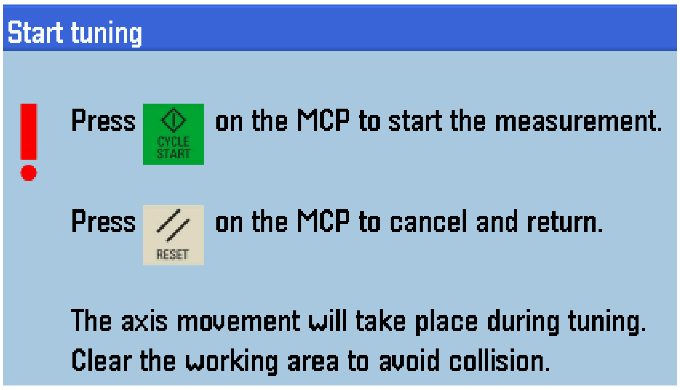
10. Press this softkey to initiate the drive tuning process.

OK

11. Press this softkey to confirm and proceed to one-key auto tuning.



12. Press this key on the MCP and the drive tuning starts automatically. Since the axes traverse during the tuning process, make sure you take proper precautions to avoid personal injury or machine damage.



13. After the drive tuning finishes successfully, the tuning results appear on the screen in the form of a parameter list.

Axis +

Axis -

You can check the tuning results of the additional axis with these softkeys.

Accept

14. Press this softkey to save the tuning results and write the modified parameters into the drives.

Cancel

Pressing this softkey aborts the tuning and deletes the results.

Export results

It returns automatically to the main screen of drive tuning after the tuning finishes. You can use this softkey to save the trace files during the tuning process to a USB flash disk (if inserted).

Note

For the machine data that are changeable only with a manufacturer password, the settings made during drive tuning cannot be restored after an NC restart in case of power failure or unexpected abortion of the tuning process.

12.3 Configuring an additional spindle

An additional spindle can be configured as follows:

- If a digital spindle is already configured on the control system, you can additionally configure either a digital spindle driven by SINAMICS V70 feed drive or an analog spindle driven by an inverter or servo spindle drive.
- If an analog spindle is already configured on the control system, you can only configure a digital spindle additionally which is driven by SINAMICS V70 feed/spindle drive.

12.3.1 Setting parameters for the additional digital spindle

To use the additional digital spindle, you must set the Drive Bus address (p0918) properly via the drive BOP. For more information, see Section "Configuring Drive Bus addresses (Page 119)".

Proceed as follows to set the parameters for the additional digital spindle:

SHIFT + SYSTEM ALARM

1. Select the system data operating area.
2. Open the channel machine data window through the following softkey operations:

   MD Mach. data → Expert list → Channel MD

Search

3. Use this softkey or the cursor keys to search for the following machine data and assign the desired values:
   - For the turning variant of the control system:
     - 20070[3] = 5
     - 20080[3] = SP2
   - For the milling variant of the control system:
     - 20070[4] = 5
     - 20080[4] = SP2

General MD

4. Open the general machine data window and set 10000[4] = MSP2.
5. Press this key to return to the higher-level menu.

NC basic list

6. Open the basic machine data window.

Search

7. Use this softkey or the cursor keys to search for "14512 USER_DATA_HEX[20]".

SELECT

8. Select "Bit2" and "Bit3" by using this key and the cursor keys.

OK

9. Press this softkey to confirm your input.

Activate

10. Press this softkey to activate the value changes. Note that the control system restarts to accept the new values.

SHIFT + SYSTEM ALARM

11. Select the system data operating area.

12. Open the axis machine data window through the following softkey operations:

    MD Mach. data → Expert list → Axis MD

Axis +

Axis -

13. Use these softkeys to switch to the data set for the additional spindle (MSP2).

Default

14. Default the following machine data for MSP2 with this softkey: 30100[0], 30110[0], 30120[0], 30200, and 30220.

Search

15. Use this softkey or the cursor keys to search for the following machine data and assign the desired values:
    - If you use an external spindle encoder for the additional spindle:
      – 30210[1] = 0
      – 30230[1] = 4
      – 30240[1] = 2
      – 31020[1] = resolution of the external spindle encoder
      – 31040[1] = 1
      – 36300[1] ≤ 2000000 (2 MHz which is the max. frequency of interface X60)
    - If no external spindle encoder is used for the additional spindle:
      – 30210[0] = 5
      – 30230[0] = 1
      – 30240[0] = 1
      – 31020[0] = resolution of the motor encoder
      – 31040[0] = 0

Search

16. Use this softkey or the cursor keys to search for the following machine data and assign the desired values:
    - 30130[0] = 1
    - 32260 = the rated motor speed
    - 35000 = 2

Activate

17. Press this softkey to activate the value changes. Note that the control system restarts to accept the new values and the additional spindle can be used in the system.

Note

The factory default PLC program only supports one additional axis.

12.3.2 Setting parameters for the additional analog spindle

Proceed as follows to set the parameters for the additional analog spindle:

SHIFT + SYSTEM ALARM

1. Select the system data operating area.
2. Open the channel machine data window through the following softkey operations:

   MD Mach. data → Expert list → Channel MD

Search

3. Use this softkey or the cursor keys to search for the following machine data and assign the desired values:
   - For the turning variant of the control system:
     - 20070[3] = 5
     - 20080[3] = SP2
   - For the milling variant of the control system:
     - 20070[4] = 5
     - 20080[4] = SP2

General MD

4. Open the general machine data window and set 10000[4] = MSP2.

^

5. Press this key to return to the higher-level menu.

NC basic list

6. Open the basic machine data window.

Search

7. Use this softkey or the cursor keys to search for "14512 USER_DATA_HEX[20]".

SELECT

8. Select "Bit2" and "Bit3" by using this key and the cursor keys.

OK

9. Press this softkey to confirm your input.

Activate

10. Press this softkey to activate the value changes. Note that the control system restarts to accept the new values.

SHIFT + SYSTEM ALARM

11. Select the system data operating area.
12. Open the axis machine data window through the following softkey operations:

    MD Mach. data → Expert list → Axis MD

Axis +

Axis -

13. Use these softkeys to switch to the data set for the additional spindle (MSP2).

Default

14. Default the machine data 30110[0] and 30220[0] for MSP2 with this softkey.

Search

15. Use this softkey or the cursor keys to search for the following machine data and assign the desired values:
    - If you use an external spindle encoder for the additional spindle:
        - 30200[0] = 1
        - 30210[0] = 0
        - 30230[0] = 4
        - 30240[0] = 2
        - 31020[0] = resolution of the external spindle encoder
        - 31040[0] = 1
        - 36300[0] ≤ 2000000 (2 MHz which is the max. frequency of interface X60)
    - If no external spindle encoder is used for the additional spindle:
        - 30200[0] = 0

Search

16. Use this softkey or the cursor keys to search for the following machine data and assign the desired values:
    - 30100[0] = 0
    - 30120[0] = 4
    - 30130[0] = 1
    - 30134[0]
        - = 0: bipolar output (± 10 V)
        - = 1: unipolar spindle with separate enable and direction signals
        - = 2: unipolar spindle with direction-dependent enable
    - 32250[0] = 100
    - 32260 = the rated motor speed
    - 35000 = 2

Activate

17. Press this softkey to activate the value changes. Note that the control system restarts to accept the new values and the additional spindle can be used in the system.

Note

The factory default PLC program only supports one additional axis.

12.4 Configuring an additional positioning axis

Note

The optional function of additional positioning axis/auxiliary spindle is available on PPU16x.3 only.

Auxiliary movements are performed with positioning axes. These axes are not interpolation axes and scarcely affect the performance of the control. Typical applications for positioning axes are, for example, the tool or workpiece change.

In addition to the NC axes, you can configure up to three (for the turning variant) or two (for the milling variant) positioning axes.

Prerequisites

- The Drive Bus address (p0918) of the corresponding drive is properly set. For more information, see Section "Configuring Drive Bus addresses (Page 119)".
- At least one additional positioning axis is activated. For more information, see Section "Activating the optional functions (Page 127)".

Proceed as follows to set the parameters for an additional positioning axis:

SHIFT + SYSTEM ALARM

1. Select the system data operating area.
2. Open the channel machine data window through the following softkey operations:
   MD Mach. data → Expert list → Channel MD
3. Set the machine data 20070 as follows:
   - For the turning variant: set 20070[3]/[4]/[5] = 5 or 6
   - For the milling variant: set 20070[4]/[5] = 5 or 6.
4. Press this key to return to the higher-level menu.

NC basic list

5. Open the basic machine data list.

Search

6. Use this softkey or the cursor keys to search for "14512 USER_DATA_HEX[20]".

SELECT

7. Select "Bit2" by using this key and the cursor keys.

OK

8. Press this softkey to confirm your input.

Activate

9. Press this softkey to activate the value changes. Note that the control system restarts to accept the new values and the additional axis can be displayed in the system.

SHIFT + SYSTEM ALARM

10. Select the system data operating area.
11. Open the axis machine data window through the following softkey operations:
    MD Mach. data → Expert list → Axis MD

Search

12. Use this softkey or the cursor keys to search for the machine data 30460 for the positioning axis.

SELECT

13. Select "Bit2" by using this key and the cursor keys.

OK

14. Press this softkey to confirm your input.

Activate

15. Press this softkey to activate the value changes. The control system restarts to accept the new value.
16. Perform further operations to configure the drive system (Page 235) and tune the drive performance (Page 236) for the positioning axis.

12.5 Configuring the Y axis on a turning machine

Prerequisites:

- The Drive Bus address of the corresponding drive is properly set (p0918 = 12). For more information, see Section "Configuring Drive Bus addresses (Page 119)".
- At least one additional axis is activated. For more information, see Section "Activating the optional functions (Page 127)".

12.5.1 Setting parameters for the Y axis

Proceed as follows to set the parameters for the Y axis:

SHIFT + SYSTEM ALARM

1. Select the system data operating area.
2. Open the general machine data window through the following softkey operations:
   MD Mach. data → Expert list → General MD
3. Set the machine data 10000[1] to MY1.

Channel MD

4. Press this softkey to open the channel machine data window and set the following machine data:
   - 20050[1] = 2
   - 20050[2] = 3
   - 20060[1] = Y
   - 20070[1] = 2
   - 20070[2] = 3
   - 20070[3] = 4
   - 20080[1] = Y
   - 20080[2] = Z
   - 20080[3] = SP

Activate

5. Press this softkey to activate the value changes. Note that the control system restarts to accept the new values and the additional axis can be displayed in the system.

SHIFT + SYSTEM ALARM

6. Select the system data operating area.
7. Open the axis machine data window through the following softkey operations:
   MD Mach. data → Expert list → Axis MD

Axis +

Axis -

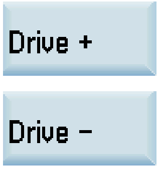
8. Use these softkeys to switch to the data set for axis MY1.

Search

9. Use this softkey or the cursor keys to search for the following machine data and assign the desired values:
   - 30130[0] = 1
   - 30240[0] = 1 (incremental encoder) or 4 (absolute encoder)
   - 31020[0] = encoder resolution (= 2500: incremental encoder; = 2048: absolute encoder)
   - 34200[0] = 1 (incremental encoder) or 0 (absolute encoder)

Drive MD

10. Press this softkey to open the drive data list.



11. Use these softkeys to switch to the data set for axis MY1.

12. Use this softkey or the cursor keys to search for the drive parameter p29000. Enter the motor ID of the motor connected to axis MY1. You can find the motor ID on the motor rating plate.

13. Press this softkey to activate the value changes. Note that the control system restarts to accept the new values.

14. If necessary, you can also tune the drive performance for the Y axis. For more information, see Section "Tuning the drive performance (Page 236)". Note that you must perform the reference point approach for the Y axis first before you start the drive tuning.

12.5.2 Measuring the tool manually (with the Y axis)

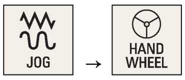
Note

This section takes the milling tool measurement as an example.

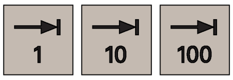
Measuring the X axis of the tool

1. Select the machining operating area.

2. Switch to "MDA" mode and enter "SPOS=0" in the program editor window to fix the spindle.



3. Switch to handwheel control mode.



4. Select a suitable override feedrate.

5. Use the handwheel to move the tool to approach the workpiece and cut the surface of the workpiece for about 1 mm along the Y axis. Then retract the tool along the Y axis.

   Note:

   Make sure you do not move the tool along the X axis afterwards.

6. Switch to "MDA" mode and continue to enter "SPOS=180" in the program editor window.

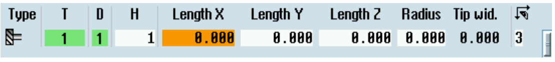
7. Press this key to rotate the spindle 180 degrees.

8. Repeat Steps 3 to 5.
9. Measure the distance between the two cutting surfaces machined in the previous steps with a calliper.

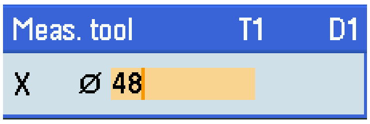
10. Select the offset operating area.

11. Press the alphabetic key <X> or proceed through the following method to open the window for measuring the tool in the X direction:

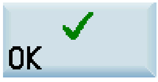
Move the cursor to the input field for Length X with the cursor keys and then press this softkey.



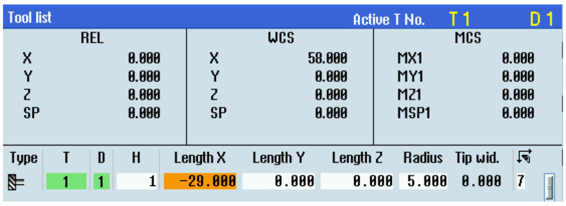
12. Enter the distance measured in Step 9 in the input field (for example, 48).



If you desire to use the relative coordinate, press this softkey.



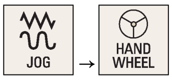
13. Press this softkey to confirm your input. The system calculates the offset and enters it in the geometry input field of the currently active tool automatically.



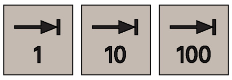
Measuring the Y axis of the tool

1. Select the machining operating area.

2. Switch to "MDA" mode and enter "SPOS=0" in the program editor window to fix the spindle.



3. Switch to handwheel control mode.



4. Select a suitable override feedrate.

5. Use the handwheel to move the tool to approach the workpiece and cut the surface of the workpiece for about 1 mm along the X axis. Then retract the tool along the X axis.

   Note:

   Make sure you do not move the tool along the Y axis afterwards.

6. Switch to "MDA" mode and continue to enter "SPOS=180" in the program editor window.

7. Press this key to rotate the spindle 180 degrees.

8. Repeat Steps 3 to 5.

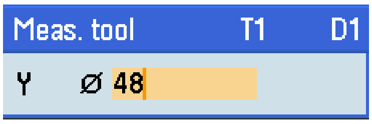
9. Measure the distance between the two cutting surfaces machined in the previous steps with a calliper.

10. Select the offset operating area.

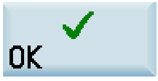
11. Press the alphabetic key <Y> or proceed through the following method to open the window for measuring the tool in the Y direction:

Move the cursor to the input field for Length Y with the cursor keys and then press this softkey.

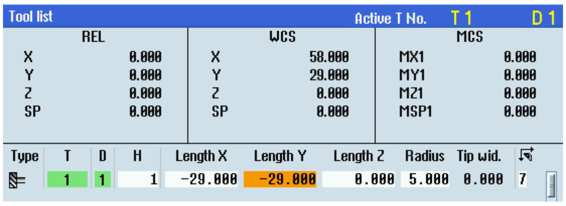
12. Enter the distance measured in Step 9 in the input field, for example, "48".



If you desire to use the relative coordinate, press this softkey.

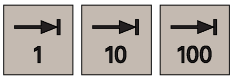


13. Press this softkey to confirm your input. The system calculates the offset and enters it in the geometry input field of the currently active tool automatically.



Measuring the Z axis of the tool

1. Select the machining operating area.

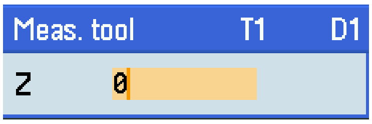


2. Select a suitable override feedrate and use the handwheel to move the tool to scratch the required workpiece edge (or the edge of the setting block, if it is used).
3. Select the offset operating area.

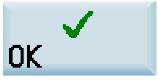
4. Press the alphabetic key <Z> or proceed through the following method to open the window for measuring the tool in the Z direction:

Move the cursor to the input field for Length Z with the cursor keys and then press this softkey.

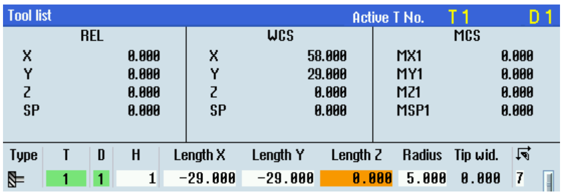
5. Enter the distance between the tool tip and the workpiece edge in the input field, for example, "0". (This value is the thickness of a setting block if it is used.)



If you desire to use the relative coordinate, press this softkey.



6. Press this softkey to confirm your input. The system calculates the offset and enters it in the geometry input field of the currently active tool automatically.

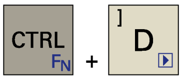


7. Repeat the above steps to finish measuring all the tools.

13 Other frequently used functions

13.1 Playing a slide show

The control system has the function of playing a slide show. By default, the slide show of Siemens product information is provided.



You can press this key combination on the PPU to play a slide show and press the key combination again to exit the slide show.

Playing the machine manufacturer's slide show

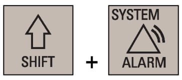
You can create your own slides and play them on the control system. The control system supports the slide show of images in ".png" or ".bmp" format. To achieve the best display effect, the recommended image size is 800*600 pixels.

Proceed through the following steps to playing your own slide show:

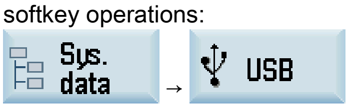
1. Prepare the images for the slide show and name each image according to the following syntax:
   - **slide%u.png**, or
   - **slide%u.bmp**

   Here "**%u**" stands for the number sequence starting with "1". For example, slide1.png, slide2.png, slide3.png ...

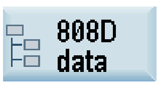
   If your slides include both PNG-format images and BMP-format images, number them separately. During the slide show, the PNG-format images will have a higher priority over the BMP-format images.
2. Store all the images in a folder on a USB memory stick, and name the folder with the corresponding language code, for example, "chs" for Chinese, "eng" for English. For more information about other available language codes, see Section "Loading system languages (Page 125)". Note that a slide show in a non-standard language works only if this language is loaded on the control system.
3. Insert the USB stick into the USB interface on the front panel of the PPU.



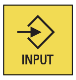
4. Select the system data operating area.
5. Locate the folder(s) containing the slides under the USB directory through the following softkey operations:



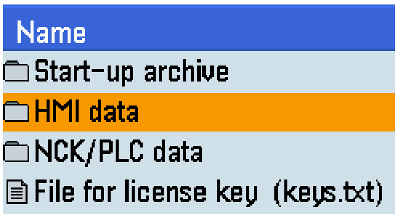
6. Select the folder(s) and press this softkey to copy.



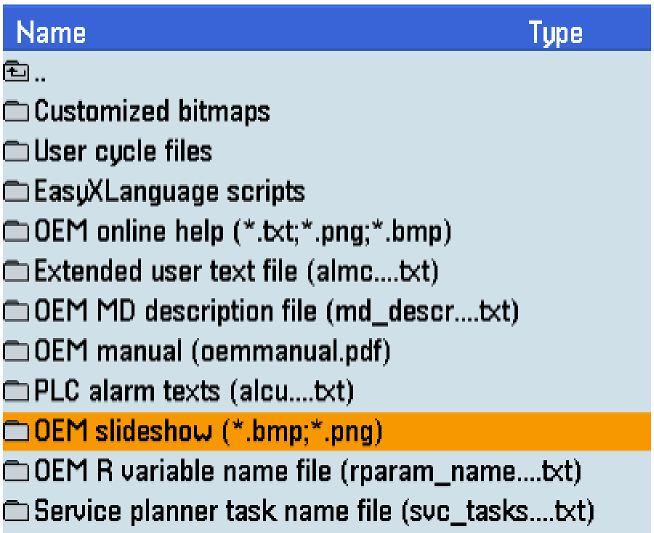
7. Press this softkey to open the window of system data.

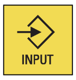


8. Select the HMI data folder and press this key to open it.



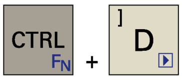
9. Move the cursor to the folder highlighted as follows:





10. Press this key to open this folder.

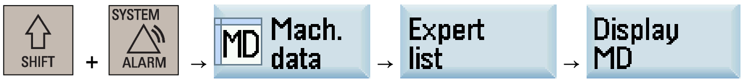
11. Paste the copied folder(s) containing the slides with this softkey.



12. Now you can press this key combination to play your own slide show.

Note

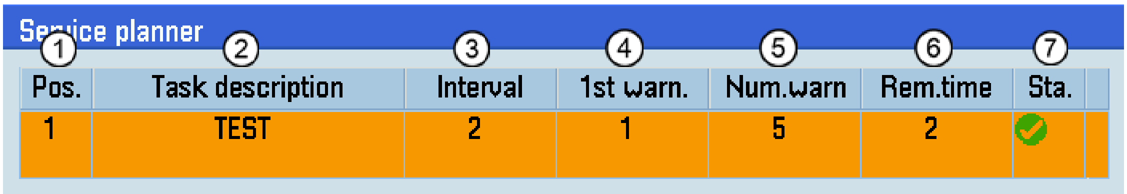
You can set the time interval of the slide show with MD9001 TIME_BTWEEN_SLIDES. This parameter can be found through the following operations:



13.2 Defining the service planner

With the service planning function, you can set up maintenance tasks that have to be performed at certain intervals (for example, top up oil, change coolant). An alarm appears as a reminder when the interval expires.

A list is displayed of all the maintenance tasks that have been set up together with the time remaining until the end of the specified maintenance interval.



① Position of the maintenance task in the PLC interface

② Name of the maintenance task

③ Maximum time until next servicing in hours

④ Time in hours at which an initial warning is displayed

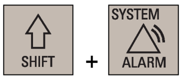
⑤ Number of warnings that can be acknowledged by the operator before an alarm message is output for the last time

⑥ Time until the interval expires in hours. The remaining time cannot be edited.

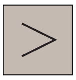
⑦ Display of the current status of a maintenance task
: The maintenance task has been started.
: The maintenance task is completed.

Creating a new maintenance task

Proceed as follows to create a new maintenance task:



1. Open the system data operating area.

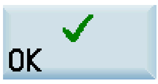


2. Press this key on the PPU to view the extended softkeys.

3. Open the window of service planning.

4. Press this softkey to open the dialog box for creating a new task.

5. Enter desired data in the respective input fields.



6. Press this softkey to confirm your settings, and the new maintenance task displays on the screen.

7. You can also select the vertical softkeys as required in the service planning window to complete the following operations:

Acknowledges the selected task which has been completed

Edits the selected task

Deletes the selected task

Reset all	Resets the remaining time for all tasks

After you have created at least one maintenance task on the control system, you can find a task name file (.txt) which contains the name(s) of all maintenance task(s) created under the current system language. You can access this file through the following operations:

SHIFT + SYSTEM ALARM → Sys. data → 808D data → HMI data →

Name	Type
..	
Customized bitmaps	
User cycle files	
EasyXLanguage scripts	
OEM online help (*.txt;*.png;*.bmp)	
Extended user text file (almc....txt)	
OEM MD description file (md_descr....txt)	
OEM manual (oemmanual.pdf)	
PLC alarm texts (alcu....txt)	
OEM slideshow (*.bmp;*.png)	
OEM R variable name file (rparam_name....txt)	
Service planner task name file (svc_tasks....txt)	

A task name file is language-dependent. You can copy the file in the desired language to your computer using a USB memory stick for backup or batch editing of the maintenance task descriptions.

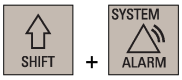
13.3 Using the machine manufacturer's startup screen and machine logo

Using the machine manufacturer startup screen

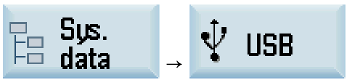
The control system uses the Siemens startup screen as follows by default. If necessary, you can use your own startup screen.

Proceed as follows to use your own startup screen:

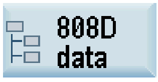
1. Prepare the image for the startup screen in BMP format. To achieve the best display effect, the recommended image size is 750*450 pixels. Name the image "startup.bmp" and save it on a USB memory stick.
2. Insert the USB stick into the USB interface on the front panel of the PPU.



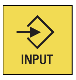
3. Select the system data operating area.
4. Locate the startup screen file under the USB directory through the following softkey operations:



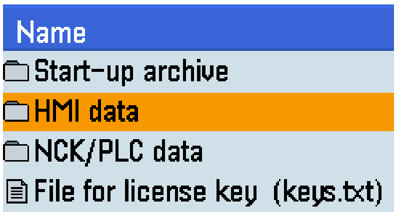
5. Select the file with cursor keys and press this softkey to copy the file.



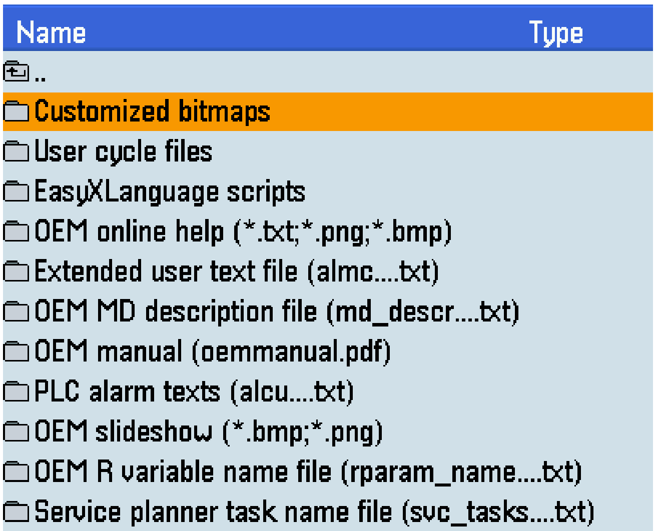
6. Press this softkey to open the window of system data.

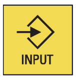


7. Select the HMI data folder and press this key to open it.



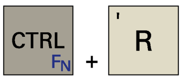
8. Move the cursor to the folder highlighted as follows:





9. Press this key to open this folder.

10. Press this softkey to replace the default startup screen file with your own file.



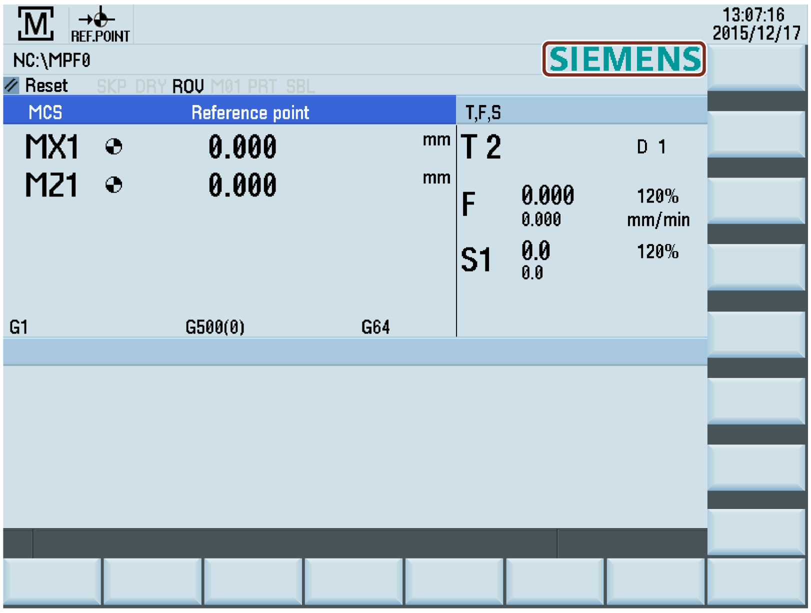
11. Press these two keys to restart the HMI. Then you can see your own startup screen during the startup of the control system.

Note

To restore the default startup screen, delete the customized bitmap file (startup.bmp) from the control system.

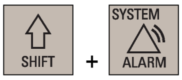
Using the machine manufacturer machine logo

The default machine logo is displayed in the machining operating area as follows. If necessary, you can use your own machine logo.

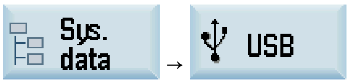


Proceed as follows to use your own machine logo:

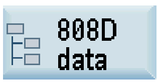
1. Prepare the image of your own machine logo in BMP format. To achieve the best display effect, the recommended image size is 153*24 pixels. Name the image "mtbico.bmp" and save it on a USB memory stick.
2. Insert the USB stick into the USB interface on the front panel of the PPU.



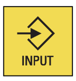
3. Select the system data operating area.
4. Locate the machine logo file under the USB directory through the following softkey operations:



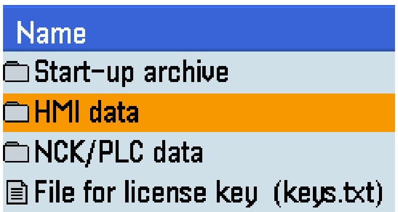
5. Select the file with cursor keys and press this softkey to copy the file.



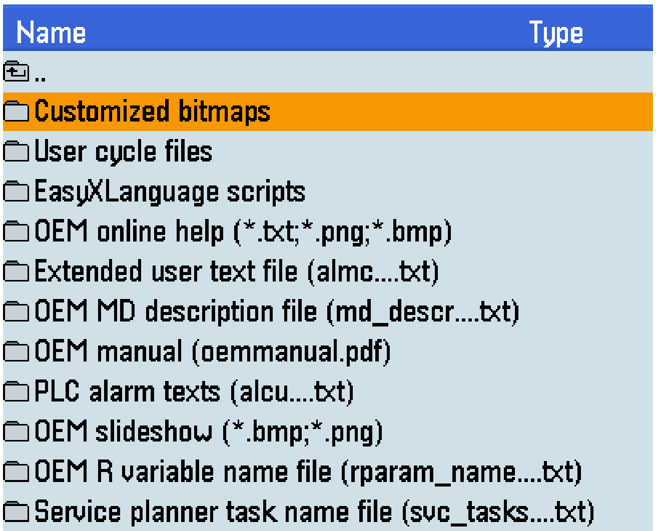
6. Press this softkey to open the window of system data.

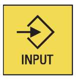


7. Select the HMI data folder and press this key to open it.



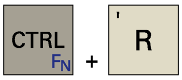
8. Move the cursor to the folder highlighted as follows:





9. Press this key to open this folder.

10. Press this softkey to replace the default machine logo file with your own machine logo file.



11. Press these two keys to restart the HMI. Then you can see your own machine logo in the machining operating area.

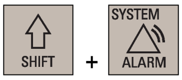
Note

To restore the default display of "SIEMENS" logo, delete the customized bitmap file (mtbico.bmp) from the control system.

13.4 Configuring the operating area after startup

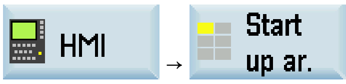
The machining operating area is displayed by default after the startup of the control system. Alternatively, you can select another operating area which you desire to enter after the system starts up.

Operating sequence



1. Select the system data operating area.

2. Open the window for setting the startup operating area through the following softkey operations:



3. Use the cursor keys to select the desired operating area in the following window:

4. Press this softkey to confirm your setting, and the configured operating system will display after the control system restarts.

13.5 Creating user cycles

The control system is integrated with standard Siemens cycles. If necessary, you can also create your own cycles.

To create a customized cycle, you must prepare the files shown below:

- User cycle file (Page 254)
- User cycle alarm file (Page 256)
- User cycle bitmap file (Page 256)
- Extended user text file (Page 256)
- User cycle softkey index file (Page 257)
- User cycle parameter file (Page 257)

13.5.1 Creating the user cycle file

You can create a user cycle file according to different machining functions. It is a subroutine program that can be used at calling a cycle.

Naming rule

CYCLExxx.SPF

Here "xxx" refers to the cycle number. It **must not** exceed four digits..

Note

The name of a user cycle **must not** be same with that of a standard Siemens cycle. It is recommend to use a cycle number with the range of 100 to 800.

Programming example

Create the program with a wordpad or notepad.

As a cycle screen always also transfers values as call parameters to the user cycle, the transfer interface is defined as follows.

```
PROC CYCLE100(REAL DIA,REAL DIAF,REAL STAP,REAL ENDP,REAL MID,REAL UX,INT MACH,REAL VRT)
SAVE SBLOF DISPLOF
```

PROC is a keyword followed by the cycle name with the cycle number. All the transfer parameters for the screen are contained within brackets with the data type and name separated by commas.

```
PROC CYCLE100(REAL DIA,REAL DIAF,REAL STAP,REAL ENDP,REAL MID,REAL UX,INT MACH,REAL VRT)
SAVE SBLOF DISPLOF
DEF REAL VAR1
IF $P_EP[X]<DIA GOTOF LL1
```

```
LL3:
IF DIAF>DIA GOTOF END2
START:
IF MACH==0 GOTOF ROUGHING1
IF MACH==1 GOTOF FINISHING
IF MACH==2 GOTOF ROUGHING1
DEF REAL VAR1
ROUGHING1:
R101=(DIA-DIAF)/2-UX
R102=R101/MID
R103=TRUNC(R102)
R104=0
VAR1=DIA
IF R103<=1 GOTOF ROUGHING2
LL2:
SBLON
G90 G0 X=VAR1 Z=STAP+2
G1 Z=ENDP
G91 X=MID
G0 G91 X=VRT Z=VRT
G90 G0 Z=STAP+2
SBLOF
VAR1=VAR1-2*MID
R104=R104+1
IF R104<=R103 GOTOB LL2
IF R104>R103 GOTOF ROUGHING2
ROUGHING2:
SBLON
G90 G0 X=DIAF+UX
G1 Z=ENDP
G0 G91X=VRT Z=VRT
G90 G0 X=DIA+2
Z=STAP+2
IF MACH==2 GOTOF FINISHING
SBLOF
RET
FINISHING:
SBLON
G0 X=DIAF
G1 Z=ENDP
G1 X=DIA+VRT
G0 G91X=VRT Z=VRT
G90 Z=STAP+2
SBLOF
RET
LL1:
IF $P_EP[Z]<STAP GOTOF END1
GOTOB LL3
END1:
SETAL(65000)
STOPRE
```

```
M0
RET
END2:
SETAL(65001)
STOPRE
M0
RET
```

13.5.2 Creating the user cycle alarm file

The user cycle alarm file is required to display alarm numbers and alarm messages for user cycles.

Naming rule

alc_<LANG>.txt

Here "**<LANG>**" refers to the language denotation, for example, eng.

For more information, see Section "Loading system languages (Page 125)".

Text definition rules

When defining the texts, you must follow the rule below:

<AlarmNumber> "<Text>" // <lines*chars>

- <AlarmNumber>: here you define the alarm number. The number ranges from 65000 to 69999.
- <Text>: here you define the actual alarm text.
- <lines*chars>: here you specify the available space for the text in the GUI in number of characters and lines. You can start a new line by inserting the character of "**%n**".

Example

65000 "Current tool position is incorrect" // 34 ⇒ one line with 34-character space

65001 "DIAF is bigger than DIA" // 23 ⇒ one line with 23-character space

13.5.3 Creating the user cycle bitmap file

The cycle icons **must** be stored as bitmap files (*.bmp) with a maximum size of **224 * 224** pixels in **16** colors.

The icon name **must** begin with an uppercase/lowercase "**C**" and its length **must not** exceed **32** characters including the file extension (for example, CN1.bmp).

Note

If 16 colors are not sufficient for the display, you can also use 24-bit color depth bitmaps.

13.5.4 Creating the extended user text file

The extended user text file is required for the display of respective screen texts, cycle messages and softkey texts.

Naming rule

almc_<LANG>.txt

Here "**<LANG>**" refers to the language denotation, for example, eng.

For more information, see Section "Loading system languages (Page 125)".

Text definition rules

When defining the texts, you must follow the rule below:

<Identifier> "<Text>" // <lines*chars>

- <Identifier>: here you use a number to define the identifier for a softkey, message, or screen. The number ranges from 83000 to 84999.
- <Text>: here you define the actual text to be displayed, such as softkey name, message text, and parameter description text.
- <lines*chars>: here you specify the available space for the text in the GUI in number of characters and lines. You can start a new line by inserting the character of "**%n**". A maximum of 2 lines with 9 characters each are available for softkey texts.

Example

83000 "User%nCycles" // 2*9 ⇒ two lines, each line with nine-character space

83001 "CYCLE100" // 9 ⇒ one line with nine-character space

83020 "DIA short description" // 21 ⇒ one line with 21-character space

13.5.5 Creating the user cycle softkey index file

The user cycle softkey index file (cov.com) file is required to define the softkeys for the user cycle. You can create the cov.com file with a text editor like the WordPad or Notepad.

Text definition rules

Sx.y.z\$identifier\bitmap(cycle)

Parameters	Value range	Significance
x	5	The fifth horizontal key.
y	1 to 8	The first to eighth vertical key in the first level.
z	1 to 8	The first to eighth vertical key in the second level.
\$identifier\	-	The softkey identifier defined in the extended user text file.
bitmap(cycle)	-	The bitmap for the cycle screen. The bitmap name must be followed with the user cycle name which will display in the upper left corner of the cycle screen.

Example

`S5.0.0\$83000\` ⇒ define a softkey (with the identifier 83000) at the fifth horizontal key.

`S5.1.0\$83001\CN1(CYCLE100)` ⇒ define a softkey (with the identifier 83001) at the first vertical key in the first level after pressing the fifth horizontal key; CN1.bmp is used for the CYCLE100 screen.

`S5.2.0\$83002\CN2(CYCLE101)` ⇒ define a softkey (with the identifier 83002) at the second vertical key in the first level after pressing the fifth horizontal key; CN2.bmp is used for the CYCLE101 screen.

`M17`

13.5.6 Creating the user cycle parameter file

The user cycle parameter file (sc.com) file is required to define the help information and the parameters for the user cycle. You can create the sc.com file with a text editor like the WordPad or Notepad.

Text definition rules

The "**//**" symbol indicates the beginning of a cycle description.

If you have created an image to display on the left of the screen at cycle start, call the image at the first line. The image is followed by the cycle name written in brackets.

Now define the parameters for the individual variables according to the format shown in the table below:

Bit	Description of the parameters	Entry
1	Start of variable definition	(
2	Variable type	R - REAL I - INTEGER C - CHAR S - STRING

Bit	Description of the parameters	Entry
3	Separator	/
4	• Minimum value + space + maximum value • * + values available for selection	• Minimum value + space + maximum value • * + different values (separated with space) Note that you can also define different pictures for the characters.
5	Separator	/
6	Default value	Value is missing in the cycle if no entry is made.
7	Separator	/
8	Short parameter text	$ + the identifier (the short description of the selected parameter, which will display in the upper left corner of the parameter screen; defined in the extended user text file)
9	End of variable definition	)
10	Start of description	[
11	Parameter name	Text preceding the input field; a maximum of five characters in length
12	End of description	]
13	Parameter-specific image	/B + bmp file name (without file extension)

Note

Separators, start and end identifiers must always be entered.

The bits 4, 6, and 13 can be left blank.

If no texts are stored with the $ identifier, three question marks appear in the associated fields on the screen.

Example

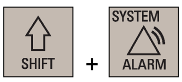
```
//CN1(CYCLE100)
(R/0 99999.999//$83020)[DIA]
(R/0 99999.999//$83021)[DIAF]
(R/-9999.999 99999.999//$83022)[STAP]
(R/-9999.999 99999.999//$83023)[ENDP]
(R/0 99999.999//$83024)[MID]
(R/0 99999.999//$83025)[UX]
(I/*0 1 2/0/$83026)[MACH]/B CN1
(R/1 99999.999/1/$83027)[VRT]
M17
```

13.5.7 Transferring the desired files to the control system

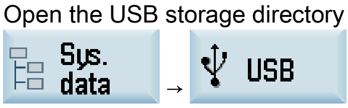
Proceed as follows to transfer the required files to the control system.

Prerequisite: A USB memory stick which contains all required files is inserted into the USB interface at the front of the PPU.

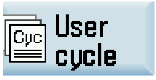
Transferring the user cycle file



1. Select the system data operating area.
2. Open the USB storage directory through the following softkey operations:



3. Select the desired user cycle file (for example, CYCLE100.SPF) and then press this softkey to copy the file.



4. Press this softkey to open the user cycle directory.

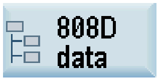
5. Press this softkey to paste the file.

Transferring the bitmap file

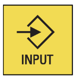
1. Press this softkey to switch to the USB storage directory.

2. Select the desired bitmap file(s) (for example, cn1.bmp, cn2.bmp...) and then press this softkey to copy the file(s).

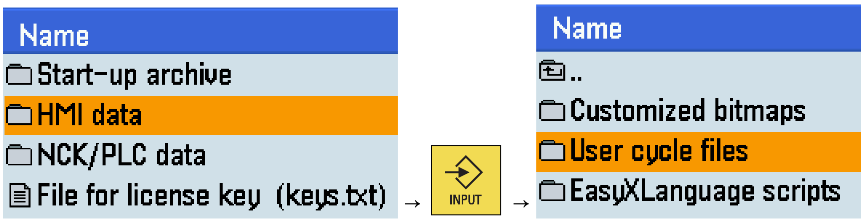
   Note that you can use the following key to select multiple files:

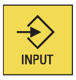


3. Press this softkey to open the window of system data.

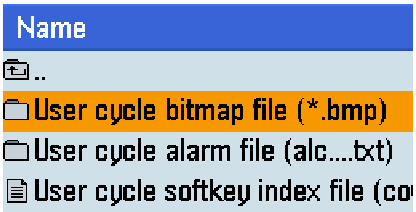


4. Find the folder for storing the user cycle files through the following operations, and press this key to open it:





5. Press this key to open the following user cycle bitmap file folder:

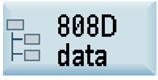


6. Paste the user cycle bitmaps with this softkey.

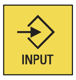
Transferring the user cycle alarm file

1. Press this softkey to switch to the USB storage directory.

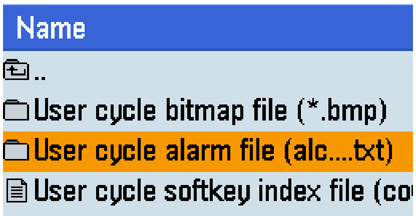
2. Locate the user cycle alarm file (for example, alc_eng.txt) and press this softkey to copy the file.



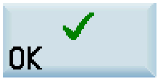
3. Press this softkey to open the window of system data.



4. Find the following user cycle alarm file folder and press this key to open it:

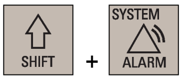


5. Paste the user cycle alarm file with this softkey.

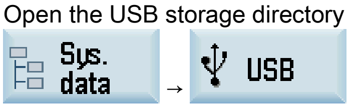


6. Press this softkey when a message appears prompting you to restart the HMI. The new data will be active after the HMI restarts successfully.

Transferring the cov.com file and sc.com file

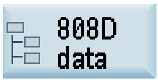


1. Select the system data operating area.
2. Open the USB storage directory through the following softkey operations:

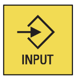


3. Select the cov.com and sc.com files and then press this softkey to copy the files.

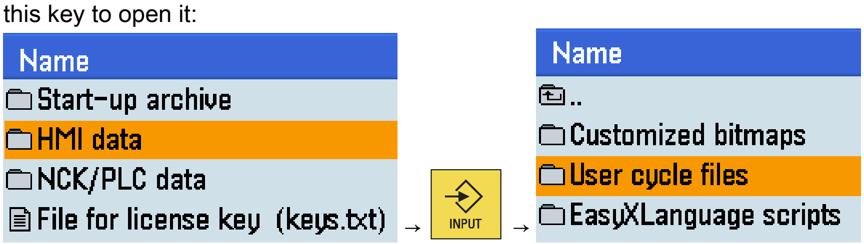
   Note that you can use the following key to select multiple files:



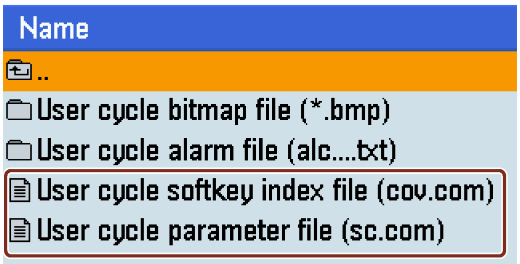
4. Press this softkey to open the window of system data.

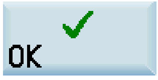


5. Find the folder for storing the user cycle files through the following operations, and press this key to open it:



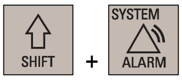
6. Press this softkey to replace the following empty files:





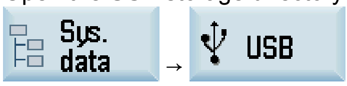
7. Press this softkey when a message appears prompting you to restart the HMI. The new data will be active after the HMI restarts successfully.

Transferring the extended user text file

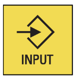


1. Select the system data operating area.

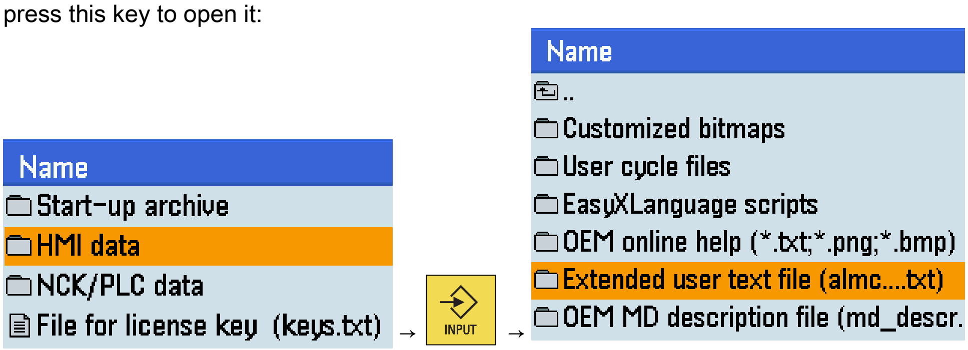
2. Open the USB storage directory through the following softkey operations:



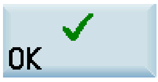
3. Locate the extended user text file (for example, almc_eng.txt) and press this softkey to copy the file.



4. Find the folder for storing the extended user text file through the following operations, and press this key to open it:



5. Press this softkey to paste the extended user text file.



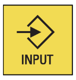
6. Press this softkey when a message appears prompting you to restart the HMI. The new data will be active after the HMI restarts successfully.

13.5.8 Calling the created user cycle

After you transfer all the files necessary for your own cycle to the control system, the cycle is created successfully. Then you can call the cycle in the program editing operating area.

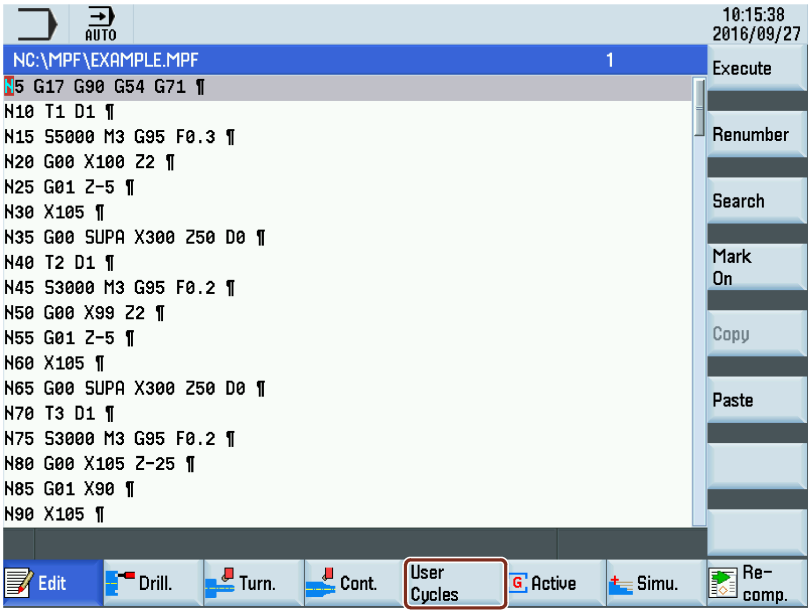
Proceed as follows to call the created cycle, for example, CYCLE100.

1. Select the program management operating area.

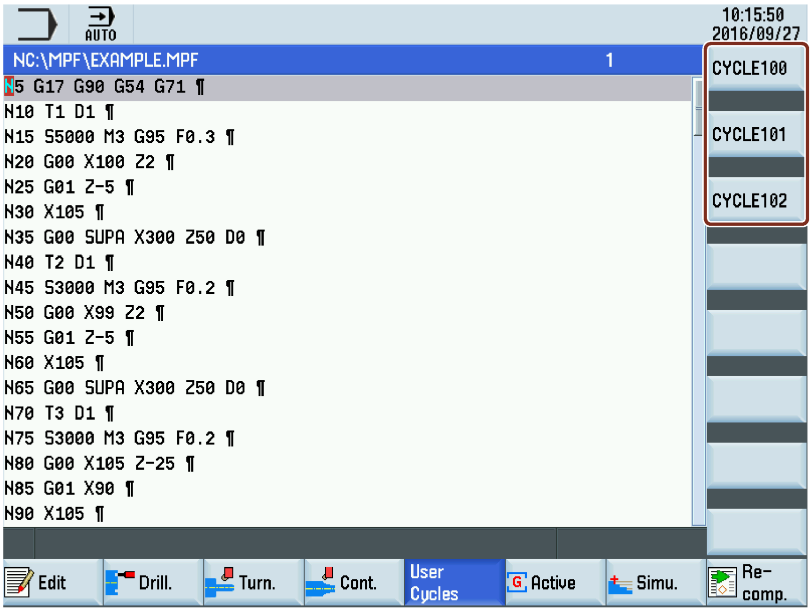


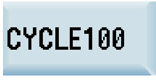
2. Select the desired part program and press this key to open it in the program editor.

Then you can see the softkey you define at the fifth horizontal softkey, for example:

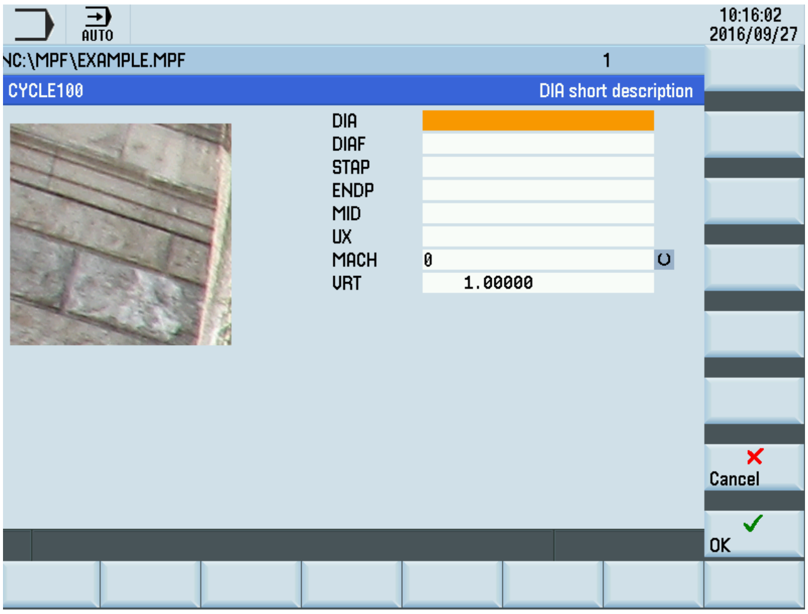


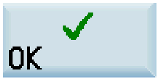
3. Press this softkey to open the lower-level menu for calling user cycles, for example:





4. Press this softkey to open the window for CYCLE100, for example:



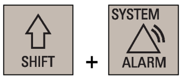


5. Set the parameters as desired, and press this softkey to confirm and return to the program editing screen. Then you can find CYCLE100 inserted in your program.

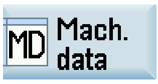
13.6 Using the machine manufacturer's machine data descriptions

If necessary, you can use your own descriptions for the PLC machine data 14510, 14512, 14514, 14516, and 17400.

Proceed as follows to edit the machine data description:

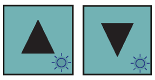


1. Select the system data operating area.



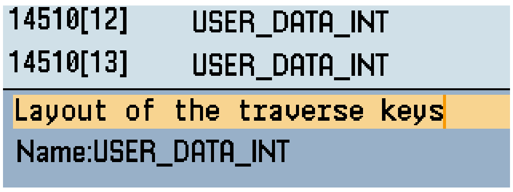
2. Press this softkey, and the window of basic NC data opens by default.

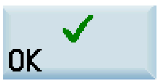
3. Press this softkey and all machine data available for editing is listed.



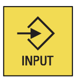
4. Use the cursor keys to select a desired MD.

5. Press this softkey to activate the input field at the bottom of the screen and enter the desired description text, for example:

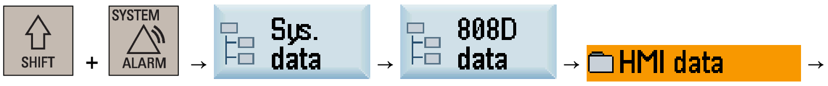


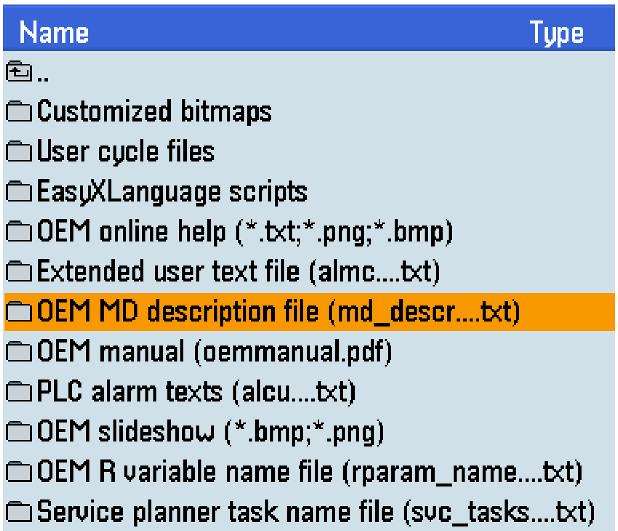


6. Confirm your entry with this softkey or the following key:



After you have modified the description of at least one MD on the control system, you can find an OEM MD description file (.txt) which contains the manufacturer's MD descriptions edited under the current system language. You can access this file through the following operations:





An OEM MD description file is language-dependent. You can copy the file in the desired language to your computer using a USB memory stick for backup or batch editing of the machine data descriptions.

13.7 Using the machine manufacturer's R variable names

If necessary, you can define the names of the R variables as desired.

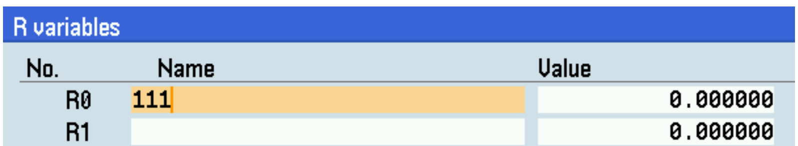
Proceed as follows to define your own R variable names:

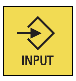
1. Select the offset operating area.

2. Press this softkey to open the list of R variables.

3. Press this softkey to activate the name display of all R variables.

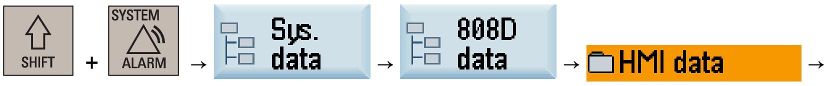
4. Use the cursor keys to select an R variable and enter the desired name in the name input field, for example:

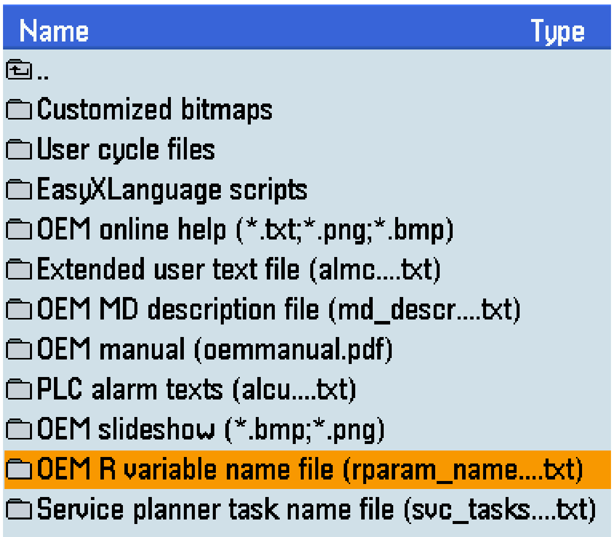




5. Press this key or move the cursor to confirm your entries.

After you have defined at least one R variable name on the control system, you can find an OEM R variable name file (.txt) which contains the manufacturer's R variable names defined under the current system language. You can access this file through the following operations:





An OEM R variable name file is language-dependent. You can copy the file in the desired language to your computer using a USB memory stick for backup or batch editing of the R variable names.

13.8 PI service functions

The following PI service functions are supported on the control system:

- ASUP function
- Deleting a password

PLC interface address

DB1200	PI service [r/w] PLC → NCK interface							
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
4000								Start
4001	PI index							

DB1200	Reading/writing NC data [r] NCK → PLC interface							
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
5000							Error in job	Job completed

DB3400	ASUP: Result [r/w] PLC → NCK interface							
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0								INT1 Start
1								INT2 Start

DB3400	ASUP: Result [r] NCK → PLC interface							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
1000	INT1							
					ASUP execution not possible	Interrupt no. not allocated	ASUP is being executed	ASUP ended
1001	INT2							
					ASUP execution not possible	Interrupt no. not allocated	ASUP is being executed	ASUP ended

ASUP function

The ASUP function means the execution of the program PLCASUP1.SPF or PLCASUP2.SPF called by the PLC. The two ASUPs cannot be simultaneously executed, and PLCASUP1.SPF has a higher priority over PLCASUP2.SPF.

In a PLC program, firstly you must initialize the ASUP by setting "PI index" (DB1200.DBB4001) and "NCK read/write start" (DB1200.DBX4000.0), and then use a rising edge to trigger "ASUP1 start" (DB3400.DBX0.0) or "ASUP2 start" (DB3400.DBX1.0).

The control system provides two default ASUPs for the PLC. ASUP1 is used for manual tool change and ASUP2 is used for the manual machine of the workpiece on a turning machine with the Manual Machine Plus function.

You can also use your own ASUPs as required. To do so, you must first place your programs (PLCASUP1.SPF and PLCASUP2.SPF) in the manufacturer cycle directory (N:\CMA), and then set "PI index" (DB1200.DBB4001) to 1 (ASUP1)/2 (ASUP2).

Deleting a password

To use this function, you need to only execute the PI service. Here, no initialization of the PI service is required.

By default, MD14512 [19].2 = 0, which indicates that the control system will automatically delete the password after NC restarts. If you want the control system to remember the last used password every time the NC restarts, you need to set MD14512 [19].2 = 1.

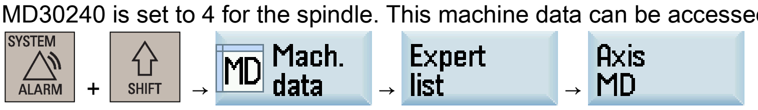
13.9 Programming a retraction for rigid tapping

When the rigid tapping is interrupted under the following circumstances, you can retract the tapping tool to a safe position by programming with G332 in "MDA" mode, without causing damage to the workpiece or the machine tool:

- NC reset
- Emergency stop
- Power-off

Prerequisites:

- A digital spindle is configured with a single-turn 21-bit absolute encoder.
- MD30240 is set to 4 for the spindle. This machine data can be accessed through the following operations:



Programming example

The retraction distance is specified by axis X, Y, or Z (which should be the same as the tapping axis); the thread pitch is specified via the relevant I (for axis X), J (for axis Y), or K (for axis Z). The spindle speed is programmed with S.

Example:

```
G332 Z20 K1 S100
```

Note

- For the tapping retraction after an emergency stop, you must first press the following key to reset the NC before executing the retraction program in "MDA" mode.

- For the tapping retraction after system power-off, you must enable the spindle first via program block "SPOS=IC(0)" after power-on, and then execute the retraction program in "MDA" mode; otherwise, an alarm 014092 appears.

13.10 CNC lock function

13.10.1 Function overview

Note

The "CNC lock function" is a licensed option (article number: 6FC5800-0AS71-0YB0).

Note

It's machine manufacturer's responsibility to ensure that the CNC lock function works properly and reliably.

NOTICE
License certificate The company that created the CNC lock function (machine manufacturer or dealer) must retain the license certificate for this option. This certificate can be used as legitimation for Siemens should the PIN be forgotten. The owner of the certificate (CoL) can have the machine unlocked.

The machine manufacturer can use the CNC lock function and the encrypted file created with Access MyMachine (AMM) application to activate a lock date in the control system. This allows the use of the machine to be limited to the time until the lock date is reached. The NC start function of the control system is locked when the lock date is exceeded. An NC program being processed in "AUTO" mode at this time is not interrupted.

The CNC lock function can be lengthened or deactivated with an additional encrypted file. The machine manufacturer sends this file to the end user if the user has fulfilled the agreed obligations.

Requirements

The following preconditions must be met for using the CNC lock function:

- The option of the CNC lock function must be activated with a license key. For more information about how to activate the optional functions, see Section "Activating the optional functions (Page 127)".
- A PLC project (of type 808D PPU15x/PPU16x) especially adapted to your machine tool must be downloaded into the control system with PLC Programming Tool. The compatibility mode must be deactivated. The default PLC project should never be used together with the CNC lock function. For more information about the operations with PLC Programming Tool, see Section "PLC Programming Tool (Page 182)".
- The AMM tool must be installed on your computer. For more information about AMM installation, see Section "Installing the software tools (Page 38)".

Supplementary conditions

NOTICE

Circumvention of the CNC lock function due to improper operations

Any of the following operations allow circumvention of the CNC lock function:

- Using an unlocked PLC project
- Using the default PLC project
- Reimplementing the PLC project of the machine tool
- Applying no password protection to the PLC project, or failing to keep the password secret

To avoid the circumvention, do as follows:

- Never give the PLC project to the customer without saved OEM PIN.
- Never reimplement the PLC project.
- Never run your machine tool with the default PLC project delivered with the control system.
- Always use the password protection of the program organization units in the PLC of the control system (activation in PLC Programming Tool is possible), which prevents users from copying the machine-specific know-how and using it in their own PLC user program, and then replacing the PLC user program with the PLC user program of the machine manufacturer that contains the PLC key of the CNC lock function. The password of the PLC project must be kept secret.

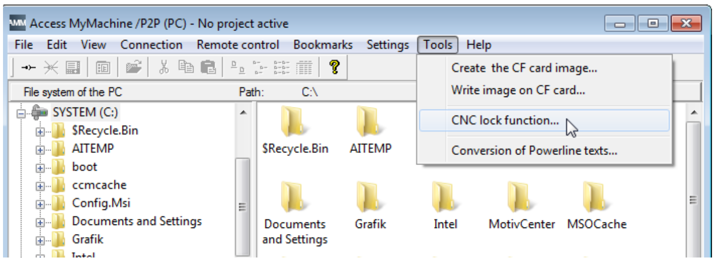
- Manipulation attempts and/or inconsistencies can lead to the CNC lock function causing a machine standstill.
- The use of the CNC lock function may require additional service calls of the machine manufacturer or dealer at the customer site.
- To provide better protection, each machine must be given its own OEM PIN.
- Before setting up the lock function for the first time, the setting up engineer must correctly set the date and the time in the control system. If the date lies in the past, then the operating time of the machine extends corresponding to the difference to the real date.
- The CNC lock function is built on the real-time clock of the control system. The maintenance-free design of the control system can cause the time of day to be lost. The CNC lock function performs a computerized numerical plausibility check of the time of day. This check can be impaired by power loss to the real-time clock. In this case, the time without power supply is ignored.
- A software malfunction can cause unintentional locking of the control system.

13.10.2 Creating the activation file

To use the CNC lock function, an encrypted activation file (.clc) appropriate for the hardware must be generated. The file is created with the AMM tool.

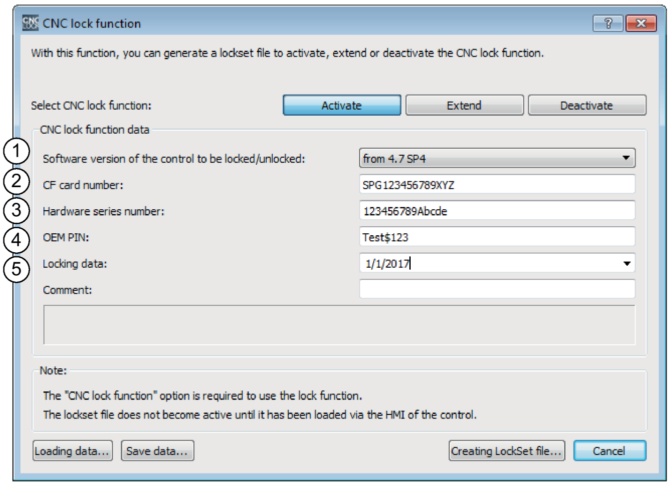
Proceed through the following steps to create the encrypted file for activating the CNC lock function:

1. Start Access MyMachine on your computer.
2. Select the following menu command:



3. Click this button in the displayed dialog box to proceed to the next step.

4. Enter the data required in the dialog box, for example:



① The software version 4.7 SP4 must be selected for the SINUMERIK 808D ADVANCED control system.

② The serial number of the CF card can be found on the PPU HMI through the following operations:

③ The serial number of the hardware (PPU) can be found on the PPU rating plate.

④ The OEM PIN must be limited to 8 to 32 English characters and contain a mixture of upper and lower case letters, numbers, and special characters (spaces are not allowed). The machine manufacturer is responsible for maintaining the confidentiality of the OEM PIN.

⑤ The machine manufacturer must set a date when the NC start is locked for the control system.

5. Click this button to save the activation data in the form of .clc file.

Note

The OEM PIN increases the protection against manipulation of the CNC lock function.

The OEM PIN is stored by the system when activating the CNC lock function in the PLC user program. The OEM PIN cannot be viewed, changed or deleted by the user in the PLC user program.

13.10.3 Importing the activation file

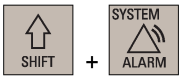
The activation file must be transferred to the control system either directly via an Ethernet connection or alternatively via a storage medium, e.g. USB flash drive. The end-user or higher access level is required for the import. The control system must be in the reset state for the import.

Note

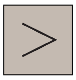
Before importing the activation file into the control system, the machine manufacturer must set the time and date of the control system correctly, because the time of activating the CNC lock function is saved as the start value for monitoring.

Proceed through the following steps to import the activation file:

1.
   - To import the file via USB, store the file in a USB memory stick and insert the USB memory stick into the USB interface at the front of the PPU.
   - To import the file via Ethernet, store the file in a shared folder (network drive) on your computer and connect the network drive via Ethernet connection.



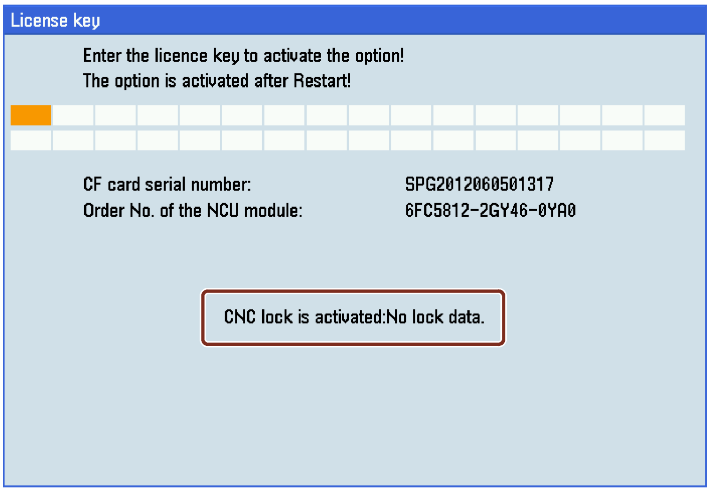
2. Select the system data operating area.



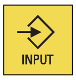
3. Press this key to view the extended softkeys.

4. Open the license key dialog box through the following softkey operations:

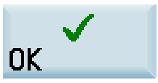
5. Check and make sure the screen displays as follows, which indicates the CNC lock option is licensed and set properly:



6. Press this softkey to open the file opening dialog box.

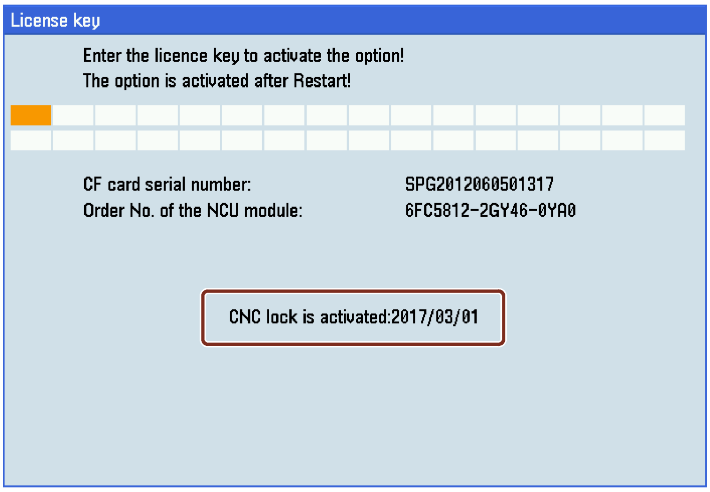


7. Select the target directory and press this key to enter it.



8. Find the desired activation file and press this softkey to import.

If no error occurs when importing the activation file, the CNC lock function is active in the control system. You can find the lock date being displayed on the HMI screen, for example:



Note

If an error occurs when importing the activation file, an error-specific alarm will be issued. The state of the CNC lock function remains unchanged.

Note

We recommend that the machine manufacturer creates a complete commissioning archive over all control system components after commissioning the machine and activating the CNC lock function. This ensures data consistency for the CNC lock function. If necessary, this commissioning archive can be used to recommission the control system without requiring a service call to reactivate the CNC lock function.

Setting the prewarning time

The prewarning time is the time range before reaching the lock date above which alarm 8063 is displayed once daily. The alarm is a reminder of the lock date, indicating the remaining days before the NC start is locked. The prewarning time is set via the machine data MD17300 (default = 30) which can be accessed through the following operations:

SYSTEM ALARM + SHIFT → MD Mach. data → Expert list → General MD

13.10.4 Extending the CNC lock function

To extend the CNC lock function, the machine manufacturer must use the AMM tool to create a new activation file **with new lock date** for the CNC lock function.

Creating the activation file

The following data is required to create a new activation file:

- Serial number of the CF card
- Serial number of the PPU
- OEM PIN
- **New lock date**

Note

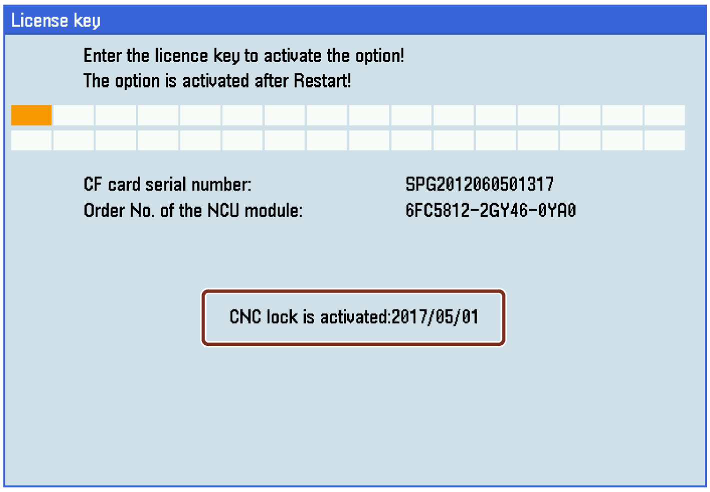
The serial numbers of the CF card and the PPU as well as the OEM PIN must match the values used when the CNC lock function was activated initially.

The process of creating an activation file for extending the CNC lock function is almost the same as that for activating the CNC lock function (see Section "Creating the activation file (Page 268)"), except that the Extend button must be clicked at step 3.

Importing the activation file

The new activation file must be imported into the control system to extend the CNC lock function. The machine manufacturer can import the new activation file directly or send the file to the end user who transfers the file to the control system. For more information about how to import the activation file, see Section "Importing the activation file (Page 269)".

If no error occurs when importing the activation file, the CNC lock function with the new lock date is active in the control system. You can find the extended lock date being displayed on the HMI screen, for example:



Note

If an error occurs when importing the activation file, an error-specific alarm will be issued. The state of the CNC lock function remains unchanged.

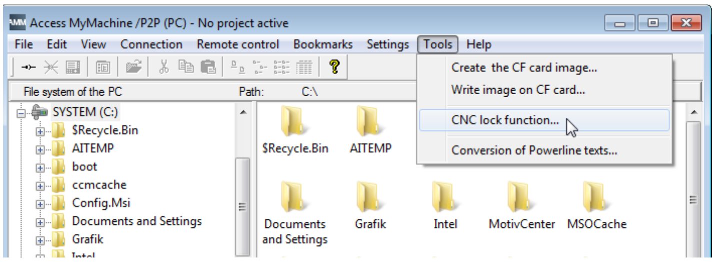
13.10.5 Deactivating the CNC lock function

To deactivate the CNC lock function, the machine manufacturer must use the AMM tool to create a deactivation file **without lock date**.

Creating the deactivation file

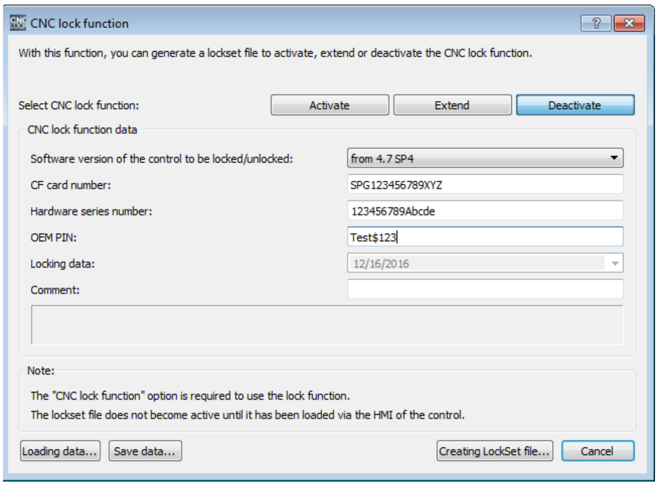
Proceed through the following steps to create the deactivation file:

1. Start Access MyMachine on your computer.
2. Select the following menu command:



3. Click this button in the displayed dialog box to proceed to the next step.

4. Enter the data required in the dialog box, for example:



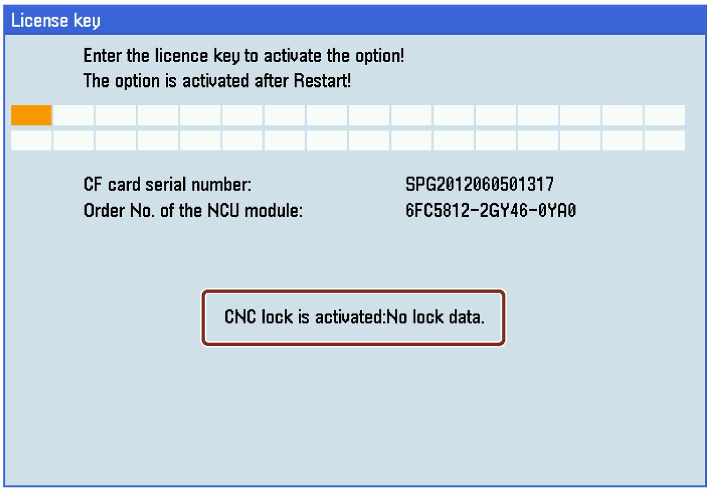
Note: The serial numbers of the CF card and the PPU as well as the OEM PIN must match the values used when the CNC lock function was activated initially. For more information, see Section "Creating the activation file (Page 268)".

5. Click this button to save the deactivation data in the form of .clc file.

Importing the deactivation file

The deactivation file must be imported into the control system to deactivate the CNC lock function. The machine manufacturer can import the deactivation file directly or send the file to the end user who transfers the file to the control system. For more information about how to import the file, see Section "Importing the activation file (Page 269)".

If no error occurs when importing the deactivation file, the CNC lock function is deactivated. You can find the CNC lock status as follows:



Note

If an error occurs when importing the deactivation file, an error-specific alarm will be issued. The state of the CNC lock function remains unchanged.

Note

We recommend that the end user creates a complete commissioning archive over all control system components after deactivating the CNC lock function. If necessary, this commissioning archive can be used to recommission the control system without re-deactivating the CNC lock function.

13.10.6 OEM PIN forgotten

The machine manufacturer or dealer has forgotten the OEM PIN that was assigned during the initial creation and so can no longer create a valid activation file for the associated control system.

Unlocking the machine

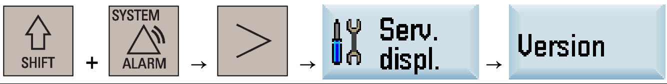
To allow the machine manufacturer or dealer to operate the machine, the technician must contact the Siemens Hotline and provide the following information:

- License certificate (CoL) for the option of the CNC lock function
- Serial number of the CF card
- Serial number of the control system (PPU)
- Software version of the CNC software

Note

For more information about how to obtain the serial numbers of the CF card and of the control system (PPU), see Section "Creating the activation file (Page 268)".

The software version of the CNC software can be found on the PPU HMI through the following operations:



The machine manufacturer or dealer receives from the Hotline the activation file to unlock the machine. The unlocking acts, however, only on the hardware of the control system (PPU). The PLC project is not unlocked. For this reason, the original PLC project appropriate for the machine must be available.

Further information concerning the procedure can be obtained from the Siemens Hotline.

13.10.7 Other information

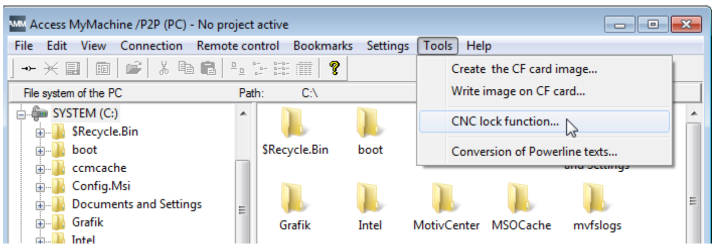
Project file

The AMM tool can be used to create an unencrypted project file (.ucls) that contains the following data:

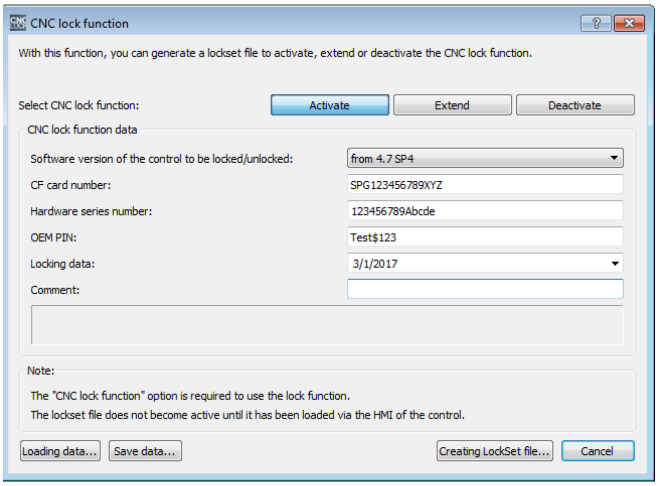
- Serial number of the CF card
- Serial number of the hardware (PPU)
- OEM PIN
- Creation date
- Lock date

Proceed through the following steps to create the unencrypted project file:

1. Start Access MyMachine on your computer.
2. Select the following menu command:



3. Enter the data required in the dialog box, for example:



4. Click this button to save the data in the form of .ucls file.

Clicking this button allows you to reimport the unencrypted data stored in the project file.

Faulty settings of date

If a date earlier than the actual date is set for activated CNC lock function, alarm 8065 is issued after NC restart and then NC start is disabled. In this case, you must correct the date and perform an NC restart again to clear the alarm.

If during the correcting, a future date is set inadvertently, alarm 8066 is issued. Provided no NC restart has been performed, the date can still be corrected. After NC restart, a date set in the future is considered as being an actual date and can no longer be reset.

NOTICE
Shorter service life After NC restart, a future date set earlier than the lock date reduces the service life until the lock date. If a date equal to or later than the lock date is set, alarm 8064 is issued and the NC start disabled. Make sure you set the date correctly prior to NC restart.

13.11 Commissioning the PLC axis

The PLC can control axes/spindles via data blocks of the PLC user interface. The PLC axis can be used for turret/magazine control or workpiece transfer on a turning or milling machine.

There are three positioning modes for the PLC axis:

- Positioning via the PLC user interface
- Positioning with the indexing position table predefined in the general machine data
- Positioning according to the distance value defined in the axis machine data

PLC user interface

Signals to PLC axis (excerpt)

DB380x	PLC -> NCK interface [r/w]							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
8	Request PLC axis/spindle			NC/PLC axis activation signal				Request NC axis/spindle
3000	Start axis positioning							
3002						Traversing dimension, inches (not metric)	Distance condition, shortest distance (DC)	Distance condition, incremental (IC)
3003	Indexing position						Distance condition, absolute positive direction (ACP)	Distance condition, absolute negative direction (ACN)
3004	Position (REAL, with indexing axis: DINT)							
3008	Feedrate velocity (REAL), if < 0, the value is taken from machine data POS_AX_VELO							

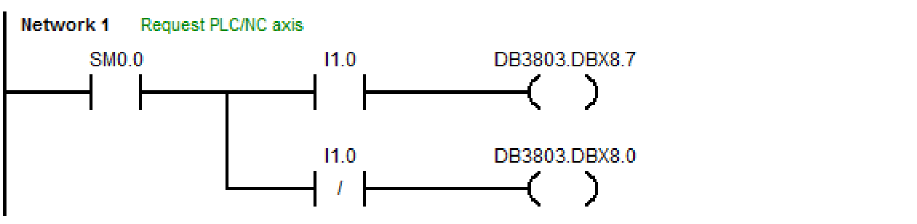
Signals from PLC axis (excerpt)

DB390x	**Signals from PLC axis [r]** NCK -> PLC interface							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
8	PLC axis/ spindle	Neutral axis/ spindle	Axis interchange possible	New type requested from PLC				NC axis/spindle
3000	Positioning axis active	Position reached					Error while traversing	Axis cannot be started
3003	Error number							

Commissioning examples

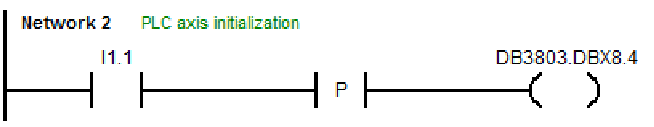
The following takes the fourth axis for example. Firstly, the PLC axis must be requested from the PLC via the PLC user interface.

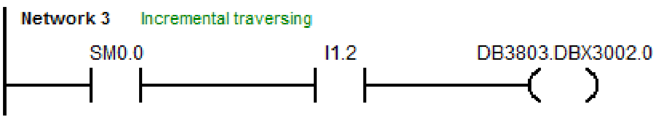
Positioning via the PLC user interface

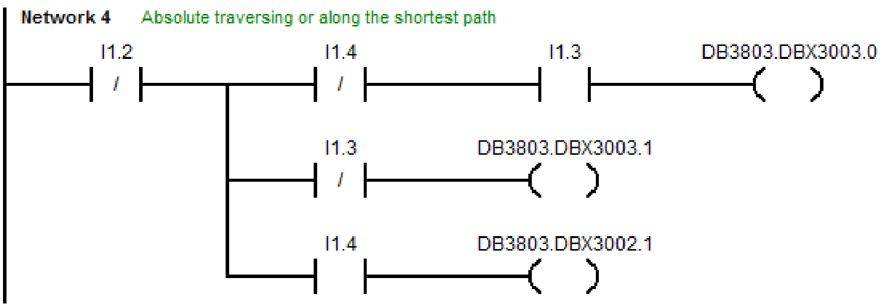
<table>
<tr><td>


</td><td>

- DB3803.DBX8.7 = 1: request PLC axis
- DB3803.DBX8.0 = 1: request NC axis

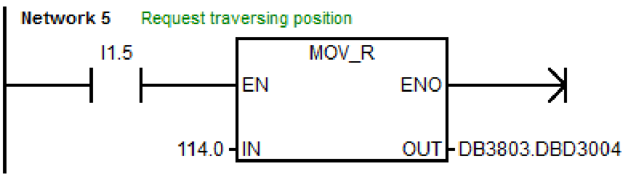
</td></tr>
<tr><td colspan="2">


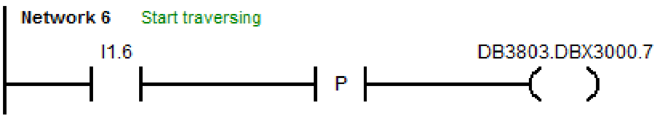
</td></tr>
<tr><td>


</td><td>DB3803.DBX3002.0 = 1: distance condition, incremental (IC)</td></tr>
<tr><td>


</td><td>

- DB3803.DBX3003.0 = 1: distance condition, absolute negative direction (ACN)
- DB3803.DBX3003.1 = 1: distance condition, absolute positive direction (ACP)
- DB3803.DBX3002.1 = 1: distance condition, shortest distance (DC)

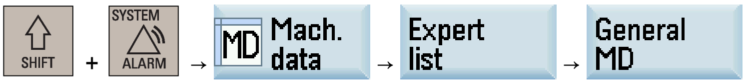
</td></tr>
<tr><td>


</td><td>PLC axis traverses to the position 114.0.</td></tr>
<tr><td colspan="2">


</td></tr>
<tr><td colspan="2">Result: The PLC axis traverses to the position setpoint (value set in DB3803.DBD3004).</td></tr>
</table>

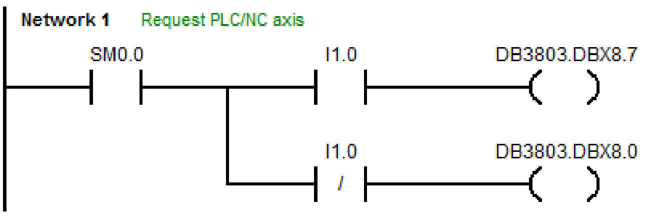
Positioning with the predefined indexing position table

You can proceed through the following operations on the PPU to define the indexing position table:

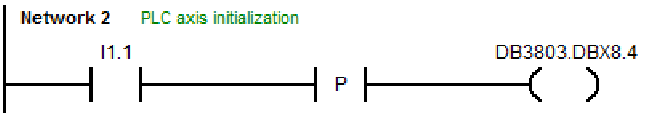


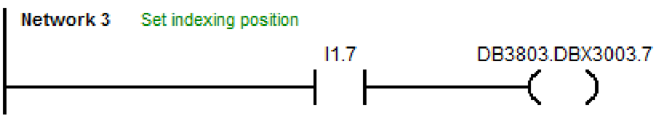
- Define the number of positions in MD10900 INDEX_AX_LENGTH_POS_TAB_1;
- Enter the value of each position in MD10910 INDEX_AX_POS_TAB_1.

10900	INDEX_AX_LENGTH_POS_TAB_1	10		re
10910[0]	INDEX_AX_POS_TAB_1	0	mm|de..	re
10910[1]	INDEX_AX_POS_TAB_1	36	mm|de..	re
10910[2]	INDEX_AX_POS_TAB_1	72	mm|de..	re
10910[3]	INDEX_AX_POS_TAB_1	108	mm|de..	re
10910[4]	INDEX_AX_POS_TAB_1	144	mm|de..	re
10910[5]	INDEX_AX_POS_TAB_1	180	mm|de..	re
10910[6]	INDEX_AX_POS_TAB_1	216	mm|de..	re
10910[7]	INDEX_AX_POS_TAB_1	252	mm|de..	re
10910[8]	INDEX_AX_POS_TAB_1	288	mm|de..	re
10910[9]	INDEX_AX_POS_TAB_1	324	mm|de..	re
10910[10]	INDEX_AX_POS_TAB_1	0	mm|de..	re
10910[11]	INDEX_AX_POS_TAB_1	0	mm|de..	re
10910[12]	INDEX_AX_POS_TAB_1	0	mm|de..	re

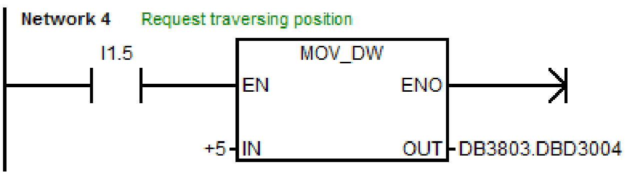


- DB3803.DBX8.7 = 1: request PLC axis
- DB3803.DBX8.0 = 1: request NC axis

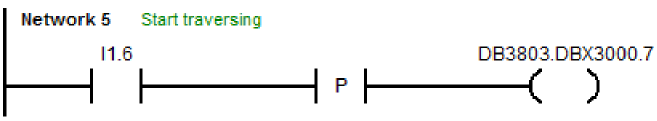




Indexing position active



Select the fifth indexing position



Result: The PLC axis traverses to the fifth position set in MD10910[4].

For more information about PLC axis function, see the SINUMERIK 808D ADVANCED Function Manual.

13.12 Configuring the DSC function for the digital spindle

Function overview

The Dynamic Stiffness Control (DSC) function eliminates the deadtime that necessarily exists at the speed-setpoint interface normally used between the NCK and drive due to relocation of the position controller into the drive.

To use the DSC function for the digital spindle, you must additionally connect an external spindle encoder via interface X60 in addition to the motor encoder and configure two measuring systems. For more information about interface X60, see Section "Analog spindle interface - X54, spindle encoder interface - X60 (Page 89)".

Setting parameters for two measuring systems

SHIFT + SYSTEM ALARM

1. Select the system data operating area.
2. Open the axis machine data window through the following softkey operations:
   MD Mach. data → Expert list → Axis MD

Axis +

Axis -

3. Use these softkeys to switch to the data set for the spindle (MSP1).

Search

4. Use this softkey or the cursor keys to search for the following machine data and assign the desired values:
   - 30200 = 2
   - For the first measuring system (motor encoder):
     - 30210[0] = 5
     - 30220[0] = 4
     - 30230[0] = 1
     - 30240[0] = 1
     - 31020[0] = resolution of the motor encoder
     - 31040[0] = 0
     - 31050[0] = load gearbox denominator
     - 31060[0] = load gearbox numerator
   - For the second measuring system (external encoder):
     - 30210[1] = 0
     - 30220[1] = 4
     - 30230[1] = 4
     - 30240[1] = 2
     - 31020[1] = resolution of the external spindle encoder
     - 31040[1] = 1
     - 31050[1] = load gearbox denominator
     - 31060[1] = load gearbox numerator
     - 36300[1] ≤ 2000000 (2 MHz which is the max. frequency of interface X60)

Activate

5. Press this softkey to activate the value changes. Note that the control system restarts to accept the new values.

After finishing the parameter setting, you can activate the second measuring system by setting the following PLC user interfaces (where the fourth axis is configured as spindle):

- DB3803.DBX1.5 = 0
- DB3803.DBX1.6 = 1

Activating the DSC function

With the second measuring system activated, you can use the Dynamic Stiffness Control function by setting MD32640[0] = 1.

Precondition

Before activating the DSC function via MD32640, you must check and make sure MD32110[0] = 1 and MD32110[1] = 1. In case of MD32110[0]/MD32110[1] = -1, you must first change its value to 1 and then set MD32100 and drive parameter p1821 according to your desired encoder feedback direction and motor direction of rotation. Note that to change the parameter p1821, you need to first set the drive parameter p10 = 3 when the drive is in "S OFF" state.

Operating sequence of setting MD32640

SHIFT + SYSTEM ALARM

1. Select the system data operating area.
2. Open the axis machine data window through the following softkey operations:
   MD Mach. data → Expert list → Axis MD

Axis +

Axis -

3. Use these softkeys to switch to the data set for the spindle (MSP1).

Search

4. Use this softkey or the cursor keys to search for MD32640 and set its value to 1.

Activate

5. Press this softkey to activate the value changes. Note that the control system restarts to accept the new values.

Note

Before performing the drive tuning for a digital spindle configured with two measuring systems, make sure you set MD32110[0] = 1 and MD32110[1] = 1. Otherwise, the drive tuning process cannot be completed successfully.

13.13 Cycle protection

13.13.1 Overview

Overview

Note

You require the software option "Lock MyCycles" (article number: 6FC5800-0AP54-0YB0) in order to use this function.

With cycle protection function, cycles can be encrypted and then protected in the control after you encrypt the cycle files (.MPF/.SPF) with Access MyMachine (AMM) tool and transfer the generated encrypted cycle files (.CPF) to the control.

In order to protect the manufacturer's know-how, any type of view is inhibited for cycles with cycle protection. If service is required, the machine manufacturer must provide the unencrypted cycle.

Note

This type of encryption is in compliance with export restrictions and embargo regulations.

Note

End user

When using encrypted cycles of a machine manufacturer, if problems occur, then only the service department of the machine manufacturer should be contacted.

Machine manufacturer

When using encrypted cycles, the machine manufacturer must ensure that original, unencrypted cycles are archived with the appropriate version management.

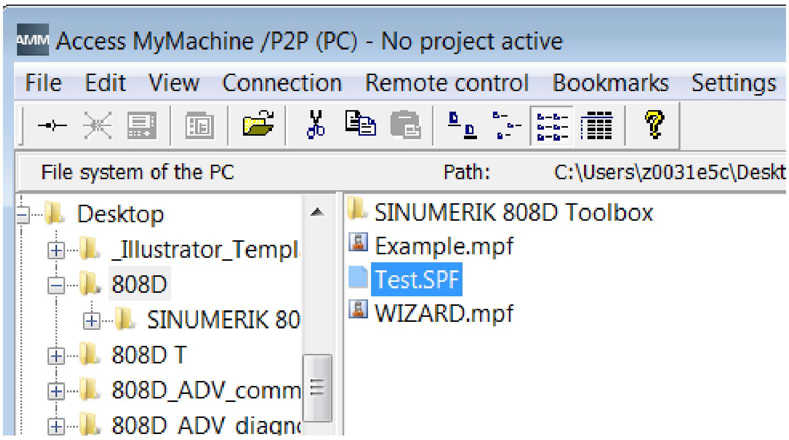
Requirements

- The option "Lock MyCycles" must be activated with a license key. For more information about how to activate the optional functions, see Section "Activating the optional functions (Page 127)".
- The AMM tool must be installed on your computer. For more information about AMM installation, see Section "Installing the software tools (Page 38)".

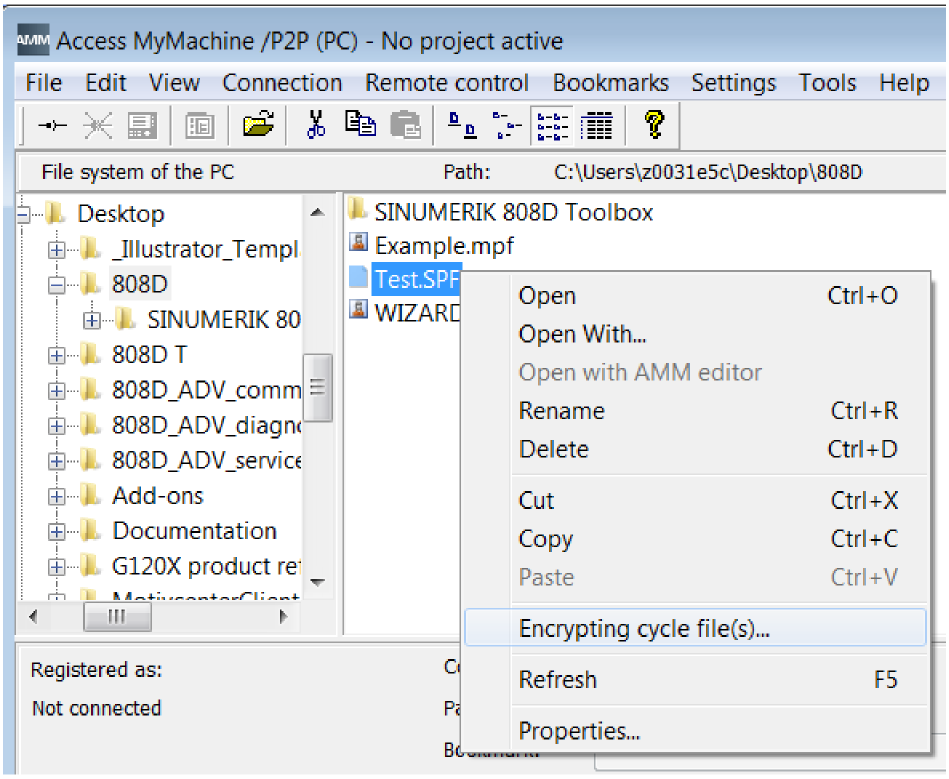
13.13.2 Encrypting cycle file(s)

Proceed through the following steps to use the AMM tool to encrypt the cycle files:

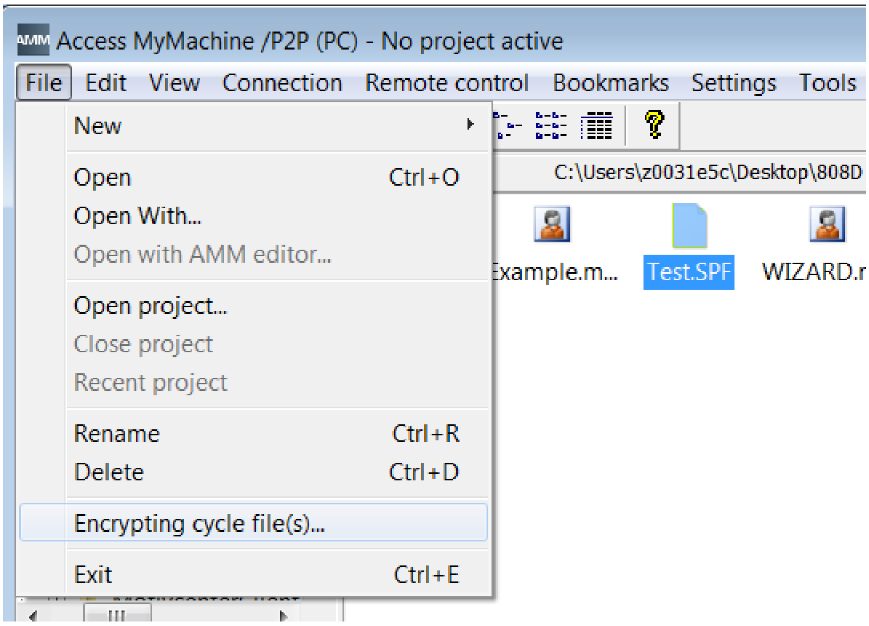
1. Start Access MyMachine on your computer.
2. Select one or more cycle files as desired from the PC file system, for example:



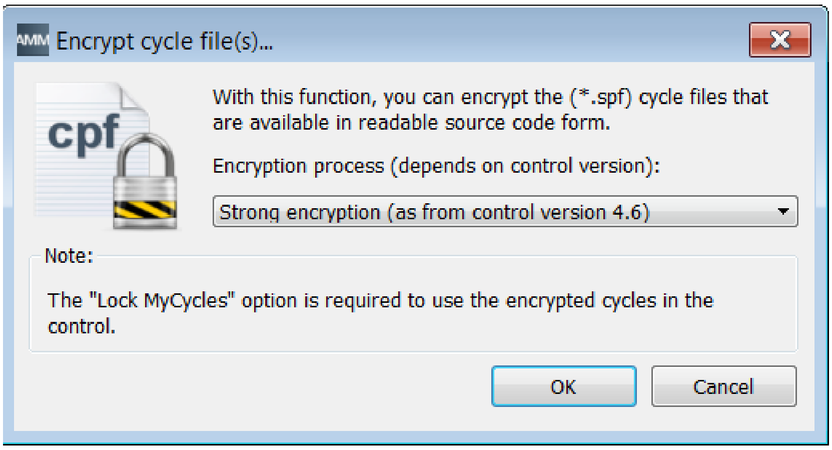
3. Right-click the file to open the context menu and select the cycle encrypting function as follows:



Alternatively, you can select this function via the main menu:

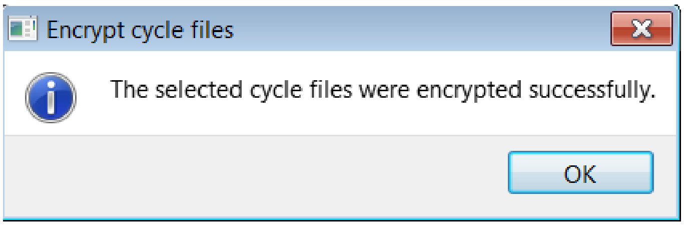


4. Select the desired encryption option from the following dialog box:



5. Click this button and the encryption process starts.

After the encryption process completes successfully, the following message appears and an encrypted cycle file is generated in the same directory as the original file. The name of the new created file is "Original file name.CPF".



13.13.3 Handling the encrypted cycles

The machine manufacturer must transfer the encrypted cycles (.CPF files) to the control and perform a power-on reset before executing the encrytped cycles. If no power-on reset is performed, the processing of a .CPF file causes the NC alarm 15176.

An encrypted cycle can be deleted or unloaded just like an .SPF or .MPF file. All the encrypted .CPF files are also backed up when an archive is generated.

Executing an encrypted cycle

- An encrypted cycle cannot be directly selected for execution. It can only be called from a part program - or directly in MDI.
- An encrypted cycle cannot be executed with the external execution function.

Using encrypted cycles at one or more machines

- **Using encrypted cycles at only one machine**

  If a cycle must not be used at another machine, then it can be permanently linked to a particular machine. The machine data MD18030 $MN_HW_SERIAL_NUMBER can be used for this purpose.

  When the control powers on, the unique hardware serial number of the CF card is saved in this machine data. If a cycle is to be permanently linked to a machine, then the serial number of the CF card (MD18030) must be queried in the call of the cycle. If the cycle identifies a serial number that does not match, then an alarm can be output in the cycle and so prevents further processing. As the code of the cycle is encrypted, there is always a fixed link to a defined hardware.
- **Using encrypted cycles at several machines**

  If a cycle is to be permanently linked to several defined machines, then each of the hardware serial numbers must be entered in the cycle. The cycle must be re-encrypted with these hardware serial numbers.

14 Customizing HMI display with EasyXLanguage scripts

14.1 Scope of functions

The "Generate user dialogs" function offers an open structure and enables the user to develop customer-specific and application-specific user interfaces in the SINUMERIK 808D ADVANCED.

The control system offers an XML-based script language for generating user dialogs.

This script language makes it possible to display machine-specific menus and dialog forms in the user-defined operating area on the HMI.

All dialog forms can be designed on a language-neutral basis. In such cases, the system reads out the texts to be displayed from the accompanying language database.

Use

The defined XML instructions offer the following properties:

- Display dialogs containing the following elements:
  - Softkeys
  - Variables
  - Texts and Help texts
  - Graphics and Help displays
- Call dialogs by performing the following operation:
  - Pressing the (start) softkeys
- Restructure dialogs dynamically by performing the following operations:
  - Editing and deleting softkeys
  - Defining and designing variable fields
  - Inserting, exchanging, and deleting display texts (language-dependent or language-neutral)
  - Inserting, exchanging, and deleting graphics
- Initiate operations in response to the following actions:
  - Displaying dialogs
  - Inputting values (variables)
  - Selecting a softkey
  - Exiting dialogs
- Exchange data between dialogs
- Operate variables as follows:
  - Read (NC, PLC, and user variables)
  - Write (NC, PLC, and user variables)
  - Combine with mathematical, comparison, or logic operators
- Execute the following functions:
  - Subprograms
  - File functions
  - PI services
- Apply protection levels according to user classes

The valid elements (tags) for the script language are described in Section "XML identifier (Page 288)".

Note

The following section is not intended as a comprehensive description of XML (Extensible Markup Language). Please refer to the relevant specialist literature for additional information.

14.2 Fundamentals of configuration

Configuration files

The defining data for new user interfaces are stored in configuration files. These files are automatically interpreted and the result displayed on the screen. Configuration files are not stored in the software supplied and must first be set up and loaded by the user.

Example configuration files (EasyXLanguage scripts) are included in the ...\examples\SINUMERIK_808D\easyXL folder of the Toolbox.

An XML editor or another form of text editor can be used to generate the configuration files.

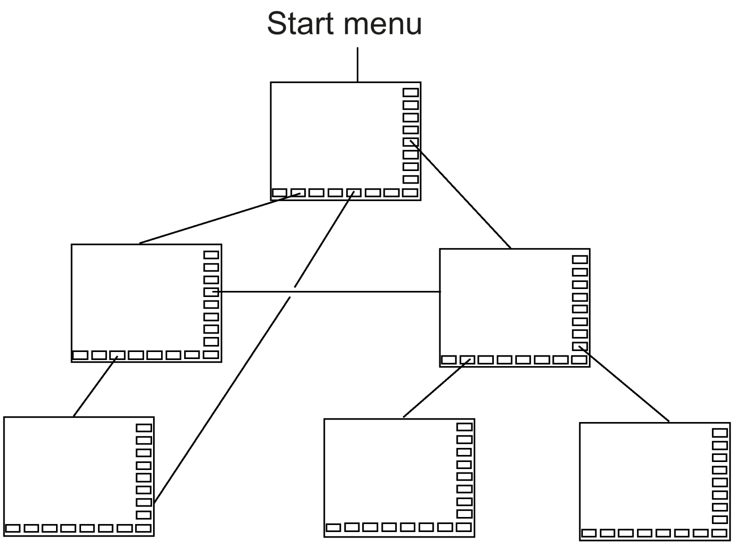
Note

The configuration file name is case-insensitive.

Menu tree principle

Several interlinked dialogs create a menu tree. A link exists if you can switch from one dialog to another. You can use the newly defined horizontal/vertical softkeys in this dialog to call the preceding or any other dialog.

Configured start softkeys can be used to create a further menu tree behind the start menu:



Start menu

Pressing this key on the PPU calls the start menu, which is defined by the name "main" in the "xmldial.xml" file. The start menu is used to initiate your own operating sequences.

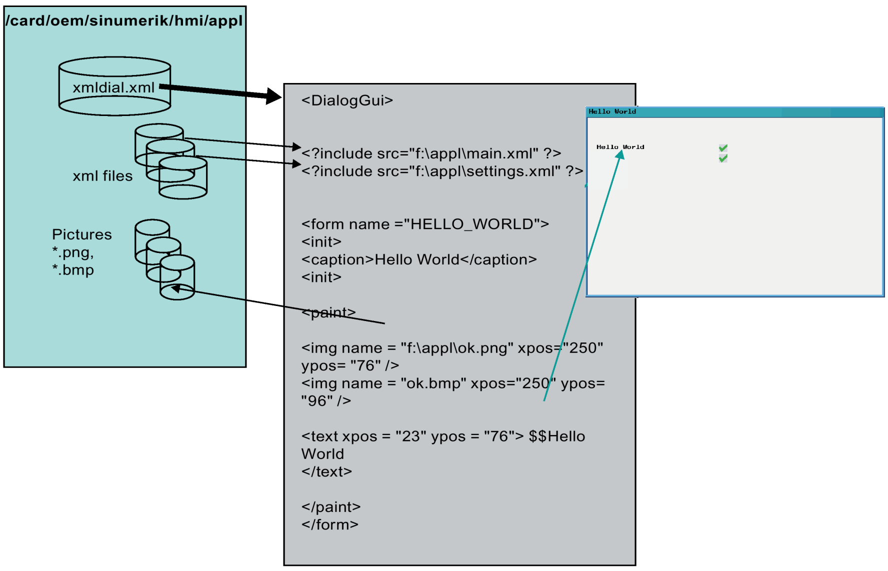
You can use the "main" menu to link your own dialogs or additional softkey bars so that they can be loaded and used for executing additional actions.

14.3 Configuration files (EasyXLanguage scripts)

The following files in the relevant manufacturer's folder on the control are needed to configure user dialogs:

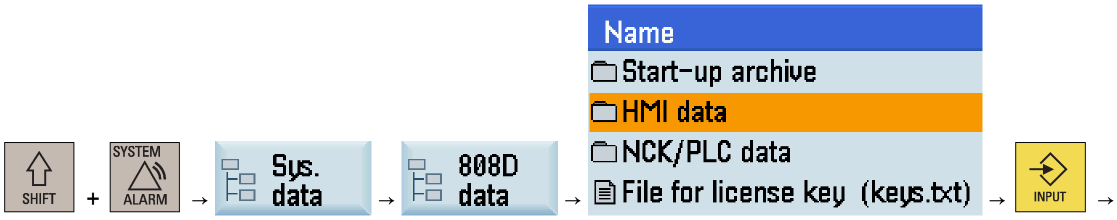
File type	Name of the file	Meaning
Script file	"xmldial.xml"	This script file uses XML tags to control how the configured softkey menus and dialog forms will appear in the user-defined operating area on the HMI.
Bitmaps	E.g. "text.bmp" or "text.png"	The control system supports BMP and PNG formats.
XML files inserted in the "xmldi-al.xml" control file with the "INCLUDE" XML tag.	E.g. "machine_settings.xml"	These files also contain programmed instructions for displaying the dialog forms and parameters on the HMI.

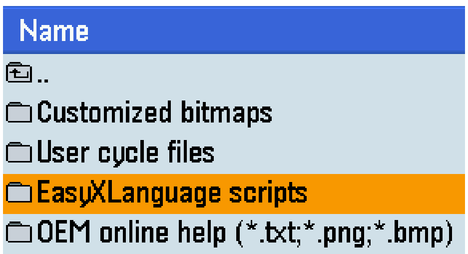
Dependencies of files for configuring user dialogs



Loading configuration

Make sure that you copy the generated configuration files to the following path from a USB stick directly or from a network drive via Ethernet connection:





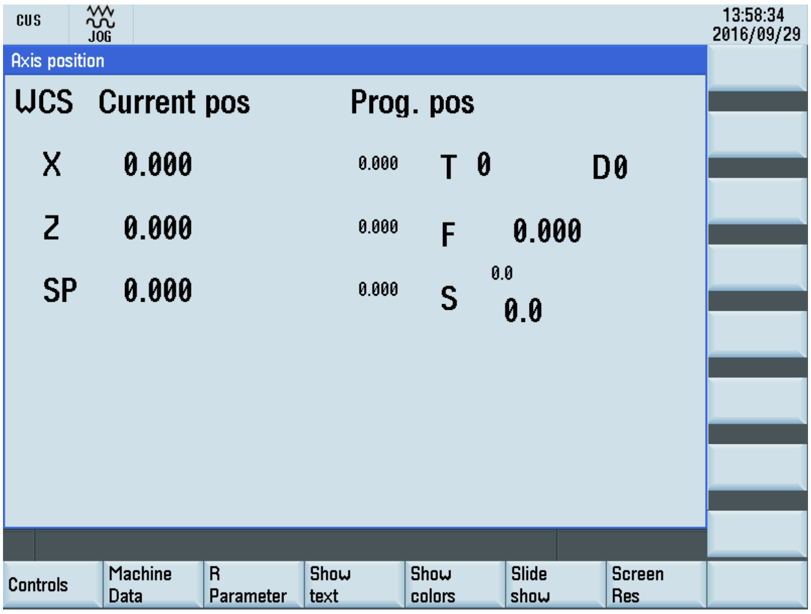
Note

When a script file "xmldial.xml" is available in the folder above, you can call the start menu in the user-defined operating area.

After the initial copying process, reset the control system through the following operations:

Example of a user dialog on the HMI

The configured softkey menus are displayed when the user-defined operating area is called. This enables the user to operate the dialog forms which have been configured.



See also

Predefined functions (Page 348)

14.4 Structure of configuration file

Overview

A configuration file consists of the following elements:

- Description of the "main" start menu with start softkeys
- Definition of dialogs
- Definition of variables
- Description of the blocks
- Definition of softkey bars

14.5 Language dependency

Language-dependent texts are used for:

- Softkey labels
- Headers
- Help texts
- Any other texts

14.6 XML identifier

14.6.1 General structure

Structure and instructions of the script file for dialog configuration

All dialog configurations should be stored in the **DialogGui** tag.

```
<DialogGui>
…
</DialogGui>
```

Example:

```
<?xml version="1.0" encoding="utf-8"?>
<DialogGui>
…
<FORM name ="Hello_World">
<INIT>
<CAPTION>Hello World</CAPTION>
</INIT>
...
</FORM>

</DialogGui>
```

Instructions

The language offers the following instructions for executing conditional instructions and loop controls:

- For loop
- While loop
- Do while loop
- Conditional processing
- Switch and case instructions
- Operator controls in a dialog form
- Softkey descriptions
- Define variables

For a detailed description of instructions, see Instruction/identifier description (Page 288).

14.6.2 Instruction/identifier description

The following **XML tags** are defined for generating dialogs and menus, and for executing program sequences:

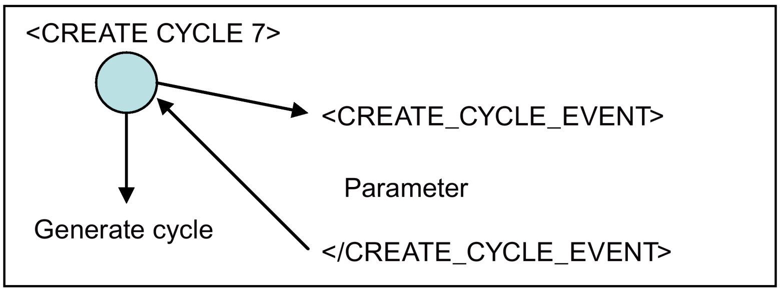
Note

Attribute values that are in quotation marks "<...>" should be replaced by the currently used expressions.

Example:
<DATA_LIST action="read/write/append" id="<list name>">
is programmed as follows:
<DATA_LIST action="read/write/append" id="my datalist">

Tag identifier	Meaning
BREAK	Conditional cancellation of a loop.
CONTROL	The tag is used to generate control elements.

Tag identifier	Meaning
CONTROL_RESET	The tag enables one or more control components to be restarted. **Syntax:** `<CONTROL_RESET resetnc="TRUE" />` **Attributes:** • **RESETNC = "TRUE"** The NC component is restarted.

CREATE_CYCLE_EVENT	If the parser starts to process the tag CREATE_CYCLE, initially, the message <CREATE_CYCLE_EVENT> is sent to the active form. This message can be used for preparing the cycle parameters, before the parser generates the NC operation from the parameter list and the generation rule.
	
	Syntax:
	`<CREATE_CYCLE_EVENT>`
	…
	…
	`</CREATE_CYCLE_EVENT>`
	
	Example:
	`<SOFTKEY_OK>`
	…
	`<CREATE_CYCLE />`
	…
	…
	`<SOFTKEY_OK>`
	…
	…
	
	`<FORM>`
	`<NC_INSTRUCTION>MY_CYCLE($P1, $P2)</ NC_INSTRUCTION >`
	…
	…
	`<CREATE_CYCLE_EVENT>`
	`<type_cast name="P1" type="int"/>`
	
	`<OP> P1 = P1 * 150 </OP>`
	
	`</CREATE_CYCLE_EVENT>`
	…
	…
	
	`</FORM>`

Tag identifier	Meaning

DATA	The tag enables the NC, PLC, GUD and drive data to be directly written to.
	The Addressing components (Page 339) section contains details on address formation.
	
	Attribute:
	• **name**
	Variable address
	
	Tag value:
	All alphanumeric terms are approved as tag values. If a value is to be written from a local variable directly, the **$** replacement operator preceding the name of the local variable should be used.
	
	Syntax:
	`<DATA name="<variable name>"> value </DATA>`
	
	Example:
	`<DATA name = "plc/mb170"> 1 </DATA>`
	…
	`<LET name = "tempVar"> 7 </LET>`
	`<!— the contents of the local variables "tempVar" are written to bit memory byte 170 →`
	`<DATA name = "plc/mb170">$tempVar</DATA>`

DATA_LIST	The tag enables the listed drive and machine data to be saved or restored.
	Addresses are listed in lines. Section "Addressing components (Page 339) " describes how addresses are formed.
	Up to 20 temporary data lists can be created.
	
	Attributes:
	• **action**
	read – the values of the listed variables are stored in a temporary memory
	append – the values of the listed variables are added to an existing list
	write – the backed up values are copied to the relevant machine data
	• **id**
	The identifier identifies the temporary memory
	
	Syntax:
	`<DATA_LIST action="<read/write/append>"  id="<list name>">`
	`NC/PLC address compilation`
	`</DATA_LIST>`
	
	Example:
	`<DATA_LIST action ="read" id="<name>">`
	`nck/channel/parameter/r[2]`
	`nck/channel/parameter/r[3]`
	`nck/channel/parameter/r[4]`
	`$MN_USER_DATA_INT[0]`
	…
	`</ DATA_LIST>`
	`<DATA_LIST action ="write" id="<name>" />`

Tag identifier	Meaning

DO_WHILE	Do while loop
	`DO`
	`   Instructions`
	`WHILE (Test)`
	
	Syntax:
	`<DO_WHILE>`
	`Instructions`
	`…`
	`<CONDITION>…</CONDITION>`
	`</DO_WHILE>`
	The Do while loop comprises a block of instructions and a condition. The code in the instruction block is executed first, then the condition is applied. If the condition is true, the function executes the code section again. This is continually repeated until the condition is false.
	
	Example:
	`<DO_WHILE>`
	`<DATA name = "PLC/qb11"> 15 </DATA>`
	`<CONDITIION> "plc/ib9" == 0 </CONDITION>`
	`</DO_WHILE>`

DYNAMIC_INCLUDE	The tag includes an XML script file.
	Contrary to the INCLUDE tag, read-in is first only realized when executing the corre-sponding operation.
	For large projects, the use of the tag reduces the load time of the customer area and/or the cycle support. Further, the average level of resources is reduced, as not all of the dialogs are always called during a session.
	
	Syntax:
	<DYNAMIC_INCLUDE src="path name"/>
	
	Example:
	`<SOFTKEY POSITION="3">`
	`   <CAPTION>MY_MENU</CAPTION>`
	`   <DYNAMIC_INCLUDE src/>`
	`   <NAVIGATION>MY_MENU</NAVIGATION>`
	</SOFTKEY>

ELSE	Instruction for situations where the condition has not been met (**IF, THEN, ELSE**)

Tag identifier	Meaning

FOR	For loop
	`for (initialization; test; continuation) instruction(s)`
	
	Syntax:
	`<FOR>`
	`<INIT>…</INIT>`
	`<CONDITION>…</CONDITION>`
	`<INCREMENT>…</INCREMENT>`
	`Instructions`
	`…`
	`</FOR>`
	The For loop is executed as follows:
	1. Evaluation of the expression **initialization** (INIT).
	2. Evaluation of the expression **test** (CONDITION) as a Boolean expression.
	If the value is false, the For loop is exited.
	3. Execution of the following instructions.
	4. Evaluation of the expression **continuation** (INCREMENT).
	5. Continue with 2.
	All the variables within the INIT, CONDITION, and INCREMENT branches are declared and initialized outside the FOR loop.
	
	Example:
	`<LET name = "count">0</LET>`
	`<FOR>`
	`   <INIT>`
	`   <OP> count = 0</OP>`
	`   </INIT>`
	`   <CONDITION> count <= 7 </CONDITION>`
	`   <INCREMENT>`
	`   <OP> count = count + 1 </OP>`
	`   </INCREMENT>`
	`   <OP> "plc/qb10" = 1+ count </OP>`
	`</FOR>`

Tag identifier	Meaning
FORM	The tag contains the description of a user dialog. The relevant tags are described in the section on generating menus and dialog forms. **Syntax:** `<FORM name="<dialog name>" color="#ff0000">` **Attributes:** • **color** Background color of the dialog form (color coding, see Section "Color coding (Page 309)") – Default white • **name** Identifier of the form • **type** Permissible value is *cycle* , which identifies a user cycle screen form • **xpos** X-position of the top left corner of the dialog box (optional) • **ypos** Y position of the top left corner (optional) • **width** Extension in the X direction (in pixels) (optional) • **height** Extension in the Y direction (in pixels) (optional)

FORM Continued	**Attributes:**
	• **truetypefont**
	Whether the font of the dialog form is of the true type (optional)
	
	Values:
	• **true**
	The font of the dialog form is of the true type regardless of the value of machine data MD1113
	• **false**
	The font of the dialog form is set via bit 0 of MD1113 (default)
	– Bit 0 = 0: the fixed type font is used for text display (default)
	– Bit 0 = 1: the true type font is used for text display
	
	Example:
	`<FORM name="dialog name" truetypefont="true">`
	…
	…
	…
	`</form>`

Tag identifier	Meaning
FORM Continued	You can define how the images in a form will be displayed on the screen with a resolution of 800x600 pixels, that is, adapt the image size to the screen, by setting bit 1 of MD1113. **Precondition:** This function is applicable only when the script file is copied to the control system with a screen resolution of 800x600 pixels. **Values:** • Bit 1 = 0: the image is automatically scaled up by a factor of 1.25 (default) • Bit 1 = 1: the original image size is kept without automatic scaling

IF	Conditional instruction (**IF, THEN, ELSE**)
	The THEN and ELSE tags are enclosed in the IF tag.
	The condition that is executed in the CONDITION tag follows the IF tag. The further processing of the instructions depends upon the result of the operation. If the function result is true, then the THEN branch is executed and the ELSE branch is skipped. If the result of the function is false, the parser executes the ELSE branch.
	
	Syntax:
	`<IF>`
	`<CONDITION> Condition != 7 </CONDITION>`
	`<THEN>`
	`Instruction for the case: Condition fulfilled`
	`</THEN>`
	`<ELSE>`
	`Instruction for the case: Condition not fulfilled`
	`</ELSE>`
	`</IF>`
	Or simplified as follows (cannot be used for addresses that require quotation marks):
	`<IF CONDITION>="Condition != 7">`
	`<THEN>`
	`Instruction for the case: Condition fulfilled`
	`</THEN>`
	`<ELSE>`
	`Instruction for the case: Condition not fulfilled`
	`</ELSE>`
	`</IF>`
	
	Example:
	`<IF>`
	`<CONDITION> "plc/mb170" != 7 </CONDITION>`
	`<THEN>`
	`<OP> "plc/mb170" = 7 </OP>`
	…
	`</THEN>`
	`<ELSE>`
	`<OP> "plc/mb170" = 2 </OP>`
	…
	`</ELSE>`
	`</IF>`

<table>
<tr><th>Tag identifier</th><th>Meaning</th></tr>
<tr><td>INCLUDE</td><td>The instruction includes an XML description.
(see also DYNAMIC_INCLUDE in this table)
Attribute:
• src
Contains the path name.
Syntax:
<?INCLUDE src="<Path name>" ?></td></tr>
<tr><td>LET</td><td>The instruction creates a local variable under the specified name.
Fields:
Using the attribute dim (dimension) single or two-dimensional fields can be created. The field index addresses the individual field elements.
For a two-dimensional field, initially the line index is specified and then the column index.
• Single-dimensional field:
Indices 0 to 4
<table><tr><td>0</td></tr><tr><td>1</td></tr><tr><td>2</td></tr><tr><td>3</td></tr><tr><td>4</td></tr></table>
• Two-dimensional field:
Index line 0 to 3 and index column 0 to 5
<table>
<tr><td>0,0</td><td>0,1</td><td>0,2</td><td>0,3</td><td>0,4</td><td>0,5</td></tr>
<tr><td>1,0</td><td>1,1</td><td>1,2</td><td>1,3</td><td>1,4</td><td>1,5</td></tr>
<tr><td>2,0</td><td>2,1</td><td>2,2</td><td>2,3</td><td>2,4</td><td>2,5</td></tr>
<tr><td>3,0</td><td>3,1</td><td>3,2</td><td>3,3</td><td>3,4</td><td>3,5</td></tr>
</table>
Attributes:
• name
Variable name
• type
The variable type can be an integer (INT), unsigned integer (UINT), double (DOUBLE), float (FLOAT), string (STRING), or STRUCT. The variable type can also be a structure defined with typedef. If there is no type instruction specified, the system creates an integer variable.
<LET name = "VAR1" type = "INT" />
• permanent
If the attribute is set to true, then the variable value is saved permanently. This attribute is only effective for a global variable.
• dim
The following number of field elements must be specified. For a two-dimensional field, the second dimension is specified after the first dimension separated by a comma.
A field element is accessed via the field index, which is specified in square brackets after the variable name.
name[index] or name[row,column]
– Single-dimensional field: dim="<Number of elements>"
– Two-dimensional field: dim="<Number of lines>,<number of columns>"
Non-initialized field elements are pre-assigned with "0".</td></tr>
</table>

<table>
<tr><th>Tag identifier</th><th>Meaning</th></tr>
<tr><td>

LET Continued

</td><td>

Example:

One-dimensional field:

```
<let name="array" dim="10"></let>
```

Two-dimensional field:

```
<let name="list_string" dim="10,3" type="string"></let>
```

Pre-assignment:

A variable can be initialized with a value.

```
<LET name = "VAR1" type = "INT"> 10 </LET>
```

If values comprising NC or PLC variables are saved in a local variable, the assignment operation automatically adapts the format to that of the variables which have been loaded.

- Pre-assignment for a string variable:

  Texts containing more than one line can be assigned to a string variable if the formatted text is transferred as a value. If a line is to end with a line feed <LF> (line feed) , the characters "\\n" should be added at the end of the line.

```
<LET name = "text" type = "string"> F4000 G94\\n
G1 X20\\n
Z50\\n
M2\\n
</LET>>
```

Fields (Arrays):

```
<let name="list" dim="10,3">
  {1,2,3},
  {1,20}
</let>

<let name="list_string" dim="10,3" type="string">
  {"text 10","text 11"},
  {"text 20","text 21"}
</let>
```

Assignment:

Values made up of the machine data or subroutines can be assigned to a variable using the assignment operation "=".

A variable remains valid until the end of the higher-level XML block.

Variables which are to be available globally should be created directly after the **DialogGUi** tag.

The following must be observed for a dialog box:

- The message processing opens the corresponding tag.
- The tag is closed after the message has been executed.
- All variables within the tag are deleted when closing.

</td></tr>
</table>

Tag identifier	Meaning
LET Continued	**Variable type struct**: This variable type contains a composition of variables that can be addressed using the structure name. A structure can contain all variable types and structures. Within the structure, a variable is declared with the "element" tag. The attributes of the tags and the initialization correspond to the attributes and initialization of the let instruction. <let name="name" type="struct"> <element name="<Name>" type="<Variable type>" /> … … … </let>

LET Continued	Access to a variable of the structure is via the structure name and variable name. Both names are separated by a point operator.
	
	<op>
	Structure_name.variable_name = value;
	</op>
	
	Example:
	<let name="info" type="struct">
	  <element name="id" type="int" />
	  <element name="name" type="string" />
	  <element name="phone" type="string" />
	</let>
	
	<op>
	  info.id = 1;
	  info.name = _T"my name";
	  info.phone = _T"0034 45634";
	</op>
	
	Initialization of structures:
	Structures can be initialized when the variables are created by specifying an initial value for each structure element. In an array of structures, each structure must be separated from the others by braces.

MSG	The operator component shows the message which is indicated in the tag. **Example:** <MSG text ="my message" />

Tag identifier	Meaning
MSGBOX	The instruction opens a message box whose return value can be used for branching. **Syntax:** <MSGBOX text="<Message>" caption="<caption>" retvalue="<variable name>" type="<button type>" /> **Attributes:** • **text** Text • **retvalue** Name of the variables to which the return value is copied: 1 – OK 0 – CANCEL • **type** Acknowledgment options: "BTN_OK" "BTN_CANCEL" "BTN_OKCANCEL" **Example:** <MSGBOX text="Test message" retvalue="result" type="BTN_OK" />

Tag identifier	Meaning

OP	The tag executes the specified operations.
	The operations listed in Section "Operators (Page 309)" can be executed.
	For the purpose of accessing the NC, PLC, and drive data, the complete variable name should be placed in **quotation marks**. Section "Addressing components (Page 339) " describes how addresses are formed.
	`PLC: "PLC/MB170"`
	`NC: "NC/Channel/…"`
	
	Example:
	`<LET name = "tmpVar" type="INT"> </LET>`
	`<OP> tmpVar = "plc/mb170" </OP>`
	`<OP> tmpVar = tmpVar *2 </OP>`
	`<OP> "plc/mb170" = tmpVar </OP>`
	
	More than one equation can be used within an operation tag. A semicolon marks the end of the instruction.
	
	Example:
	`<op>`
	`     x = x+1;`
	`     y = y+1;`
	`</op>`
	
	Character string processing:
	The operation instruction is able to process character strings and assign the results to the string variable specified in the equation.
	The identifier _T should be placed at the start as a means of identifying text terms. Formatting of variable values is also possible. The identifier _F should be placed at the start of the formatting regulation, followed by the format instruction. The address is then specified for the variable.
	
	Example:
	`<LET name="buffer" type="string"></LET>`
	…
	…
	…
	`<OP> buffer = _T"unformatted value R0= " + "nck/Channel/Parameter/R[0]" + _T" and " + _T"$$85051" + _T" formatted value R1 " + _F%9.3f"nck/Channel/Parameter/R[1]" </OP>`

Tag identifier	Meaning
OPERATION	**Operation** Instructions can be moved within an equation. **Move left "<<" operator** The **<<** function moves bits to the left. You can specify the value and the number of move increments directly or with a variable. If the limit of the data format is reached, the bits will be moved beyond the limit without an error message being issued. **Execution rule** Execution from left to right; '**+**' and '**-**' have priority over '**<<**' and '**>>**' **Example:** <op> idx = idx << 2 </op> <op> idx = 3 + idx << 2 </op> **Move right ">>" operator** The **>>** function moves bits to the right. You can specify the value and the number of move increments directly or with a variable. If the limit of the data format is reached, the bits will be moved beyond the limit without an error message being issued. **Execution rule** Execution from left to right; '**+**' and '**-**' have priority over '**<<**' and '**>>**' **Example:** <op> idx = idx >> 2 </op> <op> idx = 3+idx >> 2</op>
POWER_OFF	A message prompts the operator to switch the machine off. The message text is permanently saved in the system.

Tag identifier	Meaning
PRINT	The tag outputs a text in the dialog line or copies the text to the variable specified. If the text contains formatting identifiers, the variable values are inserted at the appropriate places. **Syntax:** <PRINT name="Variable name " text="text %Formatting "> Variable, … </PRINT> <PRINT text="text %Formatting"> Variable, … </PRINT> **Attributes:** • **name** Name of the variable where the text is to be stored (optional) • **text** Text **Formatting:** The character "%" causes the variable specified as the value to be formatted. %[Flags] [Width] [.decimal places] type • Flags: Optional character for defining output formatting: – Right-justified or left-justified ("-") for left-justified – Add leading zeros ("0") – Fill with blanks • Width: The argument defines the minimum output width for a non-negative number. If the value to be output has fewer places than the argument defined, the missing spaces are filled with blanks. • Decimal places: With floating-point numbers, the optional parameter defines the number of decimal places. • Type: The type character defines which data formats are transferred for the print instruction. These characters need to be specified. – d: Integer value – f: Floating-point number – s: String
PRINT Continued	**Values:** Number of variables whose values are to be inserted into the text. The variable types must match the corresponding type identifier for the formatting instruction and must be separated from one another with a comma. **Example:** Output of a text in the information line <PRINT text="Infotext" /> Output of a text with variable formatting <LET name="trun_dir"></LET> <PRINT text="M%d">trun_dir</PRINT> Output of a text in a string variable with variable formatting <LET name="trun_dir"></LET> <LET name="str" type="string" ></LET> <print name="str" text="M%d ">trun_dir</print>

Tag identifier	Meaning

PROGRESS_BAR	The tag opens or closes a progress bar. The bar is displayed below the application window.
	
	Syntax:
	`<PROGRESS_BAR type="<true/false>"> value </ PROGRESS_BAR>`
	
	Attributes:
	• **type =** "TRUE" - opens the progress bar
	• **type** = "FALSE" - closes the progress bar
	• **min**
	(optional) – minimum value
	• **max**
	(optional) – maximum value
	
	Value:
	• **Value**
	Percentage position of the bar
	
	Example:
	`<PROGRESS_BAR type="true" min="0" max="101" >20<`
	`/PROGRESS_BAR>......<PROGRESS_BAR >50<`
	`/PROGRESS_BAR>......<PROGRESS_BAR type="false" >100<`
	`/PROGRESS_BAR>`

SEND_MESSAGE	The tag sends a message with two parameters to the active form, which is processed in the tag message.
	
	Syntax:
	`<SEND_MESSAGE>p1, p2</SEND_MESSAGE>`
	
	Example:
	`<SOFTKEY POSITION="3">`
	`   <caption>Set%nParameter</caption>`
	`   <send_message>1, 0</send_message>`
	`</SOFTKEY>`
	
	`<FORM>`
	…
	…
	`<MESSAGE>`
	`<SWITCH>`
	`<CONDITION>$message_par1</CONDITION>`
	`<CASE value="1">`
	…
	…
	`</CASE>`
	`</SWITCH>`
	`</MESSAGE>`
	…
	…
	
	`</FORM>`

Tag identifier	Meaning

SHOW_CONTROL	The visibility of a control can be controlled using the tag.
	
	Syntax:
	`<SHOW_CONTROL name="<name>" type="<type>" />`
	
	Attributes:
	• **name**
	Name of the control
	• **type =** "TRUE" - control becomes visible
	• **type** = "FALSE" - control becomes invisible (hidden)
	
	Example:
	`<SHOW_CONTROL name="myEditfield" type="false" />`
	…
	…
	`<SHOW_CONTROL name="myEditfield" type="true" />`

SLEEP	The tag interrupts script execution for the specified period. The interruption time is obtained from the transferred value multiplied by the time base.
	
	Syntax:
	`<SLEEP value="Interruption time" />`
	
	Example:
	Wait time, 30 * time base.
	`<SLEEP value="30" />`

STOP	Interpretation is canceled at this point.

SWITCH	The **SWITCH** instruction describes a multiple choice. A term is evaluated once and compared with a number of constants. If the expression matches the constants, the instructions are executed within the **CASE** instruction.
	The **DEFAULT** instruction is executed when none of the constants match the expression.
	
	Syntax:
	`<SWITCH>`
	`<CONDITION> Value </CONDITION>`
	`<CASE value="Constant 1">`
	`Instructions`
	…
	`</CASE>`
	`<CASE value="Constant 2">`
	`Instructions`
	…
	`</CASE>`
	`<DEFAULT>`
	`Instructions`
	…
	`</DEFAULT>`
	`</SWITCH>`

THEN	Instruction if the condition has been fulfilled (**IF, THEN, ELSE**)

Tag identifier	Meaning
TYPE_CAST	The tag converts the data type of a local variable. **Syntax:** <type_cast name="variable name" type=" new type" /> **Attributes:** • **name** Variable name • **type** The new data type is assigned to the variable. • **convert** The new data type is assigned to the variable. The variable value is also converted to the new data type.
TYPEDEF	A new identifier for a data type can be defined with the “typedef” tag. This has the benefit for the structure definitions that the data type can be defined once and then used as a data type in a LET instruction. The identifier and type are expected as attributes. The parser supports only the specification of structure definitions. In the type definition, a variable is declared with the “element” tag. The attributes of the tag correspond to the attributes of the let instruction. <typedef name="<identifier>" type="struct"> <element name="<name>" type="<variable type>" /> … … … </typedef> After definition, the identifier can be used as a data type for the LET instruction. <let name="<variable name>" type="<identifier>"></let> **Example**: <typedef name="my_struct" type="struct"> <element name="id" type="int" /> <element name="name" type="string" /> <element name="phone" type="string" /> </typedef> <let name="info" type="my_struct"></let> … … <op> info.id = 1; info.name = _T"my name"; info.phone= _T"0034 45634"; </op>

Tag identifier	Meaning
TYPEDEF Continued	Some predefined functions expect variables of structure type RECT, POINT, or SIZE as the call parameter. These structures are defined in the file struct_def.xml. **RECT:** <typedef name="StructRect" type="struct" > <element name="left" type="int">0</element> <element name="top" type="int">0</element> <element name="right" type="int">0</element> <element name="bottom" type="int">0</element> </typedef> **POINT:** <typedef name="StructPoint" type="struct" > <element name="x" type="int">0</element> <element name="y" type="int">0</element> </typedef> **SIZE:** <typedef name="StructSize" type="struct" > <element name="width" type="int">0</element> <element name="height" type="int">0</element> </typedef>
WAITING	The tag waits for the component to undergo a hot restart after an NC or drive reset. **Attributes:** • **WAITINGFORNC** = "TRUE" - the system waits for the NC to restart **Syntax:** <WAITING WAITINGFORNC = "TRUE"/> **Example:** ... <CONTROL_RESET resetnc = "true"/> <WAITING waitingfornc = "true"/> ...
WHILE	WHILE loop WHILE (Test) Instruction **Syntax:** <WHILE> <CONDITION>…</CONDITION> Instructions … </WHILE> The While loop executes a sequence of instructions repeatedly while a condition is met. This condition is tested before the sequence of instructions is executed. **Example:** <WHILE> <CONDITION> "plc/ib9" == 0 </CONDITION> <DATA name = "PLC/qb11"> 15 </DATA> </WHILE>

<table>
<tr><th>Tag identifier</th><th>Meaning</th></tr>
<tr><td>XML_PARSER</td><td>
The “XML_PARSER” tag can be used to parse XML files.

The parser interprets an XML file and calls defined call-back functions. Each call-back function belongs to a predefined event. The programmer can process the XML data within this function.

Predefined events:

start document
The parser opens the document and starts parsing.
end document
The parser closes the document.
start element
The parser has found an element and creates a list with all attributes and attribute values.

These lists are forwarded to the call-back function.
end element
The end of the element has been found.
characters
The parser forwards all characters of an element.
error
The parser has detected a syntax error.

When an event occurs, the parser calls the call-back function and checks the function return value. If the function returns "true," the parser continues the process.

Interfaces

The value of the name attribute contains the path to the XML file.

To assign events to the call-back functions, the following properties must be specified:

Standard
startElementHandler
endElementHandler
charactersHandler

Optional
errorHandler
documentHandler

The value of an attribute defines the name of the call-back function.

Example:
<pre>
<XML_PARSER name="f:\appl\xml_test.xml">
      <!-- standard handler -->
      <property startElementHandler="startElementHandler" />
      <property endElementHandler="endElementHandler" />
      <property charactersHandler="charactersHandler" />
      <!-- optional handler -->
      <property errorHandler="errorHandler" />
      <property documentHandler="documentHandler" />
</XML_PARSER>
</pre>
</td></tr>
</table>

Tag identifier	Meaning

XML_PARSER Continued	The parser also supplies variables so that the call-back functions can access the event data.
	
	startElementHandler:
	Function parameters
	tag_name - tag name
	num - number of attributes found
	System variables
	$xmlAttribute String array that contains the 0-num attribute name range.
	$xmlValue String array that contains the 0-num attribute value range.
	
	Example:
	`<function_body name="startElementHandler" return="true" parameter="tag_name, num">`
	`    <print text="attribute name %s"> $xmlAttribute[0]</print>`
	`    <print text="attribute value %s"> $xmlValue [0]</print>`
	`</function_body>`
	
	endElementHandler:
	Function parameters
	tag_name - tag name
	
	Example:
	`<function_body name="endElementHandler" parameter="tag_name">`
	`    <print text="name %s"> tag_name </print>`
	`</function_body>`

Tag identifier	Meaning

XML_PARSER Continued	**charactersHandler:**
	System variables
	$xmlCharacters String with data
	$xmlCharactersStart Always 0
	$xmlCharactersLength Number of bytes
	
	Example:
	`<function_body name="charactersHandler" return="true" >`
	`    <print text="chars %s"> $xmlCharacters </print>`
	`</function_body>`
	
	documentHandler:
	Function parameters
	state 1 start document, 2 end document
	
	errorHandler:
	System variables
	$xmlErrorString Contains the invalid line (system variable)
	
	Example:
	`<function_body name="errorHandler" >`
	`    <print text="error %s">$xmlErrorString</print>`
	`</function_body>`
	
	Call-back result:
	$return If 1 (true), the parser continues parsing the file

14.6.3 System variables

The system variables can be used in the EasyXLanguage scripts for the data exchange between a script parser and a program flow.

The table below provides the automatically created system variables that can be used in the relevant tags.

System variable	Description	Tags where valid
$actionresult	Notifies a script parser of whether the event can be executed	KEY_EVENT
$focus_name $focus_item_data	Contains the name of the control that has the input focus Contains the numeric value of item_data, which was assigned to the control	FOCUS_IN INDEX_CHANGED EDIT_CHANGED
$return	Transfers the return values of a subfunction	FUNCTION_BODY
$message_par1 $message_par2	Contains the parameters for calling the SEND_MESSAGE function	MESSAGE
$keycode $actionresult	Contains the key codes with executable scripts	KEY_EVENT
$xmlAttribute $xmlValue $xmlCharacters $xmlCharactersStart $xmlCharactersLength	Contains the attribute list of the obtained variables Contains the value list of the obtained variables Contains the data stream Contains the start index Contains the number of characters saved in a data stream	XML_PARSER - startElementHandler XML_PARSER - charactersHandler

System variable	Description	Tags where valid
$mouse_event.type $mouse_event.x $mouse_event.y $mouse_event.id $mouse_event.buttons $mouse_event.button	Contains the structures for handing over mouse event parameters	MOUSE_EVENT

14.6.4 Color coding

The color attribute uses the color coding scheme for the HTML language.

In terms of syntax, color specifications consist of the "#" (hash) character and six digits from the hexadecimal system, with each color represented by two digits.

R – Red

G – Green

B – Blue

#RRGGBB

Example:

color = "#ff0011"

14.6.5 Special XML syntax

Characters with special meanings in XML syntax have to be rewritten if they are to be displayed correctly by a general XML editor.

The following characters are affected:

Character	Notation in XML
<	<
>	>
&	&
"	"
'	'

14.6.6 Operators

The operation instruction processes the following operators:

Operator	Meaning
=	Assignment
==	Equal to
<, <	Less than
>, >	Greater than
<=, <=	Less than or equal to
>=, >=	Greater than or equal to
|	OR operation in bits
||	Logic OR operation
&, &	AND operation in bits
&&, &&	Logic AND operation
+	Addition
-	Subtraction
*	Multiplication

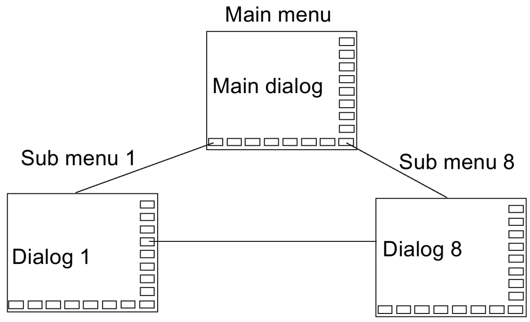
Operator	Meaning
/	Division
!	Not
!=	Not equal to

Operation instructions are processed from left to right. It may make sense to place terms in parentheses under certain circumstances in order to define the priority for executing subterms.

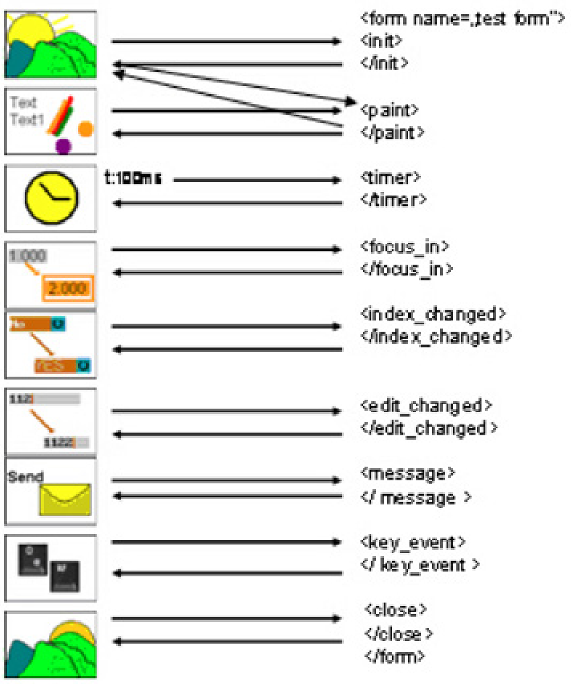
14.6.7 Generating softkey menus and dialog forms

User menus can only be inserted if there is a main-menu tag with the name "main" in the XML description. This tag is called by the system after the user-defined operating area has been activated. Further menu branches and dialog-box activation can be defined within the tag.

```
<menu name= "MAIN">
<OPEN_FORM name= "main dialogue">
<softkey POSITION="1">
<caption>sub menu 1</caption>
<navigation>sub menu 1</navigation>
</softkey>
<softkey POSITION="8">
<caption>sub menu 8</caption>
<navigation>sub menu 8</navigation>
</softkey>
</menu>

<menu name= "sub menu 1">
<OPEN_FORM name= "dialogue 1">
</menu>

<menu name= "sub menu 8">
<OPEN_FORM name= "dialogue 8“>
</menu>
```



Tag identifier	Meaning
FORM	This tag contains the description of a user dialog. **Attributes:** • **color** Background color of the dialog box (for color coding, see Section "Color coding (Page 309)") • **name** Identifier of the form • **type** *cycle* -attribute specifies a cycle form • **xpos** X-position of the top left corner of the dialog box (optional) • **ypos** Y position of the top left corner (optional) • **width** Extension in the X direction (in pixels) (optional) • **height** Extension in the Y direction (in pixels) (optional) • **truetypefont** Whether the font of the dialog form is of the true type (optional)
FORM continued	**Dialog messages:** • **INIT** • **PAINT** • **TIMER** • **CLOSE** • **FOCUS_IN** • **INDEX_CHANGED** • **EDIT_CHANGED** • **KEY_EVENT** • **MESSAGE**

<table>
<tr><th>Tag identifier</th><th>Meaning</th></tr>
<tr><td>FORM continued</td><td>


</td></tr>
<tr><td>FORM continued</td><td>
Syntax:
<FORM name = "<dialog name>" color = "#ff0000">
Example:
<FORM name = "R-Parameter">
<INIT>
<DATA_ACCESS type = "true" />
<CAPTION>R - Parameter</CAPTION>
<CONTROL name = "edit1" xpos = "322" ypos = "34" refvar = "nck/Channel/Parameter/R[1]" />
<CONTROL name = "edit2" xpos = "322" ypos = "54" refvar = "nck/Channel/Parameter/R[2]" />
<CONTROL name = "edit3" xpos = "322" ypos = "74"
</INIT>

<PAINT>
<TEXT xpos = "23" ypos = "34">R - Parameter 1</TEXT>
<TEXT xpos = "23" ypos = "54">R - Parameter 2</TEXT>
<TEXT xpos = "23" ypos = "74">R - Parameter 3</TEXT>

</PAINT>

</FORM>
</td></tr>
<tr><td>INIT</td><td>
Dialog box message
The tag is executed immediately after the dialog box is generated. All the input elements and hotlinks for the dialog form should be created here.
</td></tr>
</table>

Tag identifier	Meaning

KEY_EVENT	Dialog message
	The tag KEY_EVENT can be integrated in the form to evaluate keyboard events. The system sends the MF2 keyboard code to the active form if the tag is available in a form. If the variable **$actionresult** is not set to zero, the system then subsequently processes the keyboard event.
	The keyboard code is provided in the variable **$keycode** as an integer value.
	
	Example:
	The character entered into the variable **exclude_key** should be filtered-out of the input stream.
	
	`<LET name="stream" type="string"/>`
	`<LET name="exclude_key" type="string"/>`
	
	`<FORM name = "keytest_form">`
	`  <INIT>`
	`    <CONTROL name = "p1" xpos = "120" ypos = "84" width ="200" refvar="stream" hotlink="true" />`
	`    <CONTROL name = "p2" xpos = "160" ypos = "104" width ="8" refvar="exclude_key" hotlink="true" />`
	`  </INIT>`
	
	`  <PAINT>`
	`    <text xpos = "8" ypos = "84">data stream</text>`
	`    <text xpos = "8" ypos = "104">exclude key</text>`
	`  </PAINT>`
	
	`  <KEY_EVENT>`
	`    <LET name="excl_keycode" type="string"/>`
	`    <OP>excl_keycode = exclude_key</OP>`
	`    <type_cast name="excl_keycode" convert="int" />`
	`    <PRINT text="%d %d">$keycode, excl_keycode</PRINT>`
	
	`    <IF>`
	`      <CONDITION>$keycode == excl_keycode</CONDITION>`
	`      <THEN>`
	`        <op> $actionresult = 0</op>`
	`      </THEN>`
	`    </IF>`
	
	`  </KEY_IVENT>`
	
	`</FORM>`

Tag identifier	Meaning
MESSAGE	**Dialog message** If the Send_message operation is executed in the script, then the parser processes the tag message. Values P1 and P2 are provided in the variables $message_par1 and $message_par2 (see the "SEND_MESSAGE" tag). **Syntax:** <MESSAGE> </MESSAGE> **Example:** <LET name="user_selection" /> <SOFTKEY POSITION="3"> <CAPTION>Set%nParameter</CAPTION> <SEND_MESSAGE>1, 10</SEND_MESSAGE> </SOFTKEY> … … <FORM> … … <MESSAGE> <SWITCH> <CONDITION>$message_par1</CONDITION> <CASE value="1"> <OP> user_selection = $message_par2 </OP> … … </CASE> </SWITCH> </MESSAGE> … … </FORM>

Tag identifier	Meaning
SEND_MESSAGE	The tag sends a message with two parameters to the active form, which is processed in the tag message (see also MESSAGE). **Syntax:** <SEND_MESSAGE>p1, p2</SEND_MESSAGE> **Example:** <LET name="user_selection" /> <SOFTKEY POSITION="3"> <CAPTION>Set%nParameter</CAPTION> <SEND_MESSAGE>1, 10</SEND_MESSAGE> </SOFTKEY> … … <FORM> … … <MESSAGE> <SWITCH> <CONDITION>$message_par1</CONDITION> <CASE value="1"> <OP> user_selection = $message_par2 </OP> … </CASE> </SWITCH> </MESSAGE> … … </FORM>
FOCUS_IN	**Dialog box message** The tag is called if the system places the focus on a control. To identify the control, the system copies the name of the control into variable **$focus_name** and the value of the attribute **item_data** into variable **$focus_item_data**. This message can be used, for example, to output images depending on the focus position. **Example:** <focus_in> <PRINT text="focus on filed:%s, %d">$focus_name, $focus_item_data </PRINT> </focus_in>
PAINT	**Dialog box message** The tag is executed when the dialog box is displayed. All the texts and images which are to be displayed in the dialog box should be specified here. Further, the tag is executed if the system identifies that parts of the dialog box are to be redisplayed. For example, this can be initiated by closing high-level windows.
TIMER	**Dialog box message** The tag is executed cyclically. Each form is assigned a timer. The tag is executed within a period less than 100 ms.

Tag identifier	Meaning
CAPTION	The tag contains the title of the dialog box. This tag should be used within the INIT tag. **Syntax:** <CAPTION>Titel</CAPTION> **Example:** <CAPTION>my first dialogue</CAPTION>
CLOSE	**Dialog box message** This tag is executed before the dialog box is closed.
CLOSE_FORM	The tag closes the active dialog. This instruction is only necessary if the dialog is opened by the MMC command and the user is offered a softkey function to close the dialog. Generally, dialogs are automatically managed and do not have to be explicitly closed. **Syntax:** <CLOSE_FORM/> **Example:** <softkey_ok> <caption>OK</caption> <CLOSE_FORM /> <navigation>main_menu</navigation> </softkey_ok>

Tag identifier	Meaning
CONTROL	The tag is used to generate control elements. **Syntax:** `<CONTROL name = "<control name>" xpos = "<X position>" ypos = "<Y position>" refvar = "<NC variable>" hotlink = "true" format = "<format>" />` **Attributes:** • **name** Identifier of the field. The identifier simultaneously represents a local variable, and must not be used a multiple number of times in the form. • **xpos** X position of the top left corner • **ypos** Y position of the top left corner • **fieldtype** Field type If no type is specified, the field is set as an edit field. – **edit** Data can be changed – **readonly** Data cannot be changed **combobox** The field displays the corresponding identifiers instead of numerical values. If field type **combobox** is selected, the expressions to be displayed must also be assigned to the field. The <ITEM> tag should be used for this purpose. The combo box saves the index of the currently selected text in the variable belonging to the control (see the attribute **refvar**). – **progressbar** A progress bar with a value range of 0 to 100 appears. The valley value and peak value properties can be used to adapt the value range to the data to be displayed.

Tag identifier	Meaning
CONTROL Continued	• **fieldtype** – **graphicbox** The field type generates a 2D broken line graphic control. Using the tag <ITEM> a graphical element can be inserted into the control. Parameters **width** and **height** specify the width and height of the box. After the control has been created, additional elements can be inserted using the functions **loadItem**, **addItem** or **insertItem**. Parameter **itemdata** is not evaluated for this control. **Example:** <control name= "c_gbox1" xpos = "250" ypos="24" width="240" height="356" fieldtype="graphicbox" refvar="val" hotlink="true" <property ORDINATE="Y sinus" /> <property ABSCISSA="time *100 ms" /> </control>
CONTROL continued	• **fieldtype** – **listbox** The field type generates an empty list box control. Using the tag <ITEM> a list box element can be inserted in the list box. The ITEM attribute **value** allows this element to be assigned a unique value. For example, this can be used to identify the element. Parameters **width** and **height** specify the width and height of the list box. After the control has been created, additional list box elements can be inserted using the function **addItem**, **insertItem** or **loadItem**. Parameter **itemdata** is not evaluated for this control. – **itemlist** The field type generates a static control, which displays the corresponding identifier instead of numerical values. The <ITEM> tag can be used to assign an identifier to the field. • **item_data** A user-specific integer value can be assigned to the attribute. This value is given as part of the FOCUS_IN message for identifying the focus field. • **refvar** Identifier of the reference variable that can be linked to the field (optional). • **hotlink** = "TRUE" " If the value of the reference variable changes, then the field is automatically updated (optional). • **format** The attribute defines the display format of the specified variable. Formatting data, see print-Tag (optional).

Tag identifier	Meaning
CONTROL continued	**Attributes:** • **font** The attribute defines the font size used. – 0 – 1 – 2 – 3 – 4 – 5 • **color_bk** The attribute sets the background color of the control. • **color_fg** The attribute sets the foreground color of the control. Color coding (see Section "Color coding (Page 309)") • **display_format** The attribute defines the processing format of the specified variable. This attribute must be used when accessing a PLC float variable, as the access is realized by reading a double word. The following data formats are permitted: – FLOAT – INT – DOUBLE – STRING Assigning expressions (e.g. text or graphic element to be displayed) to a list box, graphics box or combo box: **Syntax:** <ITEM>Expression</ITEM> <ITEM value ="<Value>">Expression</ITEM>

Tag identifier	Meaning
CONTROL continued	**Example:** <CONTROL name = "button1" xpos = "10" ypos = "10" fieldtype = " com-bobox "> <ITEM>text1</ITEM> <ITEM>text2</ITEM> <ITEM>text3</ITEM> <ITEM>text4</ITEM> </CONTROL> If any integer value is to be assigned to an expression, the attribute **value = "value"** should be added to the tag. Rather than consecutive numbers, the control variable now contains the item's assigned value. **Example:** <CONTROL name = "button1" xpos = "10" ypos = "10" fieldtype = " com-bobox "> <ITEM value = "10">text1</ITEM> <ITEM value = "20">text2</ITEM> <ITEM value = "12">text3</ITEM> <ITEM value = "1">text4</ITEM> **</CONTROL>** **Example of a progress bar:** <CONTROL name = "progress1" xpos = "10" ypos = "10" width = "100" fieldtype = "progressbar" hotlink = "true" refvar = "nck/Channel/GeometricAxis/actProgPos[1]"> <PROPERTY min = "0" /> <PROPERTY max = "1000" /> </CONTROL> **Example, list box:** <let name="item_string" type="string"></let> <let name="item_data" ></let> <CONTROL name="listbox1" xpos = "360" ypos="150" width="200" height="200" fieldtype="listbox" /> • Adding elements: Elements are added using the function **insertitem**, **additem** or **loaditem**. • Deleting the content: The content is deleted using the function **empty**. <op> item_string = _T"text1\\n" </op> <function name="control.additem">_T"listbox1", item_string, item_data </function> <op> item_string = _T"text2\\n" </op> <function name="control.additem">_T"listbox1", item_string, item_data </function>
CONTROL continued	**Example itemlist:** <CONTROL name = "itemlist1" xpos = "10" ypos = "10" fieldtype = " itemlist"> <ITEM value = "10">text1</ITEM> <ITEM value = "20">text2</ITEM> <ITEM value = "12">text3</ITEM> <ITEM value = "1">text4</ITEM> </CONTROL>

Tag identifier	Meaning
CONTROL Continued	**Changing the control after creation** A control tag changes the properties of an existing control after it has been created. The tag must be specified with the name of the control to be changed and the new properties. It can be executed only within a form tag. The following properties can be changed: • xpos • ypos • width • height • color_bk • color_fg • access level • fieldtype • itemdata • min • max • default The reference variable cannot be modified. If a property is to be changed by triggering by a softkey event, the send message tag must transfer this request into the form context. The message tag is used to acquire the message. **Note:** When the script file in an earlier software version is used, check display completeness for a control due to the changed behavior of the control.
CONTROL Continued	**Example:** <menu name = "main"> <open_form name = "attrib_form" /> <softkey POSITION="3"> <caption>Set%nro</caption> <send_message>1, 0</send_message> </softkey> <softkey POSITION="4"> <caption>Set%nrw</caption> <send_message>2, 0</send_message> </softkey> </menu> <form name="attrib_form"> <init> <control name="c_p0" xpos="60" ypos="70" width="272" /> </init> <message> <switch> <condition>$message_par1</condition> <case value="1"> <control name="c_p0" fieldtype="static" /> </case> <case value="2"> <control name="c_p0" fieldtype="edit" /> </case> </switch> </message> </form>

<table>
<tr><th>Tag identifier</th><th>Meaning</th></tr>
<tr><td>CONTROL Continued</td><td>

The following properties can be changed in an operation statement. For this purpose, the control name and property have to be specified. The property has to be separated by a point from the control name.

- xpos
- ypos
- width
- height
- color_bk
- color_fg
- access level
- fieldtype
- itemdata
- min
- max
- default
- disable
- tooltip
- font
- factor

Syntax:

<name>.<property>

Example:

```
<let name="value" />
<let name="w" />
<let name="h" />
<menu name = "main">
<open_form name = "attrib_form" />
<softkey POSITION="3">
<caption>Set%nro</caption>
</softkey>
<op>
c_move.xpos = 300;
value = c_move.xpos;
h = c_move.height;
w = c_move.width;
</op>
</menu>
<form name="attrib_form">
<init>
<control name="c_move" xpos="$xpos" ypos="124" />
</init>
</form>
```

</td></tr>
</table>

Tag identifier	Meaning
DATA_ACCESS	The tag controls the behavior of the dialog forms when user inputs are being saved. The behavior should be defined within the INIT tag. If the tag is not used, inputs are buffered in each case. Exception: Controls for which the **hotlink** attribute is set to **true** are always written to and read directly. **Attribute:** • **type** = "TRUE" – the input values are not buffered. The dialog form copies the input values to the reference variables directly. • **type =** "FALSE" – the values are only copied to the reference variable with the **UPDATE_CONTROLS** type = "FALSE" tag. **Example:** <DATA_ACCESS type = "true" />
EDIT_CHANGED	**Dialog box message** This tag is called if the contents of an edit control have changed. To identify the control, the system copies the name of the control into variable **$focus_name** and the value of the attribute **item_data** into variable **$focus_item_data**. **Example:** <EDIT_CHANGED> <print text="index changed filed:%s, %d"> $focus_name, $fo-cus_item_data </print> … … </EDIT_CHANGED>
INDEX_CHANGED	**Dialog box message** The tag is called, if the operator changes the selection of a combo box. To identify the control, the system copies the name of the control into the variable **$focus_name** and the value of the attribute **item_data** into the variable **$focus_item_data**. **Note:** A reference variable assigned to the control, has not been aligned to the control variable at this point in time and contains the index of the previous selection of the combo box. **Example:** <INDEX_CHANGED> <print text="index changed filed:%s, %d"> $focus_name, $fo-cus_item_data </print> … … </INDEX_CHANGED>

Tag identifier	Meaning

MENU	The tag defines a menu containing the softkey description and the dialog to be opened.
	
	Attribute:
	• **name**
	Menu name
	
	Syntax:
	`<MENU name = "<menu name>">`
	`…`
	`<open_form …>`
	`…`
	`<SOFTKEY …>`
	`</SOFTKEY>`
	`</MENU>`

NAVIGATION	This tag defines the menu to be called. It can be used within a softkey block, a menu block, and in a form. If a variable name is assigned to the tag as its value, the parser will activate the menu stored in the variable.
	In a menu block, the navigation is at the position in the instruction. Subsequent instructions are no longer executed.
	
	Syntax:
	`<NAVIGATION>menu name</NAVIGATION>`
	
	Example:
	`<menu name = "main">`
	`    <softkey POSITION="1">`
	`        <caption>sec. form</caption>`
	`        <navigation>sec_menu</navigation>`
	`    </softkey>`
	`</menu>`
	
	`<menu name = "sec_menu">`
	`    <open_form name = "sec_form" />`
	`    <softkey_back>`
	`        <navigation>main</navigation>`
	`    </softkey_back>`
	</menu>

<table>
<tr><th>Tag identifier</th><th>Meaning</th></tr>
<tr><td>OPEN_FORM</td><td>The tag opens the dialog form given under the name.

Attribute:
• name
Name of the dialog form

Syntax:
<OPEN_FORM name = "<form name>" />

Example:
<menu name = "main">
     <open_form name = "main_form" />
    <softkey POSITION="1">
        <caption>main form</caption>
        <navigation>main</navigation>
    </softkey>
</menu>

<form name="main_form">
    <init>
    </init>

    <paint>
    </paint>

</form></td></tr>
</table>

<table>
<tr><th>Tag identifier</th><th>Meaning</th></tr>
<tr><td>PROPERTY</td><td>This tag can be used to define additional properties for an operator control.

Attributes:

max = "<maximum value>"
min = "<minimum value>"
default = "<pre-assignment>"
factor = "conversion factor"
color_bk = "<background color coding>"
color_fg = "<font color coding>"
password = "<true>" - entered character is displayed with "*"
disable = "<true/false>" - locks/permits the input in an edit control
transparent= "Transparent color of a bitmap"

Color coding (see Chapter "Color coding (Page 309)")
tooltip = information text is displayed if the cursor is set to the control.
The syntax is: <property tooltip="note text" />
abscissa = "Name of the first coordinate axis" (only permissible for a graphic box)
ordinate = "Name of the second coordinate axis" (only permissible for a graphic box)

Example:
<CONTROL name = "progress1" xpos = "10" ypos = "10" width = "100" fieldtype = "progressbar" hotlink = "true" refvar = "nck/Channel/GeometricAxis/actProgPos[1]">
   <PROPERTY min = "0" />
   <PROPERTY max = "1000" />
</CONTROL>
<CONTROL name = "edit1" xpos = "10" ypos = "10">
<PROPERTY min = "20" />
<PROPERTY max = "40" />
<PROPERTY default = "25" />
</CONTROL></td></tr>
</table>

Tag identifier	Meaning
SOFTKEY	The tag defines the properties and responses of a softkey. **Attributes:** • **position** Number of the softkey. 1-8 horizontal softkeys, 9-16 vertical softkeys The following attributes become effective from: • **type** Defines the property of the softkey. user_controled - The script defines how the softkey is displayed toggle_softkey - The softkey is displayed alternating between pressed and not pressed • **refvar** Should only be used in conjunction with toggle_softkey . Reference variable, into which the actual softkey property is copied. A variable, type "String" should be specified, which includes the properties pressed, not pressed or locked (see tag state). • **picture** Using the attribute, a bitmap can be output left justified on the softkey. The complete path name should be specified. The number of text characters that can be displayed is reduced to the width of the bit-map.

Tag identifier	Meaning
SOFTKEY continued	The following additional actions can be defined within the softkey block: • **picturealignment** The image orientation is specified by this attribute. The image is aligned with the left side of the softkey by default. The following values can be specified for alignment: – **top** Top edge – **bottom** Bottom edge – **left** Left edge – **right** Right edge – **center** Centered • **caption** Softkey text • **state** Should only be used in conjunction with user_controlled . The tag assigns the required softkey display to the system. **Syntax:** <state type="<state>" /> The following strings can be specified: – **notpressed** The softkey is displayed as being not pressed. – **pressed** The softkey is displayed as being pressed. – **disabled** The softkey is locked and is displayed in gray. • **navigation** • **update_controls** • **function**

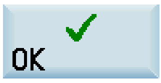
Tag identifier	Meaning
SOFTKEY continued	**Syntax:**

Standard softkey:

```
<state type="<softkey state>" />
<softkey position = "<1>">
…
…
</softkey>
or
Script-controlled softkey:
<softkey position = "<1>" type="<user_defined>" >
<state type="<softkey state>" />
…
…
</softkey>

or
Toggle softkey:
<softkey position = "<1>" type="<toggle_softkey>" refvar="<variable
name>" >
…
…
</softkey>
```

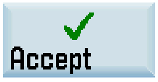
Example:

```
<let name="define_sk_type" type="string">PRESSED</let>
<let name="sk_type">1</let>

<softkey POSITION="1" type="user_controled" >
    <caption>Toggle%nSK</caption>
    <if>
    <condition>sk_type == 0 </condition>
    <then>
        <op> sk_type = 1 </op>
        <op> define_sk_type = _T"PRESSED" </op>
    </then>
    <else>
        <op> define_sk_type = _T"NOTPRESSED" </op>
        <op> sk_type = 0 </op>
    </else>
    </if>
    <state type="$$$define_sk_type" />
…
…

</softkey>
```

Tag identifier	Meaning
SOFTKEY continued	**Example:** or <let name="curr_softkey_state" type="string">PRESSED</let> </softkey> <softkey POSITION="3" type="toggle_softkey" refvar="curr_softkey_state"> <caption>Toggle%nSK</caption> … </softkey>  
SOFTKEY_OK	The tag defines the response of the softkey "OK".  The following additional actions can be defined within the softkey block: • **navigation** • **update_controls** • **function** **Syntax:** <SOFTKEY_OK> … … </SOFTKEY_OK>
SOFTKEY_CANCEL	The tag defines the response of the softkey "Cancel".  The following additional actions can be defined within the softkey block: • **navigation** • **update_controls** • **function** **Syntax:** <SOFTKEY_CANCEL> … … </SOFTKEY_CANCEL>

Tag identifier	Meaning

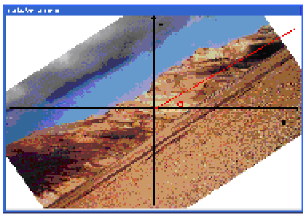
SOFTKEY_BACK	The tag defines the response of the softkey "Back".
	
	
	The following additional actions can be defined within the softkey block:
	• navigation
	• update_controls
	• function
	
	Syntax:
	`<SOFTKEY_BACK>`
	…
	…
	`</SOFTKEY_BACK>`

SOFTKEY_ACCEPT	The tag defines the response of the softkey "Accept".
	
	
	The following additional actions can be defined within the softkey block:
	• navigation
	• update_controls
	• function
	
	Syntax:
	`<SOFTKEY_ACCEPT>`
	…
	…
	`</SOFTKEY_ACCEPT>`

TEXT	The tag is used to display a text in the specified position. **Syntax:** `<TEXT xpos = "<X position>" ypos = "<Y position>"> Text </TEXT>` **Attributes:** • xpos X position of the top left corner • ypos Y position of the top left corner • color Text color (see Section "Color coding (Page 309)") **Value:** Text to be displayed

Tag identifier	Meaning

IMG	The tag is used to display an image in the specified position. The BMP and PNG image formats are supported.
	
	Syntax:
	`<IMG xpos = "<X position>" ypos = "<Y position>" name = "<name>" />`
	`<IMG … xrot="angle X axis" yrot=" angle Y axis " zrot=" angle Z axis " />`
	
	Attributes:
	• **xpos**
	X position of the top left corner
	• **ypos**
	Y position of the top left corner
	• **name**
	complete path name
	• **transparent**
	Transparent color of the bitmap (see Section "Color coding (Page 309)"):

IMG Continued	**Example**:
	The image is rotated through 34 degrees around the Z axis:
	`<img xpos = "5" ypos = "23" name = "f:/appl/pic3.bmp" height="355" width="550" zrot="34" color_bk="#ffffff" >`
	`</img>`
	
	Optional:
	If the image display is to differ from the original size, the dimensions can be defined using the attributes **width** and **height**.
	• **width**
	Width in pixels
	• **height**
	Height in pixels
	
	Examples:
	`<IMG xpos = "20" ypos = "40" name = "f:/appl/test.bmp" />`
	`<IMG xpos = "5" ypos  = "23" name = "f:/appl/test.bmp" height = "355" width = "550"/>`

Tag identifier	Meaning
BOX	The tag draws a rectangle at the specified position, colored as indicated. **Syntax:** <BOX xpos = "<X position>" ypos = "<Y position>" width = "<X extension>" height = "<Y extension>" color = "<Color code>" /> **Attributes:** • **xpos** X position of the top left corner • **ypos** Y position of the top left corner • **width** Extension in X direction (in pixels) • **height** Extension in Y direction (in pixels) • **color** Color coding (see Section "Color coding (Page 309)")
FUNCTION	**Function call** The tag executes the function body, which is specified under the attribute "**name**. **Attributes:** • **name** = "Name of the function body" • **return** = "Variable name for saving the result of the function" **Values:** List of variables to be transferred to the function body. The variables must be separated by a comma. A maximum of 10 parameters can be transferred. It is also possible to specify constants or text expressions as call parameters. The identifier _T should be placed at the start as a means of identifying text terms. **Syntax:** <FUNCTION name = "<function name>" /> Calling function expects a return value <FUNCTION name = "<function name>" return = "<Variablenname>" /> Parameter transfer <FUNCTION name = "<function name>"> var1, var2, var3 </FUNCTION> <FUNCTION name = "<function name>"> _T"Text", 1.0, 1 </FUNCTION> **Examples:** See "FUNCTION_BODY".

Tag identifier	Meaning

FUNCTION_BODY	**Function body**
	The tag contains the function body of a subfunction. The function body needs to be programmed within the DialogGui tag.
	Attributes:
	• **name** = "Name of the function body"
	• **parameter** = "Parameter list" (optional)
	The attribute lists the transfer parameters that are required. The parameters must be separated by a comma.
	When the function body is called, the values of the parameters specified in the function call are copied to the transfer parameters listed.
	• **return** = "true" (optional)
	If the attribute is set to true then the local variable $return is created. The function's return value which is forwarded to the calling function on quitting the function should be copied to this variable.
	Syntax:
	
	Function body without parameter
	`<FUNCTION_BODY name = "<function name>">`
	`…`
	`…`
	`…`
	`</ FUNCTION_BODY>`
	
	Function body with parameter
	`<FUNCTION_BODY name = "<function_name>" parameter = "<p1, p2, p3>">`
	`…`
	`<LET name = "tmp></LET>`
	`<OP> tmp = p1 </OP>`
	`…`
	`</FUNCTION_BODY>`
	
	Function body with return value
	`<FUNCTION_BODY name = "<function_name>" parameter = "<p1, p2, p3>"`
	`return = "true">`
	`…`
	`<LET name = "tmp></LET>`
	`<OP> tmp = p1 </OP>`
	`…`
	`<OP> $return = tmp </OP>`
	`</FUNCTION_BODY>`

FUNCTION_BODY continued	**Example:**
	`<function_body name = "test" parameter = "c1,c2,c3" return = "true">`
	`<LET name = "tmp">0</LET>`
	`<OP> tmp = c1+c2+c3 </OP>`
	`<OP> $return = tmp </OP>`
	`</function_body>`
	`…`
	`…`
	`…`
	`<LET name = "my_var"> 4 </LET>`
	`<function name = "test" return = " my_var "> 2, 3,4</function>`
	`<print text = "result = %d"> my_var </print>`
	`…`
	`…`

Tag identifier	Meaning
REQUEST	The tag is used to add a variable to the cyclic reading service (hotlink). As a consequence, the access time to variables, which are not linked to the control, is reduced. If a function is to be called automatically when a value changes, then the name of the function should be specified as an additional attribute. This tag is only processed within the INIT operation. **Attributes:** • **name** Address identifier • **function** Function name **Syntax:** <REQUEST name = "<NC-Variable>" /> or <REQUEST name = "<NC-Variable>" function="<function name>"/> **Example:** <request name ="plc/mb10" /> or <function_body name="my_function" > <print text="value changed" /> </function_body> … … … <request name ="plc/mb10" function="my_function"/>
UPDATE_CONTROLS	The tag runs a comparison between the operator controls and the reference variables. **Attribute:** • **type** The attribute defines the direction of the data comparison. **= TRUE** – data is read from the reference variables and copied to the operator controls. **= FALSE** – Data is copied from the operator controls to the reference variables. **Syntax:** <UPDATE_CONTROLS type = "<Direction>"/> **Example:** <SOFTKEY_OK> < UPDATE_CONTROLS type="false"/> </SOFTKEY_OK>

14.7 Generating user menus

14.7.1 Creating processing cycle forms

The cycle support function allows the automatic creation and decompilation of a cycle call through the form dialog.

To manage this functionality, the following tags are available:

- NC_INSTRUCTION
- CREATE_CYCLE

To mark a cycle form, in the **FORM** tag, the attribute **type** should be specified with the value **cycle**. This marking allows the **NC_INSTRUCTION** to be processed.

Example

```
<FORM name = "cycle100_form" type= "CYCLE">
…
…
</FORM>
```

The **NC_INSTRUCTION** tag contains the cycle call to be generated. All cycle parameters should be reserved using space retainers.

Example

```
<FORM name = "cycle100_form" type= "CYCLE">
<NC_INSTRUCTION refvar= "cyc_string" >Cycle100 ($p1, $p2, $p3)</ NC_INSTRUCTION>
…
…
…
</FORM
```

The **CREATE_CYCLE** tag prepares the values saved in the space retainer variables and generates the NC instruction.

This is then copied to the specified variable.

Tag identifier	Description
NC_INSTRUCTION	This tag is used to define the NC instruction to be generated. All listed cycle parameters are automatically created as string variables of the **FORM** and are available to the **FORM**. Precondition: The FORMattribute **type** is set to the value **CYCLE**. **Attribute:** • **refvar** If the tag is assigned a reference variable, all parameters are pre-assigned with the values from the NC block saved in the reference variables. **Syntax:** <NC_INSTRUCTION> NC instruction with placeholders </ NC_INSTRUCTION> **Example:** <let name="cyc_string" type="string"> Cycle100(0, 1000, 5)</let> … … … <FORM name = "cycle100_form" type= "CYCLE"> <NC_INSTRUCTION refvar= "cyc_string" >Cycle100($p1, $p2, $p3)</ NC_INSTRUCTION> .. … … </FORM>

Tag identifier	Description

CREATE_CYCLE	The tag generates an NC block, whose syntax is defined by the value of the **NC_INSTRUCTION** tag.
	Before generating the NC instruction, the parser calls the CYCLE_CREATE_EVENT tag of the FORM. This tag can be used to calculate the cycle parameters.
	Syntax:
	`<CREATE_CYCLE/>`
	
	Option:
	If a reference variable is specified, the instruction copies the generated call into this variable.
	`<create_cycle refvar="name" />`
	
	Attribute:
	• **refvar**
	If the tag is assigned a reference variable, the NC instruction is copied to this variable.
	
	Example:
	`<LET name="cyc_string" type="string"> Cycle100(0, 1000, 5)</LET>`
	
	`<SOFTKEY_OK>`
	`    <caption>OK</caption>`
	`    <CREATE_CYCLE />`
	`    <close_form />`
	`    <navigation>main_menu</navigation>`
	`</SOFTKEY_OK>`
	
	`or`
	
	`<SOFTKEY_OK>`
	`    <caption>OK</caption>`
	`    <CREATE_CYCLE refvar= "cyc_string" />`
	`    <close_form />`
	`    <navigation>main_menu</navigation>`
	`</SOFTKEY_OK>`

14.7.2 Substitution characters

The system offers the option of defining control properties (attribute values) for the runtime. In order to use this function, the desired property must be set in a local variable and the variable name must be transferred to the tag as an attribute value preceded by the **character $**.

If the tag expects a string as attribute value or value, the $$$ characters must be placed in front of the variable name.

Example:

```
<let name="my_ypos">100</let>
<let name="field_name" type="string"></let>


<control name = "edit1" xpos = "322" ypos = "$my_ypos" refvar="nck/Channel/Parameter/R[1]"
/>


<op>my_ypos = my_ypos +20 </op>
```

```
<control name = "edit2" xpos = "322" ypos = "$my_ypos" refvar="nck/Channel/Parameter/R[2]"
/>

<print name =" field_name" text="edit%d">3</print>
<op>my_ypos = my_ypos +20 </op>

<control name = "$field_name" xpos = "322" ypos = "$my_ypos"
refvar="nck/Channel/Parameter/R3]" />

<caption>$$$field_name</caption>
```

14.8 Addressing components

Address identifiers for the desired data must be created to address NC variables, PLC blocks or drive data. An address consists of the subpaths **component name** and **variable address**. A slash should be used as a separating character.

For detailed information about all system variables, see the SINUMERIK 840D sl/828D List Manual System variables under the following link:

https://support.industry.siemens.com/cs/ww/en/ps/14593/man

14.8.1 PLC addressing

Addressing the PLC starts with the path section **plc**.

The following addresses are permissible:

DBx.DB(f)	Data block
I(f)x	Input
Q(f)x	Output
M(f)x	Bit memory
V(f)x	Variable

DBx.DBXx.b	Data block
Ix.b	Input
Qx.b	Output
Mx.b	Bit memory
Vx.b	Variable

Data format **f**:

B	Byte
W	Word
D	Double word

Data format identification is not applicable to bit addressing.

Address **x**:

Valid S7-200 address identifier

Bit addressing:

b – Bit number

Examples:

```
<data name = "plc/mb170">1</data>
<data name = "i0.1"> 1 </data>
<op> "m19.2" = 1 </op>
```

14.8.2 Addressing NC variables

Addressing the NC variables starts with the path section **nck**.

This section is followed by the data address; its structure should be taken from the SINUMERIK 828D List Manual NC variable and interface signals under the following link:

https://support.industry.siemens.com/cs/ww/en/ps/14593/man

Example:

```
<LET name = "tempStatus"></LET>
<OP> tempStatus ="nck/channel/state/chanstatus" </OP>
```

Frequently used NC variables

See the following table for the common NC variables used for generating user dialogs.

<table>
<tr><th colspan="2">Variable address</th><th>Meaning</th><th>Remarks</th></tr>
<tr><td colspan="2">Nck/Channel/MachineAxis/actToolBasePos[n]</td><td>Machine coordinates</td><td rowspan="3">• n = 0: axis X
• n = 1: axis Y
• n = 2: axis Z
• n = 3: spindle</td></tr>
<tr><td colspan="2">nck/Channel/GeometricAxis/actprogpos[n]</td><td>Workpiece coordinates (where the tool tip is located in WCS)</td></tr>
<tr><td colspan="2">nck/Channel/GeometricAxis/actToolEdgeCenterPos[n]</td><td>Where the tool edge center is located in WCS</td></tr>
<tr><td colspan="2">nck/Channel/State/actTNumber</td><td>Actual tool number</td><td></td></tr>
<tr><td colspan="2">nck/Channel/State/actDNumber</td><td>Actual tool edge number</td><td></td></tr>
<tr><td colspan="2">nck/Channel/State/actFeedRateIpo</td><td>Actual feedrate</td><td></td></tr>
<tr><td colspan="2">nck/Channel/State/cmdFeedRateIpo</td><td>Programmed feedrate</td><td></td></tr>
<tr><td colspan="2">nck/Channel/Spindle/actSpeed</td><td>Actual spindle speed</td><td></td></tr>
<tr><td colspan="2">nck/Channel/Spindle/cmdSpeed</td><td>Programmed spindle speed</td><td></td></tr>
<tr><td rowspan="4">For turning machines</td><td>nck/Tool/Compensation/cuttEdgeParam[u1,cn,p+2]</td><td>Length X of tool n tool edge m</td><td rowspan="12">• n = tool number
• m = tool edge number
• p = (m - 1) x 35</td></tr>
<tr><td>nck/Tool/Compensation/cuttEdgeParam[u1,cn,p+3]</td><td>Length Z of tool n tool edge m</td></tr>
<tr><td>nck/Tool/Compensation/cuttEdgeParam[u1,cn,p+11]</td><td>Length X for tool wear of tool n tool edge m</td></tr>
<tr><td>nck/Tool/Compensation/cuttEdgeParam[u1,cn,p+12]</td><td>Length Z for tool wear of tool n tool edge m</td></tr>
<tr><td rowspan="6">For milling machines</td><td>nck/Tool/Compensation/cuttEdgeParam[u1,cn,p+2]</td><td>Length X of tool n tool edge m</td></tr>
<tr><td>nck/Tool/Compensation/cuttEdgeParam[u1,cn,p+3]</td><td>Length Y of tool n tool edge m</td></tr>
<tr><td>nck/Tool/Compensation/cuttEdgeParam[u1,cn,p+4]</td><td>Length Z of tool n tool edge m</td></tr>
<tr><td>nck/Tool/Compensation/cuttEdgeParam[u1,cn,p+11]</td><td>Length X for tool wear of tool n tool edge m</td></tr>
<tr><td>nck/Tool/Compensation/cuttEdgeParam[u1,cn,p+12]</td><td>Length Y for tool wear of tool n tool edge m</td></tr>
<tr><td>nck/Tool/Compensation/cuttEdgeParam[u1,cn,p+13]</td><td>Length Z for tool wear of tool n tool edge m</td></tr>
<tr><td colspan="2">nck/Tool/Compensation/cuttEdgeParam[u1,cn,p+5]</td><td>Radius of tool n tool edge m</td></tr>
<tr><td colspan="2">nck/Tool/Compensation/edgeData[cn,p+14]</td><td>Radius for tool wear of tool n tool edge m</td></tr>
<tr><td colspan="2">nck/Channel/ProgramInfo/block[u1,0]</td><td>Previous line of the currently executed block</td><td></td></tr>
<tr><td colspan="2">nck/Channel/ProgramInfo/block[u1,1]</td><td>Currently executed block</td><td></td></tr>
<tr><td colspan="2">nck/Channel/ProgramInfo/block[u1,2]</td><td>Next line of the currently executed block</td><td></td></tr>
</table>

Variable address	Meaning	Remarks
nck/Nck/ChannelDiagnose/poweronTime[u1]	Time elapsed since the last normal power-on (unit: min)	
nck/Channel/State/actProgNetTime[u1]	Run time of a selected program (unit: s)	
nck/Channel/State/reqParts[u1]	Required parts to be counted	
nck/Channel/State/actParts[u1]	Parts actually counted	
Nck/Channel/Parameter/R[n]	R parameters	

14.8.3 Generating NC/PLC addresses during the runtime

It is possible to generate an address identifier during runtime.

In this case, the content of a string variable is used as address in an operation statement as well as in the nc.cap.read and nc.cap.write functions.

Observe the following for this type of addressing mode:

- Write the variable names in quotation marks.
- Use three ‚$’ characters as prefix for variable names.

Syntax:

```
"$$$variable name"
```

Example:

```
<PRINT name="var_adr" text="plc/DB9000.DBW%d"> 2000</PRINT>
<OP> "$$$var_adr" = 1 </OP>
```

14.8.4 Addressing drive components

Addressing the drive components starts with the path section **drive**.

Then the drive device is specified:

CU - Control Unit

DC - Drive Control

The parameter to be set is added to this section.

Drive component addresses are defined as follows:

- do1: drive with address 11
- do2: drive with address 12
- do3: drive with address 13
- do4: drive with address 14
- do5: drive with address 15

Example:

```
<LET name="r0002_content"></LET>
<LET name="p1460_content"></LET>

<!— Reading of value r0002 on the CU of drive with address 11 ->
<op> r0002_content = "drive/cu/r2[do1]" </op>

<!— Reading of value r0002 on the CU of drive with address 15 ->
<op> r0002_content = "drive/cu/r0002[do5]" </op>

<!— Reading of value p1460 on dc of drive with address 12 ->
<op> p1460_content = "drive/dc/p1460[do2]" </op>
```

Example:

Alternatively, the drive index can be read from a local variable using **$<variable name>** "substitution characters".

```
for instance DO$local variable
```

Example:

```
<DATA name = "drive/dc/p1460[do1]">1</DATA>
```

Indirect addressing:

```
<LET name = "driveIndex">1</LET>
<DATA name = "drive/dc/p1460[do$driveIndex]">1</DATA>
```

14.8.5 Addressing machine and setting data

Drive and setting data is identified by the character $ followed by the name of the data.

Machine data:

$Mx_<name**[index, AX<axis_number>]>**

Setting data:

$Sx_<name[index, AX<axis_number>]>

x:

N – General machine or setting data

C – Channel-specific machine or setting data

A – Axis-specific machine or setting data

Index:

For a field, the parameter indicates the index of the data.

AX<axis_number>:

The required axis (**<axis_number>**) has to be specified for axis-specific data.

Alternatively, the axis index can be read from a local variable using **$<variable name>** "substitution characters".

e.g. AX$localvariable

Example:

```
<DATA name ="$MN_AXCONF_MACHAX_NAME_TAB[0] ">X1</DATA>
```

Direct addressing of the axis:

```
<DATA name ="$MA_CTRLOUT_MODULE_NR[0, AX1] ">1</DATA>
…
…
```

Indirect addressing of the axis:

```
<LET name ="axisIndex"> 1 </LET>
<DATA name ="$MA_CTRLOUT_MODULE_NR[0, AX$axisIndex] ">1</DATA>
```

14.8.6 Addressing the user data

Addressing user data starts with the path section **gud**, followed by the GUD name.

For a field, after the name, the required field index should be specified in square brackets.

Example:

```
<DATA name ="gud/syg_rm[0]"
<OP>"gud/syg_rm[0]" 0 10 </op>
```

Addressing the global user data

Addressing starts with the path section gud, followed by the specification of the area CHANNEL. This address section is followed by the specification of the GUD areas:

GUD areas	Assignment
sgud	Siemens GUD
mgud	Machine manufacturer GUD
ugud	User GUD

Then enter the GUD name. If an array is to be addressed, the name is followed by the array subscript in square brackets.

Example:

```
<data name ="gud/channel/mgud/syg_rm[0]">1</data>
<op>"gud/channel/mgud/syg_rm[0]" = 5*2 </op>
```

14.8.7 Creating typical menus in user dialogs by addressing components

This section describes how to create typical menus in user dialogs by generating the script file (xmldial.xml) and XML files (for example, machine_settings.xml) inserted in the "xmldial. xml" file that are required for addressing the desired components.

Generating the script file

The "xmldial.xml" control file integrates, with the "INCLUDE" XML tag, XML files containing programmed instructions for displaying the dialog forms and parameters on the HMI.

HMI	Syntax	Used identifiers and their meanings
	`<?xml version="1.0" encoding="gb2312"?>`	
	`<DialogGui type="1">`	**DialogGui**: defines all dialog configurations.

	`<?include src="f:\appl\Main.xml"?>`
	`<?include src="f:\appl\Setting.xml"?>`
	`<?include src="f:\appl\Parameter.xml"?>`
		INCLUDE: includes the desired XML description.

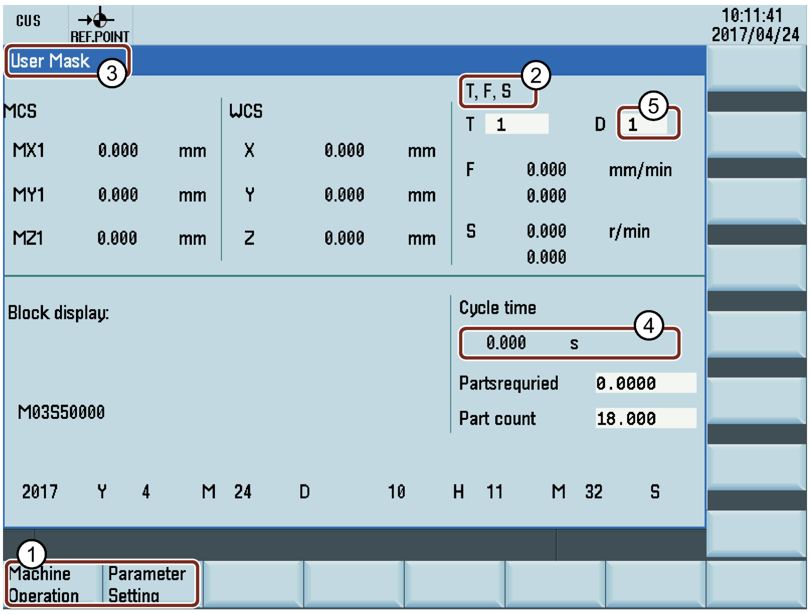
	`</DialogGui>`	**DialogGui**: defines all dialog configurations.

Generating the XML file for creating the start menu

General information

- Type of addressed components: NC variables
- Menu function on the HMI: displaying the system data

User dialog and XML file examples



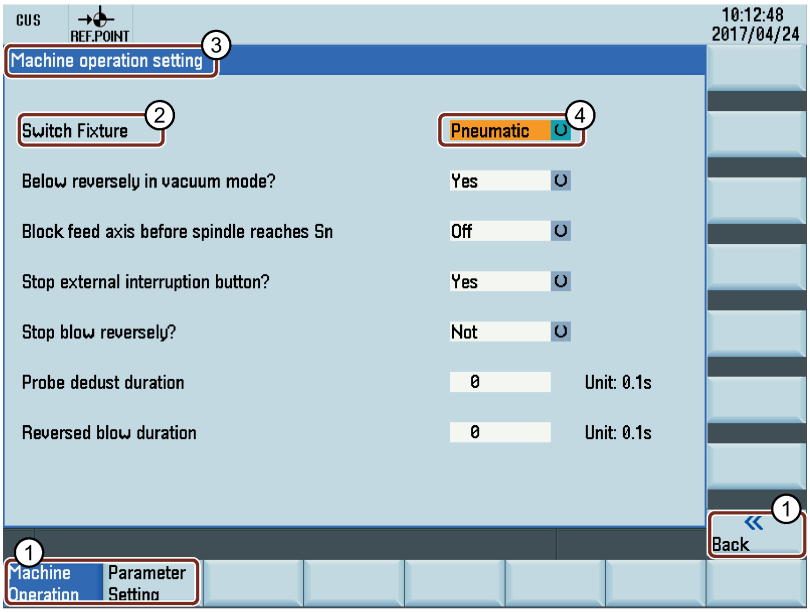
HMI	Syntax	Used identifiers and their meanings
	<menu name="Main">	**MENU**: defines the start menu containing the softkey description and the dialog to be opened.
	<OPEN_FORM name="Main" />	**OPEN_FORM**: opens the desired dialog form given under the desired name.
①	<softkey position="1" type="user_controlled">	**SOFTKEY**: defines the properties and responses of the desired softkeys.
	<state type="notpressed" />	
	<caption>Machine%nOperation</caption>	
	<navigation>Setting</navigation>	
	</softkey>	
	<softkey position="2" type="user_controlled">	
	<state type="notpressed" />	
	<caption>Parameter%nSetting</caption>	
	<navigation>Parameter</navigation>	
	</softkey>	
	</menu>	**MENU**: defines the start menu containing the softkey description and the dialog to be opened.
	<form name="Main">	**FORM**: defines the description of the desired user dialog.
②	</paint>	**PAINT**: defines the desired texts and images which are to be displayed in the dialog box.
	<text xpos="369" color="#000000" ypos="28">T, F, S</text>	
	...	
	</paint>	
	<init>	**INIT**: defines the desired input elements and hotlinks for the dialog form
③	<caption>User Mask</caption>	**CAPTION**: defines the title of the desired dialog box.
④	<let name="time array" dim="7" />	**LET**: defines the desired local variable under the specified name.
	<function name ="control.localtime">_T"time_array"</function>	
⑤	<control name="InputField1" xpos="489" ypos="54" height="16" width="40" refvar="nck/Channel/State/actDNumber" hot-link="true" format="%2d" />	**CONTROL**: defines the desired control elements.
	...	
	</init>	**INIT**: defines the desired input elements and hotlinks for the dialog form
	</form>	**FORM**: defines the description of the desired user dialog.

Generating the XML file for creating the machine operating menu

General information

- Type of addressed components: PLC data
- Menu function on the HMI: making machine settings by addressing the PLC data to operate the machine.

User dialog and XML file examples



HMI	Syntax	Used identifiers and their meanings
	<menu name="Setting">	**MENU**: defines the start menu containing the softkey description and the dialog to be opened.
	<OPEN_FORM name="Setting" />	**OPEN_FORM**: opens the desired dialog form given under the desired name.
①	<softkey position="1" type="user_controlled">	**SOFTKEY**: defines the properties and responses of the desired softkeys.
	<state type="pressed" />	
	<caption>Machine%nOperation</caption>	
	</softkey>	
	<softkey position="2" type="user_controlled">	
	<state type="notpressed" />	
	<caption>Parameter%nSetting</caption>	
	<navigation>Parameter</navigation>	
	</softkey>	
	<softkey back type="user controlled">	
	<state type="notpressed" />	
	<navigation>Main</navigation>	
	</softkey_back>	
	</menu>	**MENU**: defines the start menu containing the softkey description and the dialog to be opened.
	<form name="Setting">	**FORM**: defines the description of the desired user dialog.
②	<paint>	**PAINT**: defines the desired texts and images which are to be displayed in the dialog box.
	<text xpos="15" color="#000000" ypos="60">Switch Fixture</text>	
	...	
	</paint>	
	<init>	**INIT**: defines the desired input elements and hotlinks for the dialog form
③	<caption>Machine operation set-ting</caption>	**CAPTION**: defines the title of the desired dialog box.

HMI	Syntax	Used identifiers and their meanings

④	`<control name="Toggle1" xpos="346" ypos="60" height="16" width="80" refvar="plc/db1400.dbx9.0" hotlink="true" fieldtype="combobox">`
	`<item value="1">Vacuum</item>`
	`<item value="0">Pneumatic</item>`
	`</control>`
	`...`
		CONTROL: defines the desired control elements.

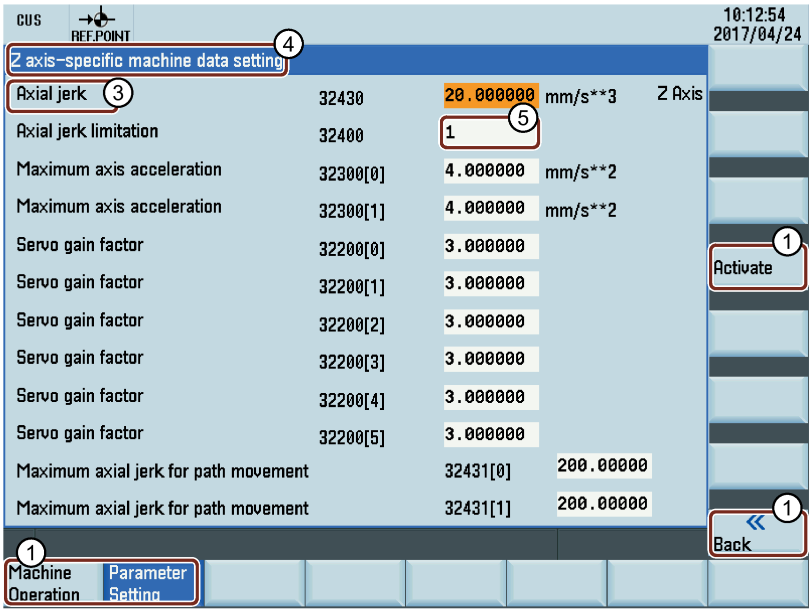
	`</init>`	**INIT**: defines the desired input elements and hotlinks for the dialog form
	`</form>`	**FORM**: defines the description of the desired user dialog.

Generating the XML file for creating the parameter setting menu

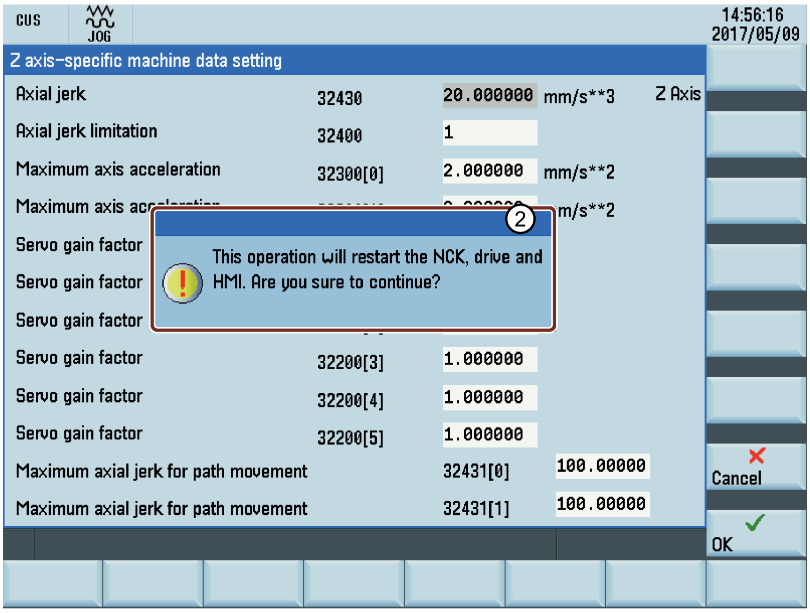
General information

- Type of addressed components: machine and setting data
- Menu function on the HMI: making settings for frequently used Z axis parameters

User dialog and XML file examples



Pressed ⇒



HMI	Syntax	Used identifiers and their meanings
	<let name="var2" type="int"></let>	**LET**: defines the desired local variable under the specified name.
	<menu name="Parameter">	**MENU**: defines the start menu containing the softkey description and the dialog to be opened.
	<OPEN_FORM name="Parameter" />	**OPEN_FORM**: opens the desired dialog form given under the desired name.
①	<softkey position="1" type="user controlled">	**SOFTKEY**: defines the properties and responses of the desired softkeys.
	<state type="notpressed" />	
	<caption>Machine%nOperation</caption>	
	<navigation>Setting</navigation>	
	</softkey>	
	<softkey position="2" type="user controlled">	
	<state type="pressed" />	
	<caption>Parameter%nSetting</caption>	
	</softkey>	
	<softkey back type="user controlled">	
	<state type="notpressed" />	
	<navigation>Main</navigation>	
	</softkey back>	
	<softkey position="12">	
	<caption>Activate</caption>	
②	<msgbox text="This operation will restart the NCK, drive and HMI. Are you sure to con-tinue?" caption="1" retvalue="var2" type="btn okcancel"/>	**MSGBOX**: opens the desired message box whose return value can be used for branching.
	<if>	
	<condition>var2==1</condition>	
	<then>	
	<control reset resetnc="true"/>	
	<waiting waitingfornc="true"/>	
	</then>	
	</if>	

HMI	Syntax	Used identifiers and their meanings
	`</softkey>`	**SOFTKEY**: defines the properties and responses of the desired softkeys.
	`</menu>`	**MENU**: defines the start menu containing the softkey description and the dialog to be opened.
	`<form name="Parameter">`	**FORM**: defines the description of the desired user dialog.
③	`<paint>`	**PAINT**: defines the desired texts and images which are to be displayed in the dialog box.
	`<TEXT xpos="10" ypos="30" color="#000000">Axial jerk</TEXT>`	
	`...`	
	`</paint>`	
	`<init>`	**INIT**: defines the desired input elements and hotlinks for the dialog form
④	`<caption>Z axis-specific machine data setting</caption>`	**CAPTION**: defines the title of the desired dialog box.
⑤	`<DATA_ACCESS type="true"/>`	**CONTROL**: defines the desired control elements.
	`<CONTROL name="III" xpos="350" ypos="30" height="20" width="75" fieldtype="edit" refvar="$MA_JOG_AND_POS_MAX_JERK[AX3]" hotlink="true"/>`	
	`...`	
	`</init>`	**INIT**: defines the desired input elements and hotlinks for the dialog form
	`</form>`	**FORM**: defines the description of the desired user dialog.

14.9 Predefined functions

The script language offers various string processing and standard mathematical functions. The function names listed below are reserved and cannot be overloaded.

Function name	Description

ncfunc.cap.read	The function copies a value from the specified address into a local variable. If the read operation was error-free, then the return variable contains the value zero.
	
	Contrary to the operation instruction, in the event of a fault, this function does not interrupt the processing of the script operations.
	
	Syntax:
	`<function name="ncfunc.cap.read" return="error"> lokale variable, "address"</function>`
	
	Example:
	`<let name="error"></let>`
	`<function name="ncfunc.cap.read" return="error"> 3, "drive/cu/p0009"</function>`
	`<if>`
	`<condition>error != 0</condition>`
	`<then>`
	`<break />`
	`</then>`
	`</if>`

Function name	Description
ncfunc.cap.write	The function writes a value into the specified variable. If the write operation was error-free, then the return variable contains the value zero. Contrary to the operation instruction, in the event of a fault, this function does not interrupt the processing of the script operations. **Syntax:** <function name="ncfunc.cap.write" return="error"> local variable or constant, "address"</function> **Example:** <let name="error"></let> <function name="ncfunc.cap.write" return="error"> 0, "drive/cu/p0009"</function> <if> <condition>error != 0</condition> <then> <break /> </then> </if>

ncfunc.pi_service	Jobs can be transferred to the NCK using the program invocation (PI) service.
	If the service has been executed error-free, the function returns the value 1 in the return variable.
	Manipulation of the tool list
	_N_CREATO - Create tool
	_N_DELETO - Delete tool
	_N_CREACE - Create tool cutting edge
	_N_DELECE - Delete tool cutting edge
	Activation of work offsets
	_N_SETUFR - Activates the actual user frame
	_N_SETUDT - Activates the actual user data
	Block search
	_N_FINDBL - Activate block search
	_N_FINDAB - Cancel block search
	Syntax:
	<function name="ncfunc.pi_service" return="return var"> pi name, var1, var2, var3, var4, var5 </function>
	Attributes:
	• name - function name
	• return- Name of the variable in which the execution result is saved
	  – Value == 1 – job executed successfully
	  – Value == 0 – faulty job
	Tag values:
	• pi name - Name of the PI service (string)
	• var1 tovar5 - PI specific arguments

Function name	Description
ncfunc.pi_service Continued	**Arguments:** • _N_CREATO var1 - Tool number • _N_DELETO var1 - Tool number • _N_CREACE var1 - Tool number var2 - Cutting edge number • _N_DELECE var1 - Tool number var2 - Cutting edge number • _N_SETUFR No arguments • _N_SETUDT var1- User data area to be activated – 1 - Tool offset data – 2 - Active basic frame – 3 - Active adjustable frame • _N_FINDBL var1 - Search mode – 2 - Search with contour calculation – 4 - Search for the block end point – 1 - Block search without calculation. • _N_FINDAB No arguments **Example:** • Creating a tool – tool number 3 `<function name="ncfunc.pi_service">_T"_N_CREATO", 3</function>` • Delete cutting edge 1 of tool 5 <function name="ncfunc.pi_service">_T"_N_DELECE", 5, 1</function>

Function name	Description

ncfunc.chan_pi_service	The function executes a PI service in a channel-related manner. The channel number is passed after the PI service name. This is followed by all other call parameters.
	
	Parameters:
	channel - Channel number
	
	Syntax:
	`<function name="ncfunc.chan_pi_service" re-turn="error"> _T"_N_SETUFR", channel, …</function>`
	
	Example:
	`<let name="chan" >1</let>`
	`<function name="ncfunc.chan_pi_service" re-turn="error"> _T"_N_SETUFR", chan</function>`
	
	`<function name="ncfunc.chan_pi_service" re-turn="error"> _T"_N_SETUDT", chan, _T"016", _T"00000", _T"00000"</function>`

ncfunc.displayresolution	This function supplies the conversion rule for floating point numbers defined in the control. A string variable must be provided as variable.
	
	See also display machine data MD203 DISPLAY_RESOLUTION and MD204 DISPLAY_RESOLUTION_INCH
	
	Syntax:
	`<function name="ncfunc.displayresolution" re-turn="dislay_res" />`
	
	Example:
	`<let name="dislay_res" type="string"></let>`
	`…`
	`<function name="ncfunc.displayresolution" re-turn="dislay_res" />`
	
	`<control name = "cdistToGo" xpos = "210" ypos = "156" refvar="nck/Channel/GeometricAxis/progDistToGo[2]" hotlink="true" height="34" fieldtype="readonly" format="$$$dislay_res" time="superfast" col-or_bk="#ffffff"/>`

Function name	Description
ncfunc.password	This function sets or deletes a password level. • Set password: The password should be specified for the required password level as parameter. • Delete password: A blank string deletes the password level. **Syntax:** <function name="ncfunc.password">password </function> **Example:** <let name="password"type="string"></let> <function name="ncfunc.password" > pass- word</function> <function name="ncfunc.password" > _T"CUSTOMER" </function> Delete password: <function name="ncfunc.password" > _T"" </function>
control.formcolor	This function provides the text or background color of the dialog box as string. Color coding (see Section "Color coding (Page 309)") **Range:** • BACKGROUND – request color value of the background • TEXT – request color value of the text (foreground) **Syntax:** <function name="control.formcolor" re- turn="variable">_T"range"</function> **Example:** <let name="bk_color" type="string"></let> <function name="control.formcolor" re- turn="bk_color">_T"BACKGROUND"</function>

Function name	Description

control.localtime	The function copies the local time in a field with 7 array elements.
	The name of the variable is expected as call parameter.
	The following is stored in an array element:
	• Index 0 - year
	• Index 1 - month
	• Index 2 - weekday
	• Index 3 - day
	• Index 4 - hour
	• Index 5 - minute
	• Index 6 - second
	
	Syntax:
	`<function name`
	`="control.localtime">_T"time_array"</function>`
	
	Example:
	`<!-- index`
	`0 = Year`
	`1 = Month`
	`2 = Day of week`
	`3 = Day`
	`4 = Hour`
	`5 = Minute`
	`6 = Second`
	`-->`
	`<let name="time_array" dim="7" />`
	
	`  <function name`
	`="control.localtime">_T"time_array"</function>`

string.cmp	Two strings are compared with one another from a lexicographical perspective.
	The function gives a return value of zero if the strings are the same, a value less than zero if the first string is smaller than the second string or a value greater than zero if the second string is smaller than the first string.
	Parameter:
	str1 - string
	str2 - comparison string
	
	Syntax:
	`<function name="string.cmp" return ="<int var>" >`
	`str1, str2 </function>`
	
	Example:
	`<let name="rval">0</let>`
	`<let name="str1" type="string">A brown bear hunts a brown dog.</let>`
	`<let name="str2" type="string">A brown bear hunts a brown dog.</let>`
	
	`<function name="string.cmp" return="rval"> str1,`
	`str2 </function>`
	Result:
	rval= 0

Function name	Description
string.icmp	Two strings are compared from a lexicographical perspective (the comparison is not case-sensitive). The function gives a return value of zero if the strings are the same, a value less than zero if the first string is smaller than the second string or a value greater than zero if the second string is smaller than the first string. **Parameter:** **str1** - string **str2** - comparison string **Syntax:** <function name="string.icmp" return ="<int var>" > str1, str2 </function> **Example:** <let name="rval">0</let> <let name="str1" type="string">A brown bear hunts a brown dog.</let> <let name="str2" type="string">A brown Bear hunts a brown Dog.</let> <function name="string. icmp" return="rval"> str1, str2 </function> **Result:** rval= 0
string.left	The function extracts the first nCount character from string 1 and copies this to the return variable. **Parameter:** **str1** - string **nCount** - number of characters **Syntax:** <function name="string.left" return="<result string>"> str1, nCount </function> **Example:** <let name="str1" type="string">A brown bear hunts a brown dog.</let> <let name="str2" type="string"></let> <function name="string.left" return="str2"> str1, 12 </function> **Result:** str2="A brown bear"

Function name	Description
string.right	The function extracts the last nCount character from string 1 and copies this to the return variable. **Parameter:** **str1** - string **nCount** - number of characters **Syntax:** <function name="string.right" return="<result string>"> str1, nCount </function> **Example:** <let name="str1" type="string">A brown bear hunts a brown dog.</let> <let name="str2" type="string"></let <function name="string.right " return="str2"> str1, 10 </function> **Result:** str2="brown dog."
string.middle	The function extracts the specified number of characters from string 1, starting from the iFirst index, and copies these to the return variable. **Parameter:** **str1** - string **iFirst** - start index **nCount** - number of characters **Syntax:** <function name="string.middle" return="<result string>"> str1, iFirst, nCount </function> **Example:** <let name="str1" type="string">A brown bear hunts a brown dog.</let> <let name="str2" type="string"></let <function name="string.middle " return="str2"> str1, 2, 5 </function> **Result:** str2="brown"

Function name	Description

string.length	The function gives the number of characters in a string.
	
	Parameter:
	str1 - string
	
	Syntax:
	`<function name="string.length" return="<int var>"> str1 </function>`
	
	Example:
	`<let name="length">0</let>`
	
	`<let name="str1" type="string">A brown bear hunts a brown dog.</let>`
	`<function name="string.length" return="length"> str1 </function>`
	Result:
	length = 31

string.replace	The function replaces all the substrings found with the new string.
	
	Parameter:
	string - string variable
	find string - string to be replaced
	new string - new string
	
	Syntax:
	`<function name="string.replace"> string, find string, new string </function>`
	
	Example:
	`<let name="str1" type="string">A brown bear hunts a brown dog. </let>`
	
	`<function name="string.replace" > str1, _T"a brown dog" , _T"a big salmon"</function>`
	Result:
	str1 = "A brown bear hunts a big salmon!"

Function name	Description
string.remove	The function removes all the substrings found. **Parameter:** **string** - string variable **remove string** - substring to be deleted **Syntax:** <function name="string.remove"> string, remove string </function> **Example:** <let name="index">0</let> <let name="str1" type="string">A brown bear hunts a brown dog. </let> <function name="string.remove" > str1, _T"a brown dog" </function **Result:** str1 = "A brown bear hunts"
string.insert	The function inserts a string at the index specified. **Parameter:** **string** - string variable **index** - index (zero based) **insert string** - string to be inserted **Syntax:** <function name="string.insert"> string, index, insert string </function> **Example:** <let name="str1" type="string">A brown bear hunts. </let> <let name="str2" type="string">a brown dog</let> <function name="string.insert" > str1, 19, str2</function> **Result:** str1 = "A brown bear hunts a brown dog"

Function name	Description
string.delete	The function deletes the defined number of characters starting from the start position specified. **Parameter:** **string** - string variable **start index** - start index (zero based) **nCount** - number of characters to be deleted **Syntax:** <function name="string.delete"> string, start index , nCount </function> **Example:** <let name="str1" type="string">A brown bear hunts. </let> <function name="string.delete" > str1, 2, 5</function> **Result:** str1 = "A bear hunts"
string.find	The function searches the transferred string for the first match with the substring. If the substring is found, the function provides the index to the first character (starting with zero) or, failing this, -1. **Parameter:** **string** - string variable **find string** - string to be found **startindex** – start index (optional) **Syntax:** <function name="string.find" return="<int val>"> str1, find string </function> **Example:** <let name="index">0</let> <let name="str1" type="string">A brown bear hunts a brown dog. </let> <function name="string.find" return="index"> str1, _T"brown" </function> **Result:** Index = 2 **or** <function name="string.find" return="index"> str1, _T"brown", 1 </function>

Function name	Description
string.reversefind	The function searches the transferred string for the last match with the substring. If the substring is found, the function provides the index to the first character (starting with zero) or, failing this, -1. **Parameter:** **string** - string variable **find string** - string to be found **startindex** – start index (optional) **Syntax:** <function name="string.reversefind" return="<int val>"> str1, find string </function> **Example:** <let name="index">0</let> <let name="str1" type="string">A brown bear hunts a brown dog. </let> <function name="string.reversefind" return="index"> str1, _T"brown" </function> **Result:** Index = 21 **or** <function name="string.reversefind" return="index"> str1, _T"brown", 10 </function> **Result:** Index = 2
string.trimleft	The function trims the starting characters from a string. **Parameter:** **str1** - string variable **Syntax:** <function name="string.trimleft" > str1 </function> **Example:** <let name="str1" type="string"> test trim left</let> <function name="string.trimleft" > str1 </function> **Result:** str1 = "test trim left"

Function name	Description

string.trimright	The function trims the closing characters from a string.
	
	Parameter:
	str1 - string variable
	
	Syntax:
	`<function name="string.trimright" > str1 </function>`
	
	Example:
	`<let name="str1" type="string"> test trim right </let>`
	`<function name="string.trimright" > str1 </function>`
	Result:
	str1 = "test trim right"

sin	The function calculates the sine of the value transferred in degrees.
	
	Parameter:
	double - angle
	
	Syntax:
	`<function name="sin" return="<double val>"> double </function>`
	
	Example:
	`<let name= "sin_val" type="double"></let>`
	`<function name="sin" return="sin_val"> 20.0 </function>`

cos	The function calculates the cosine of the value transferred in degrees.
	
	Parameter:
	double - angle
	
	Syntax:
	`<function name="cos" return="<double val>"> double </function>`
	
	Example:
	`<let name= "cos_val" type="double"></let>`
	`<function name="cos" return="cos_val"> 20.0 </function>`

Function name	Description
tan	The function calculates the tangent of the value transferred in degrees. **Parameter:** **double** - angle **Syntax:** <function name="tan" return="<double val>"> double </function> **Example:** <let name= "tan_val" type="double"></let> <function name="tan" return="tan_val"> 20.0 </function>
arcsin	The function calculates the arcsine of the value transferred in degrees. **Parameter:** **double** - x in the range from -PI/2 to +PI/2 **Syntax:** <function name="arcsin" return="<double val>"> double </function> **Example:** <let name= "arcsin_val" type="double"></let> <function name="arcsin" return="arcsin_val"> 20.0 </function>
arcos	The function calculates the arccosine of the value transferred in degrees. **Parameter:** **double -** x in the range from -PI/2 to +PI/2 **Syntax:** <function name="arcos" return="<double val>"> double </function> **Example:** <let name= "arccos_val" type="double"></let> <function name="arccos" return="arccos_val"> 20.0 </function>

Function name	Description
arctan	The function calculates the arctan of the value transferred in degrees. **Parameter:** **double** - arctan of y/x **Syntax:** <function name="arctan" return="<double val>"> double </function> **Example:** <let name= "arctan_val" type="double"></let> <function name="arctan" return="arctan_val"> 20.0 </function>
File processing	
doc.readfromfile	The function reads the contents of the specified file into a string variable. The number of characters to be read can optionally be specified as a second parameter. **Attribute:** **return** - name of the local variable **Parameter:** **progname** - file name **number of characters** - number of characters to be read in bytes (optional): **Syntax:** <function name="doc.readfromfile" return="<string var>"> progname, number of characters </function> **Example:** <let name = "my_var" type="string" ></let> NC file system <function name="doc.readfromfile" return="my_var"> _T"n:\mpf\test.mpf" </function> CompactFlash card <function name="doc.readfromfile" return="my_var"> _T"f:\appl\test.mpf" </function> or <function name="doc.readfromfile" return="my_var"> _T".\test.mpf" </function>

Function name	Description
doc.writetofile	The function writes the contents of a string variable to the file speci-fied. **Parameter:** **progname** - file name **str1** - string **Syntax:** <function name="doc.writetofile" > progname, str1 </function> **Example:** <let name = "my_var" type="string" > file content </let> NC file system <function name="doc.writetofile">_T"n:\mpf\test.mpf", my_var </function> CompactFlash card <function name="doc.writetofile">_T"f:\appl\test.mpf", my_var </function> or <function name="doc.writetofile">_T".\test.mpf", my_var </function>
doc.remove	The function removes the file specified from the directory. **Parameter:** **progname** - file name **Note:** The file name is case-sensitive for a file on the CF card. **Syntax:** <function name="doc.remove" > progname </function> **Example:** NC file system <function name="doc.remove">_T"n:\mpf\test.mpf" </function> CompactFlash card <function name="doc.remove">_T"f:\appl\test.mpf" </function> or <function name="doc.remove">_T".\test.mpf" </function>

Function name	Description
doc.loadscript	The function copies a dialog description embedded in a part program into the specified local variable. The call parameters to be specified are the program name, the dialog name, and a variable for storing the main menu name. If the name of the dialog description was found in the part program, the return variable contains this description. If the content of the variable is stored in a file, the script can be executed with an indirect call. The system provides a script that extracts the dialog description from the active part program and activates the dialog. This script can be called in an MMC command to activate the screen associated with the part program. **Syntax:** <function name="doc.loadscript" return="<name of script variable>">progname, _T"dialog part name", main menu </function> **Attribute**: **return** - variable in which the extracted script is stored **Parameters:** **progname** - full path to the program. (The path name can be passed to the function in DOS notation.) **main menu** - the menu name found is copied into this variable **dialog part name** - tag name in which the dialog description is embedded **Example:** <function name="doc.loadscript" return="contents">prog_name, _T"main_dialog", entry</function>

Function name	Description
doc.exist	If the file exists, the function returns the value 1. **Parameter:** **progname** - file name **Note:** The file name is case-sensitive for a file on the CF card. **Syntax:** <function name="doc.exist" return="<int_var>" > progname </function> **Example:** <let name ="exist">0</let> NC file system <function name="doc.exist" re-turn="exist">_T"n:\mpf\test.mpf" </function> CompactFlash card <function name="doc.exist" re-turn="exist">_T"f:\appl\test.mpf" </function> or <function name="doc.exist" re-turn="exist">_T".\test.mpf" </function>
ncfunc.select	The function selects the program specified for execution. The program must be stored in the NC file system. **Parameter:** **progname** - file name **Syntax:** <function name="ncfunc.select"> progname </function> **Example:** NC file system <function name="ncfunc.select"> _T"n:\mpf\test.mpf" </function> CompactFlash card <function name="ncfunc.select"> _T"f:\appl\test.mpf" </function> or <function name="ncfunc.select"> _T".\test.mpf" </function>

Function name	Description
ncfunc.bitset	The function is used to manipulate individual bits of the specified variables. The bits can either be set or reset. Syntax: <function name="ncfunc.bitset" refvar="address" value="set/reset" > bit0, bit1, … bit9 </function> Attributes: **refvar** - specifies the name of the variable, in which the bit combination should be written **value** – bit value, value range 0 and 1 Values: The bit numbers starting with zero should be transferred as function values. A maximum of 10 bits per call can be modified. Example: <function name="ncfunc.bitset" refvar="nck/Channel/Parameter/R[1]" value="1" > 0, 2, 3, 7 </function> <function name="ncfunc.bitset" refvar="nck/Channel/Parameter/R[1]" value="0" > 1, 4 </function>
control.delete	The function deletes the specified control. Syntax: <function name="control.delete"> control name </function> Attribute: **name** – function name Value: **control name** – name of the control Example: <function name="<control.delete>"> _T"my_editfield" </function>

Function name	Description
control.additem	The function inserts a new element at the end of the list. Note: The function is only available for the control types "listbox" and "graphicbox". **Syntax:** <function name="control.additem"> control name, item </function> **Attribute:** **name** – function name **Values:** **control name** – control name **item** - expression to be inserted **itemdata** - integer value; defined by the user **Example:** <let name ="itemdata">1</let> … … … <op> item_string = _T"text1" </op> <function name="control.additem">_T"listbox1", item_string, itemdata </function>

Function name	Description

control.insertitem	The function inserts a new element at the specified position.
	Note:
	The function is only available for the control types "listbox" and "graphicbox".
	
	Syntax:
	`<function name="control.insertitem"> control name, index, item, itemdata </function>`
	
	Attribute:
	name – function name
	
	Values:
	control name – control name
	index – position starting with zero
	item - expression to be inserted
	itemdata - integer value; defined by the user
	
	Example:
	`<let name ="itemdata">1</let>`
	…
	…
	…
	`<op> item_string = _T"text2" </op>`
	`<function name="control.insertitem">_T"listbox1", 1, item_string, itemdata </function>`

control.deleteitem	The function deletes an element at the specified position.
	Note:
	The function is only available for the control type "listbox".
	
	Syntax:
	`<function name="control.deleteitem"> control name, index </function>`
	
	Attribute:
	name – function name
	
	Values:
	control name – control name
	index– index starting at 0
	
	Example:
	`<function name="control.deleteitem">_T"listbox1", 1</function>`

<table>
<tr><th>Function name</th><th>Description</th></tr>
<tr><td>

control.loaditem

</td><td>

The function inserts a list of expressions into the control.

The function is only available for the control types "listbox" and "graphicbox".

Syntax:

```
<function name="control.loaditem"> control name,
list </function>
```

Attribute:

name – function name

Values:

control name – control name

list- string variable

Structure of the list:

The list contains a number of expressions, which must be separated from one another using a \n.

Example:

```
<let name="item_string" type="string"></let>
<let name="plotlist" type="string"></let>
…
…
<print name ="item_string" text="p; %f; %f; %f;
%f\n">s_z, s_x</print>
      <op>plotlist = plotlist + item_string</op>
      <print name ="item_string" text="l; %f; %f;
%f; %f\n">s_z, s_x, e_z, e_x </print>
      <op>plotlist = plotlist + item_string</op>
      <op> s_x = e_x </op>
      <op> s_z = e_z</op>
      <op> e_x = s_x + 10 </op>
      <op> e_z = s_z - 100 </op>
      <print name ="item_string" text="l; %f; %f;
%f; %f\n">s_z, s_x, e_z, e_x </print>
      <op>plotlist = plotlist + item_string</op>

      <function name="control.loaditem">_T"gbox",
plotlist</function>
```

</td></tr>
</table>

Function name	Description
control.empty	The function deletes the contents of the specified list box or graphic box controls. **Syntax:** <function name="control.empty"> control name, </function> **Attribute:** **name** – function name **Values:** **control name** – control name **Example:** <function name="control.empty"> T"listbox1"</function>
control.getfocus	The function supplies the name of the control, which has the input focus. **Syntax:** <function name="control.getfocus" re-turn="focus_name" /> **Attributes:** **name** – function name **return** – a string variable should be specified, into which the control name is copied. **Example:** <let name>="focus_field" type="string"></let> <function name="control.getfocus" re-turn="focus_field"/>
control.setfocus	The function sets the input focus to the specified control. The control name should be transferred as text expression of the function. **Syntax:** <function name="control.setfocus"> control name </function> **Attribute:** **name** – function name **Value:** **control name** – name of the control **Example:** <function name="control.setfocus" "> T"listbox1"</function>

Function name	Description

control.getcurssel	For a list box, the function supplies the cursor index.
	The control name should be transferred as text expression of the function.
	
	Syntax:
	`<function name="control.getcurssel" retvar="var"> control name </function>`
	
	Example:
	`<let name>="index"></let>`
	`<function name="control.getcurssel"`
	`"> T"listbox1"</function>`

control.setcurssel	For a list box, the function sets the cursor to the appropriate line.
	The control name should be transferred as text expression of the function.
	
	Syntax:
	`<function name="control.setcurssel" > control name, index</function>`
	
	Example:
	`<let name>="index">2</let>`
	`<function name="control.setcurssel"`
	`"> T"listbox1",index</function>`

control.getitem	For a list box, the function copies the contents of the selected line to the specified variable.
	A string variable should be specified as reference variable.
	The control name should be transferred as text expression of the function.
	
	Syntax:
	`<function name="control.getitem" return="var"> control name, index </function>`
	
	Example:
	`<let name>="index">2</let>`
	`<let name>="item" type="string"></let>`
	
	`<function name="control.getitem" return="item"`
	`">_T"listbox1",index</function>`

Function name	Description

control.getitemdata	For a list box, the function copies the user-specific allocated value of an element to the specified variable.
	For an edit control, the function copies the user-specific allocated value (item_data) to the specified variable.
	An integer variable should be specified as reference variable.
	The control name should be transferred as text expression of the function.
	
	Syntax:
	`<function name="control.getitemdata" return="var">`
	`control name, index </function>`
	
	Example:
	`<let name>="index">2</let>`
	`<let name>="itemdata"></let>`
	
	`<function name="control.getitemdata" re-`
	`turn="itemdata" ">_T"listbox1",index</function>`

bitmap.dim	The function copies the dimension of a bitmap back into a variable with structure type SIZE. To define the type, file struct_def.xml must be included in the project.
	
	Syntax:
	`<function name="bitmap.dim" >name, variable type`
	`</function>`
	
	Parameters:
	name - file path
	variable type - variable name of a variable of type SIZE
	
	Example:
	`<let name="bmp_size" type="size" />`
	
	`<function name="bitmap.dim" >_T"test.bmp", bmp_size`
	`</function>`

hmi.get_hmi_resolution	The function copies the absolute screen resolution of the system back into a variable with structure type StructSize. To define the type, file struct_def.xml must be included in the project.
	
	Syntax:
	`<function name="hmi.screen_resolution" >vari-`
	`alble type </function>`

hmi.get_hmi_resolution	The function copies the screen resolution used by SINUMERIK Operate back into a variable with structure type StructSize. To define the type, file struct_def.xml must be included in the project.
	
	Syntax:
	`<function name="hmi.get_hmi_resolution" >varia-`
	`ble type </function>`

Function name	Description
hmi.get_caption_heigt	The function returns the title bar height in pixels. **Syntax:** `<function name="hmi.get_caption_heigt" return="<return var>" />` **Attributes:** **return** - integer variable
abs	This function returns the absolute value of the specified number. **Syntax:** `<function name="abs" return="var"> value </function>`
sdeg	The function converts the specified value into degrees. **Syntax:** `<function name="sdeg" return="var"> value </function>`
srad	The function converts the specified value into RADian. **Syntax:** `<function name="srad" return="var"> value </function>`
sqrt	The function calculates the square root of the specified value. **Syntax:** `<function name="sqrt" return="var"> value </function>`
round	The function rounds of the transferred number to the specified number of decimal places. If the number of decimal places is not specified, then the function rounds off the number, taking into account the first decimal place. **Syntax:** `<function name="round" return="var"> value, nDecimalPlaces </function>`
floor	The function supplies the largest possible integer value, which is less than or equal to the transferred value. **Syntax:** `<function name="floor" return="var"> value </function>`
ceil	The function supplies the smallest possible integer value, which is greater than or equal to the transferred value. **Syntax:** `<function name="ceil" return="var"> value </function>`

Function name	Description
log	The function calculates the logarithm of the specified value. **Syntax:** <function name="log" return="var"> value </function>
log10	The function calculates the common (decadic) logarithm of the specified value. **Syntax:** <function name="log10" return="var"> value </function>
pow	The function calculates the value "a^b". **Syntax:** <function name="pow" return="var"> a, b </function>
min	The function compares the transferred value and returns the lower of the values. **Syntax:** <function name="min" return="var"> value1, value2 </function>
max	The function compares the transferred value and returns the higher of the values. **Syntax:** <function name="max" return="var"> value1, value2 </function>
random	The function returns a pseudo random number. **Syntax:** <function name="random" return="var" </function>

15 Technical data

15.1 SINUMERIK 808D ADVANCED

Technical specifications		Horizontal PPU (161.3/151.3)	Vertical PPU (160.3/150.3)	Horizontal MCP	Vertical MCP
Dimensions (W × H × D, mm)		420 × 200 × 95	265 × 330 × 96	420 × 120 × 58 [1]/38 [2]	265 × 230 × 58
Gross weight (kg)		3.95/3.9	3.85	1.05 [1]/0.76 [2]	1.2 [3]/1.1 [4]
Net weight (kg)		3.0	3.0	0.7 [1]/0.41 [2]	0.75 [3]/0.65 [4]
Degree of protection		Front: IP65 Rear: IP20		Front: IP65 Rear: IP00	
Supply voltage		24 V DC (permissible range: 20.4 V to 28.8 V)		5 V DC powered by PPU	
Mains buffering time		3 ms		-	
Ripple		3.6 Vpp		-	
Current consumption from 24 V		1.5 A (I/O open)		-	
Rated input current		2 A		0.5 A	
Power consumption		Max. 50 W		Max. 5 W	
Cooling method		Self-cooling			
Humidity rating in accordance with EN 60721-3-3		Class 3K5, condensation and icing excluded; low air temperature 0 °C			
Shock and vibration		• Product packaging according to Class 1M2 according to EN 60721-3-1: 2002 • Shock and vibration in operation according to Class 3M1 according to EN 60721-3-3: 2002			
Relative humidity	Transport and storage	5% to 95%, without condensation			
	Operation	5% to 90%, without condensation			
Ambient temperature	Transport and storage	-20 °C to +60 °C			
	Operation	Front: 0 °C to 45 °C Rear: 0 °C to 50 °C			
Atmospheric pressure	Transport and storage	1060 hPa to 700 hPa (corresponds to an altitude of 3000 m)			
	Operation	1080 hPa to 795 hPa			
Overvoltage category		3			
Degree of pollution		2			
Protection against chemical substances		Protected according to 3C2 to EN 60721-3-3			
Free fall		< 1 m			
Certification		CE, KC, RCM, and EAC			

1) For the horizontal MCP with override switches;

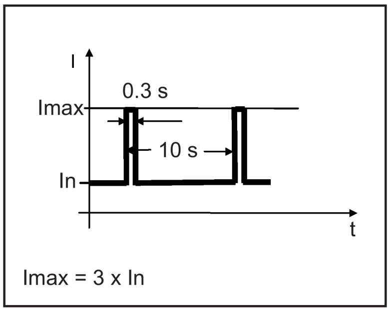
2) For the horizontal MCP with a reserved slot for the handwheel;

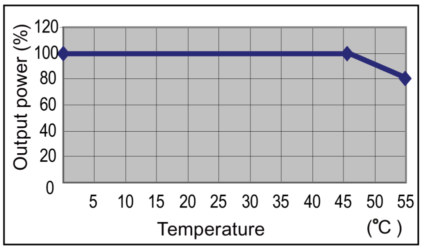
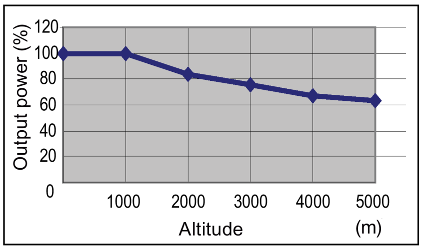
3) For the vertical MCP with an override switch for the spindle;

4) For the vertical MCP with a reserved slot for the handwheel;

15.2 Servo drives

15.2.1 SINAMICS V70 feed drives

Frame size		FSA		FSB			FSC	
Article number	6SL3210-5DE...	12-4UA0	13-5UA0	16-0UA0	17-8UA0	21-0UA0	21-4UA0	21-8UA0
Rated output current		1.2 A	3.0 A	4.6 A	5.3 A	7.8 A	11.0 A	13.2 A
Max. output current		3.6 A	9.0 A	13.8 A	15.9 A	23.4 A	33.0 A	39.6 A
Max. supported motor power		0.4 kW	1.0 kW	1.5 kW	1.75 kW	2.5 kW	3.5 kW	7.0 kW
Output frequency		0 Hz to 330 Hz						
Power supply	Voltage/frequency	3 phase 380 VAC to 480 VAC, 50/60 Hz						
	Permissible supply configuration	TN, TT, IT						
	Permissible voltage fluctuation	-15% to +10%						
	Permissible frequency fluctuation	-10% to +10%						
	Rated input current	1.5 A	3.8 A	5.8 A	6.6 A	9.8 A	13.8 A	16.5 A
	Power supply capacity	1.7 kVA	4.3 kVA	6.6 kVA	7.6 kVA	11.1 kVA	15.7 kVA	18.9 kVA
	Inrush current	8.0 A	8.0 A	4.0 A	4.0 A	4.0 A	2.5 A	2.5 A
Power loss [1]	Main circuit	31 W	32 W	76 W	90 W	96 W	115 W	138 W
	Control circuit	32 W	32 W	35 W	35 W	35 W	36 W	36 W
	Built-in regenerative resistor	57 W	57 W	131 W	131 W	131 W	339 W	339 W
	Total	120 W	121 W	242 W	256 W	262 W	490 W	513 W
24 VDC power supply	Voltage	24 V (-15% to +20%) Exception: When the SINAMICS V70 works with a motor with brake, the voltage tolerance of 24 VDC power supply must be -10% to +10% to meet the voltage requirement of the brake.						
	Maximum current	1 A (when using a motor without a brake) 3 A (when using a motor with a brake)						
Overload capability		300% 						
Control system		Servo control						
Braking resistor		Built-in						
Protective functions		Earthing fault protection, output short-cut protection, overvoltage/undervoltage protection [2], I^2t detection, IGBT overtemperature protection						
Cooling method		Self-cooled		Fan-cooled				

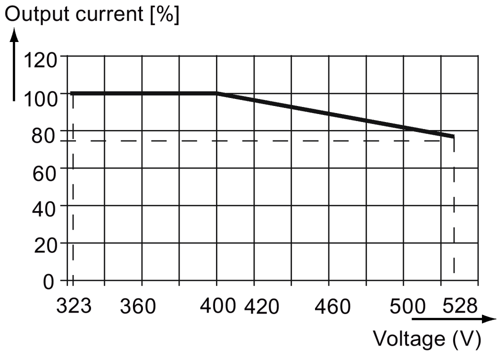
<table>
<tr><th colspan="3">Frame size</th><th colspan="2">FSA</th><th colspan="3">FSB</th><th colspan="2">FSC</th></tr>
<tr><td rowspan="12">Environmental conditions</td><td rowspan="2">Surrounding air temperature</td><td>Operation</td><td colspan="7">0 °C to 45 °C: without power derating
45 °C to 55 °C: with power derating

</td></tr>
<tr><td>Storage</td><td colspan="7">-40 °C to +70 °C</td></tr>
<tr><td rowspan="2">Ambient humidity</td><td>Operation</td><td colspan="7">< 90% (non-condensing)</td></tr>
<tr><td>Storage</td><td colspan="7">90% (non-condensing)</td></tr>
<tr><td colspan="2">Operating environment</td><td colspan="7">Indoor (without direct sunlight), free from corrosive gas, combustible gas, oil gas, or dust</td></tr>
<tr><td colspan="2">Altitude</td><td colspan="7">< 1000 m (without derating)

</td></tr>
<tr><td colspan="2">Degree of protection</td><td colspan="7">IP20</td></tr>
<tr><td colspan="2">Degree of pollution</td><td colspan="7">Class 2</td></tr>
<tr><td>Shock</td><td>Operation</td><td colspan="7">Operational area II
Peak acceleration: 5 g
Duration of shock: 30 ms</td></tr>
<tr><td rowspan="2">Vibration</td><td>Operation</td><td colspan="7">Operational area II
10 Hz to 58 Hz: 0.075 mm deflection
58 Hz to 200 Hz: 1g vibration</td></tr>
<tr><td>Transport & storage</td><td colspan="7">5 Hz to 9 Hz: 7.5 mm deflection
9 Hz to 200 Hz: 2 g vibration
Vibration class: 2M3 transportation</td></tr>
<tr><td colspan="9"></td></tr>
<tr><td>Certification</td><td colspan="9"></td></tr>
<tr><td colspan="3">Outline dimensions (W × H × D, mm)</td><td colspan="2">80 × 180 × 200</td><td colspan="3">100 × 180 × 220</td><td colspan="2">140 × 260 × 240</td></tr>
<tr><td colspan="3">Net weight</td><td>1.86 kg</td><td>1.87 kg</td><td>2.445 kg</td><td>2.505 kg</td><td>2.565 kg</td><td>5.62 kg</td><td>5.725 kg</td></tr>
</table>

1) The values here are given at rated load.

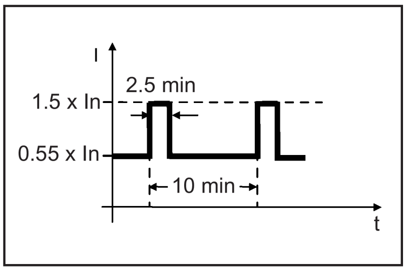
2) The overvoltage threshold is 820 VDC; the undervoltage threshold is 320 VDC.

15.2.2 SINAMICS V70 spindle drives

Frame size		FSB	FSC		FSD	
Article number	6SL3210-5DE...	21-1UA0	21-3UA0	22-0UA0	23-0UA0	24-0UA0
Rated output current		10.5 A	12.9 A	19.6 A	29.8 A	37.6 A
Max. output current		21 A	25.8 A	39.2 A	59.6 A	75.2 A
Max. supported motor power		3.7 kW	3.7 kW	7.5 kW	11 kW	15 kW
Output frequency		0 Hz to 400 Hz				
Power supply	Voltage/frequency	3 phase 380 VAC to 480 VAC, 50/60 Hz				
	Permissible supply configuration	TN, TT, IT				
	Permissible voltage fluctuation	-15% to +10%				



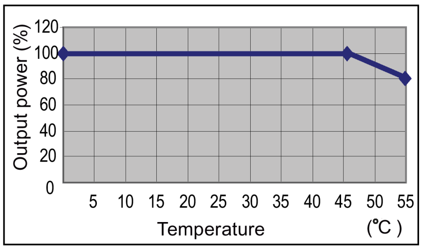
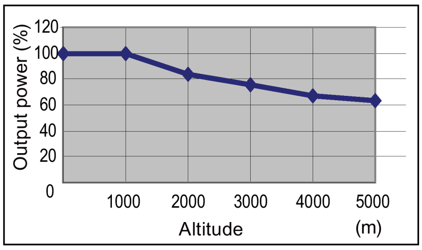
	Permissible frequency fluctuation	-10% to +10%				
	Rated input current	13.2 A	16.2 A	24.5 A	37.3 A	47 A
	Power supply capacity	8.7 kVA	10.7 kVA	16.1 kVA	24.5 kVA	30.9 kVA
	Inrush current	4 A	2.5 A	2.5 A	2.5 A	2.5 A
Power loss [1]	Main circuit	102.72 W	115 W	153.18 W	271 W	390 W
	Control circuit	35 W	36 W	36 W	36 W	36 W
	Total	137.72 W	151 W	189.18 W	307 W	426 W
24 VDC power supply	Voltage	24 V (-15% to +20%)				
	Maximum current	3 A				
Overload capability						



Note:

The overload capability is 150% by default. It can be set up to 200% via p0640, but the corresponding overload duration might be reduced under the circumstances.

Control system		Servo control				
Braking resistor		External				
Protective functions		Earthing fault protection, output short-cut protection, overvoltage/undervoltage protection [2], I^2t detection, IGBT overtemperature protection				
Cooling method		Fan-cooled				

Frame size			FSB	FSC	FSD	
Environmental conditions	Surrounding air temperature	Operation	0 °C to 45 °C: without power derating 45 °C to 55 °C: with power derating 			
		Storage	-40 °C to +70 °C			
	Ambient humidity	Operation	< 90% (non-condensing)			
		Storage	90% (non-condensing)			
	Operating environment		Indoor (without direct sunlight), free from corrosive gas, combustible gas, oil gas, or dust			
	Altitude		< 1000 m (without derating) 			
	Degree of protection		IP20			
	Degree of pollution		Class 2			
	Shock	Operation	Operational area: II Ambient classification: 3M2 Peak acceleration: 5 g + 15 g Duration: 30 ms + 11 ms Quantity of shocks: 3 Summed shocks: 18 Cycle time: 1 s			
		Transport & storage	Covered by vibration test			
	Vibration	Operation	Operational area II/3M2 10 Hz to 58 Hz: 0.075 mm deflection 58 Hz to 200 Hz: 1g vibration			
		Transport & storage	5 Hz to 9 Hz: 3.5 mm deflection 9 Hz to 200 Hz: 1 g vibration Ambient Classification: 1M2			
Certification						
Outline dimensions (W × H × D, mm)			100 × 180 × 220	140 × 260 × 240	190 × 350 × 185	
Net weight			2.35 kg	5.05 kg	8.05 kg	8.3 kg

1) The values here are given at rated load.

2) The overvoltage threshold is 820 VDC; the undervoltage threshold is 320 VDC.

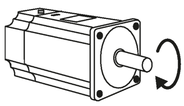
15.2.3 Permissible line supplies dependent on the installation altitude

- For installation altitudes ≤ 2000 m above sea level, it is permissible to connect the V70 drive to any of the line supplies that are specified for it.
- For installation altitudes 2000 m to 5000 m above sea level, you must connect a V70 drive to any of the specified line supplies either via an isolating transformer or with a grounded neutral point.

15.3 Servo motors

15.3.1 SIMOTICS S-1FL6 feed motors

General technical data

Parameter		**Description**		
Type of motor		Permanent-magnet synchronous motor		
Cooling		Self-cooled		
Operating temperature		0 °C to 40 °C (without power derating)		
Storage temperature		-20 °C to +65 °C		
Relative humidity		≤ 90% (non-condensing at 30 °C)		
Installation altitude		≤ 1000 m (without power derating)		
Maximum noise level		1FL604❑: 65 dB; 1FL606❑: 70 dB; 1FL609❑: 70 dB		
Thermal class		B		
Vibration resistance		≤ 49 m/s²		
Shock resistance		≤ 25 m/s² (continuous in axial direction); ≤ 50 m/s² (continuous in radial direction); ≤ 250 m/s² (in a short time of 6 ms)		
Holding brake	Rated voltage	24 V ± 10%		
	Rated current	1FL604❑: 0.88 A	1FL606❑ : 1.44 A	1FL609❑: 1.88 A
	Holding brake torque	1FL604❑: 3.5 Nm	1FL606❑ : 12 Nm	1FL609❑: 30 Nm
	Maximum brake opening time	1FL604❑: 60 ms	1FL606❑ : 180 ms	1FL609❑: 220 ms
	Maximum brake closing time	1FL604❑: 45 ms	1FL606❑ : 60 ms	1FL609❑: 115 ms
	Maximum number of emergency stops	2000 [1]		
Bearing lifetime		> 20000 h [2]		
Oil seal lifetime		5000 h		
Encoder lifetime		> 20000 h [3]		
Paint finish		Black		
Degree of protection		IP65, with shaft oil seal		
Type of construction		IM B5, IM V1 and IM V3		
Positive rotation		 Clockwise (default setting in SINAMICS V70 feed drives)		
Certification		CE EAC		

1) Restricted emergency stop operation is permissible. Up to 2000 braking operations can be executed with 300% rotor moment of inertia as external moment of inertia from a speed of 3000 RPM without the brake being subject to an inadmissible amount of wear.

2) This lifetime is only for reference. When a motor keeps running at rated speed under rated load, replace its bearing after 20,000 hours to 30,000 hours of service time. Even if the time is not reached, the bearing must be replaced when unusual noise, vibration, or faults are found.

3) This lifetime is only for reference. When a motor keeps running at 80% rated value and the surrounding air temperature is 30 °C, the encoder lifetime can be ensured.

Specific technical data

Article no.	1FL60...	42	44	61	62	64	66	67	90	92	94	96
Rated power (kW)		0.40	0.75	0.75	1.00	1.50	1.75	2.00	2.5	3.5	5.0	7.0 [1]
Stall torque (Nm)		1.9	3.5	4	6	8	11	15	15	22	30	40
Rated torque (Nm)		1.27	2.39	3.58	4.78	7.16	8.36	9.55	11.9	16.7	23.9	33.4
Maximum torque (Nm)		3.8	7.2	10.7	14.3	21.5	25.1	28.7	35.7	50.0	70.0	90.0
Rated speed (rpm)		3000		2000					2000			
Maximum speed (rpm)		4000		3000					3000		2500	2000
Rated frequency (Hz)		200		133					133			
Rated current (A)		1.2	2.1	2.5	3.0	4.6	5.3	5.9	7.8	11.0	12.6	13.2
Maximum current (A)		3.6	6.3	7.5	9.0	13.8	15.9	17.7	23.4	33.0	36.9	35.6
Stall current (A)		1.7	2.9	2.7	3.6	4.9	6.6	8.8	9.3	13.4	15	15
Moment of inertia (10^{-4} kgm^{2})		2.7	5.2	8.0	15.3 [2]/ 11.7 [3]	15.3	22.6	29.9	47.4	69.1	90.8	134.3
Moment of inertia (with brake) (10^{-4} kgm^{2})		3.2	5.7	9.1	16.4 [2]/ 13.5 [3]	16.4	23.7	31.0	56.3	77.9	99.7	143.2
Recommended load to motor inertia ration		< 1000%		< 500%					< 500%			
Weight (kg) (motor with straight connectors)												
With incremental encoder	With brake	4.6	6.4	8.6	11.3	11.3	14.0	16.6	21.3	25.7	30.3	39.1
	Without brake	3.3	5.1	5.6	8.3	8.3	11.0	13.6	15.3	19.7	24.3	33.2
With absolute encoder	With brake	4.4	6.2	8.3	11.0	11.0	13.6	16.3	20.9	25.3	29.9	38.7
	Without brake	3.1	4.9	5.3	8.0	8.0	10.7	13.3	14.8	19.3	23.9	32.7
Weight (kg) (motor with angular connectors)												
With incremental encoder	With brake	4.8	6.6	8.8	10.1	11.5	14.2	16.8	21.5	25.9	30.5	39.3
	Without brake	3.4	5.2	5.7	7.0	8.4	11.1	13.7	15.4	19.8	24.4	33.3
With absolute encoder	With brake	4.5	6.3	8.4	9.7	11.1	13.7	16.4	21.0	25.4	30.0	38.8
	Without brake	3.2	5.0	5.4	6.7	8.1	10.8	13.4	14.9	19.4	24.0	32.8

1) When the surrounding air temperature is higher than 30 °C, the 1FL6096 motors with brake will have a power derating of 10%;

2) For the motor variants with straight connectors;

3) For the motor variants with angular connectors.

Note

The data of stall torque, rated power, and maximum torque in the above table allows a tolerance of 10%.

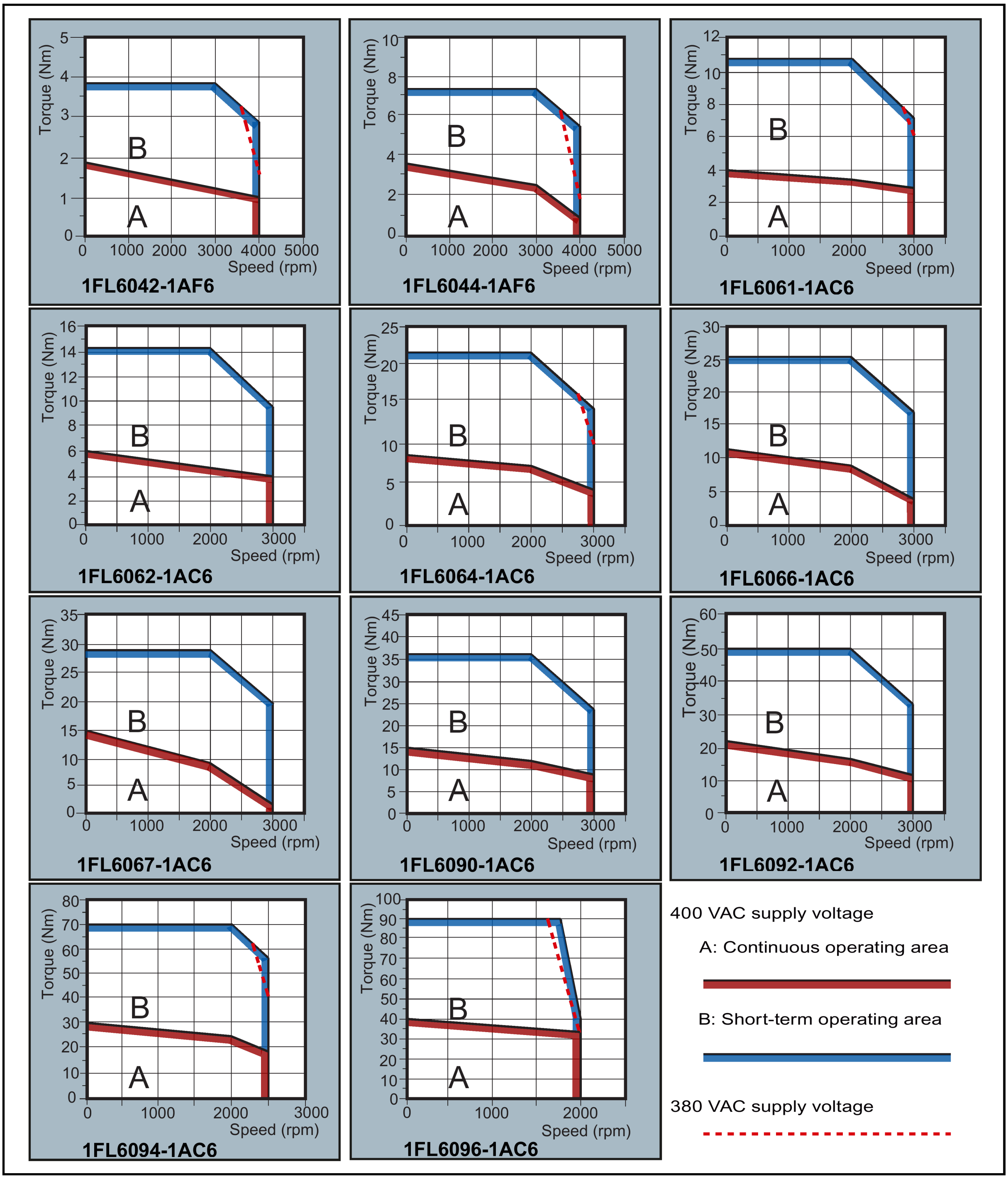
Power derating

For deviating conditions (surrounding air temperature > 40 °C or installation altitude > 1000 m above sea level), the permissible torque/power must be determined from the following table. Surrounding air temperatures and installation altitudes are rounded off to 5 °C and 500 m respectively.

Power derating as a function of the installation altitude and surrounding air temperature

Installation altitude above sea level (m)	Power deratings (kW)				
	< 30 °C	30 °C to 40 °C	45 °C	50 °C	55 °C
1000	1.07	1.00	0.96	0.92	0.87
1500	1.04	0.97	0.93	0.89	0.84
2000	1.00	0.94	0.90	0.86	0.82
2500	0.96	0.90	0.86	0.83	0.78
3000	0.92	0.86	0.82	0.79	0.75
3500	0.88	0.82	0.79	0.75	0.71
4000	0.82	0.77	0.74	0.71	0.67

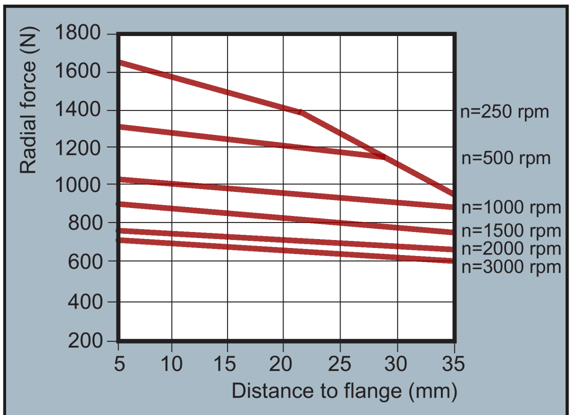
Torque-speed characteristics



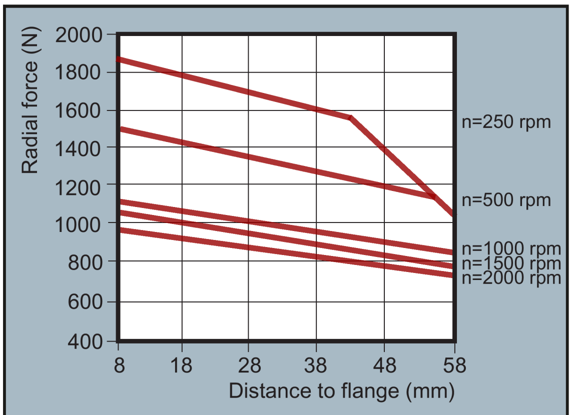
Note

- Continuous operating area is a series of states when a motor can operate continuously and safely. The effective torque must be located in this area.
- Short-term operating area is a series of states when a motor can operate in a short duration if its effective torque is smaller than the rated torque.
- For the motors with different rated and maximum speeds, the output torque will decline at a faster rate after the speed exceeds the rated speed.
- The feature in short-term operating area varies with power supply voltages.
- The continuous operating area becomes smaller and the voltage drop grows larger when the cables in the major loop exceed 20 meters.
- For 1FL6096 motors, the maximum speed can be ensured when the line supply voltage is higher than 380 V.

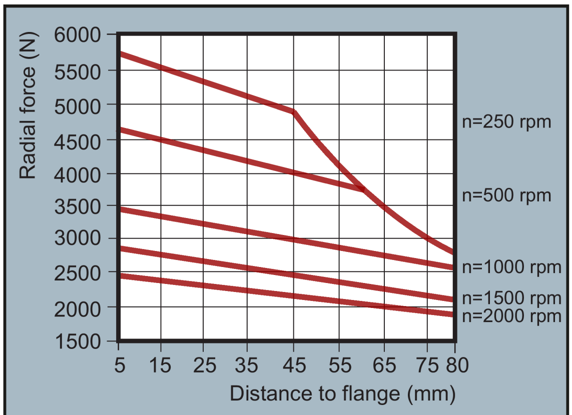
Permissible radial and axial forces



1FL604□



1FL606□



1FL609□

Axial force:

When using, for example, helical toothed wheels as drive element, in addition to the radial force, there is also an axial force on the motor bearings. For axial forces, the spring-loading of the bearings can be overcome so that the rotor moves corresponding to the axial bearing present (up to 0.2 mm).

The permissible axial force can be approximately calculated using the following formula:

$F_A = 0.35 \cdot F_Q$

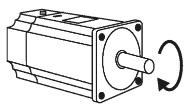
Where F_A represents axial force and F_Q radial force.

Note

1FL604❑ and 1FL609❑ have a 5 mm of shaft sheltered in sleeves, and 1FL606❑ has an 8 mm of shaft in sleeves. Therefore, the distances to flange in the above three figures begin respectively from 5 mm, 8 mm, and 5 mm.

15.3.2 SIMOTICS M-1PH1 main motors

General technical data

Parameter	Description
Type of motor	Asynchronous motor
Cooling method	Fan-cooled
Operating temperature	-15 °C to 40 °C (without power derating)
Storage temperature	-20 °C to 65 °C
Relative humidity (storage)	≤ 95%
Relative humidity (operating)	≤ 90%
Installation altitude	≤ 1000 m (without power derating)
Maximum noise level	72 dB
Thermal class	F
Vibration severity grade	1PH11❑❑-1❑F: Grade B is maintained up to 1800 rpm; Grade S is maintained from 1800 rpm to 10000 rpm 1PH11❑❑-1❑D: Grade B is maintained up to 1800 rpm; Grade R is maintained from 1800 rpm to 6000 rpm
Shock resistance	2.25 m/s^2 (continuous in axial direction); 10 m/s^2 (continuous in radial direction)
Static bearing lifetime	> 20000 h [1)]
Oil seal lifetime	> 20000 h
Encoder lifetime	> 20000 h
Motor lifetime	20000 h
Paint finish	Anthracite
Degree of protection	IP54 (dust-tight and splash-proof during motor operation)
Type of construction	IM B5, IM B3, IM V1, and IM V5
Positive rotation	 Clockwise (default setting in SINAMICS V70 spindle drives)
Certification	CE EAC

1) This lifetime is only for reference. When a motor keeps running at rated speed under rated load, replace its bearing after 20,000 hours to 30,000 hours of service time. Even if the time is not reached, the bearing must be replaced when unusual noise, vibration, or faults are found.

Specific technical data - SH100

Article no.	1PH110...	1-1❑F	3-1❑F	5-1❑F	3-1❑D	5-1❑D
Insulation class		F				
Rated power		3.7 kW	5.5 kW	7.5 kW	3.7 kW	5.5 kW
Rated torque		24 Nm	35 Nm	48 Nm	35 Nm	53 Nm
Maximum torque for 30 s		48 Nm	70 Nm	96 Nm	70 Nm	106 Nm
Overload torque (S6-25% (1.5 Pn))		36 Nm	52.5 Nm	72 Nm	52.5 Nm	79.5 Nm
Rated speed		1500 rpm	1500 rpm	1500 rpm	1000 rpm	1000 rpm
Maximum speed		10000 rpm	10000 rpm	10000 rpm	6000 rpm	6000 rpm

Article no.	1PH110...	1-1❑F	3-1❑F	5-1❑F	3-1❑D	5-1❑D
Rated frequency		53.3 Hz	53 Hz	52.6 Hz	36.9 Hz	36.4 Hz
Rated voltage (phase/phase)		326 V	290 V	327 V	269 V	265 V
Motor maximum voltage		355 V				
Rated current		10.3 A	16.9 A	19.6 A	12.9 A	18.8 A
Maximum current (for maximum torque)		20.6 A	33.8 A	39.2 A	25.8 A	37.6 A
Winding resistance/stator phase resistance (20°C)		0.9682 Ω	0.4595 Ω	0.3597 Ω	0.8227 Ω	0.4557 Ω
Winding inductance/motor magnetizing inductance		97 mH	56 mH	54.5 mH	91 mH	69.5 mH
Moment of inertia		0.009 kgm^2	0.0112 kgm^2	0.015 kgm^2	0.0112 kgm^2	0.015 kgm^2
Motor weight		29 kg	36 kg	45 kg	36 kg	45 kg

Specific technical data - SH132

Article no.	1PH113...	1-1❑F	3-1❑F	1-1❑D	3-1❑D
Insulation class		F			
Rated power		11 kW	15 kW	7.5 kW	11 kW
Rated torque		70 Nm	95.5 Nm	71.6 Nm	105 Nm
Maximum torque for 30 s		140 Nm	191 Nm	143 Nm	210 Nm
Overload torque (S6-25% (1.5 Pn))		105 Nm	143 Nm	107 Nm	158 Nm
Rated speed		1500 rpm	1500 rpm	1000 rpm	1000 rpm
Maximum speed		8000 rpm	8000 rpm	6000 rpm	6000 rpm
Rated frequency		51.5 Hz	50.8 Hz	35.2 Hz	35 Hz
Rated voltage (phase/phase)		295 V	317 V	220 V	301 V
Motor maximum voltage		355 V			
Rated current		28.8 A	36.7 A	26.6 A	28.3 A
Maximum current (for maximum torque)		57.6 A	73.4 A	53.2 A	56.6 A
Winding resistance/stator phase resistance (20°C)		0.1977 Ω	0.1354 Ω	0.2645 Ω	0.2705 Ω
Winding inductance/motor magnetizing inductance		45.55 mH	34.7 mH	52.5 mH	69 mH
Moment of inertia		0.0547 kgm^2	0.074 kgm^2	0.0504 kgm^2	0.074 kgm^2
Motor weight		73 kg	90 kg	70 kg	90 kg

Power deratings at different installation altitudes and surrounding air temperatures

Operation: T = -15 °C to +40 °C (without restriction)

Under conditions other than those specified above (surrounding air temperature > 40 °C or installation altitude > 1000 m above sea level), the permissible torque/power must be determined from the following table. Surrounding air temperatures and installation altitudes are rounded off to 5 °C or 500 m respectively.

Operation: T = -15 °C to +40 °C (without derating)
Under conditions other than those specified above (ambient temperature > 40° C or installation altitude > 1000 m above sea level), the permissible torque/power reduction must be determined from the following table. Ambient temperatures and installation altitudes are rounded off to 5 °C and 500 m respectively.

Installation altitude above sea level	Factors for reducing the torque/power according to EN 60034-6		
	40 °C	45 °C	50 °C
1000	1.00	0.96	0.92
1500	0.97	0.93	0.89
2000	0.94	0.90	0.86
2500	0.90	0.86	0.83

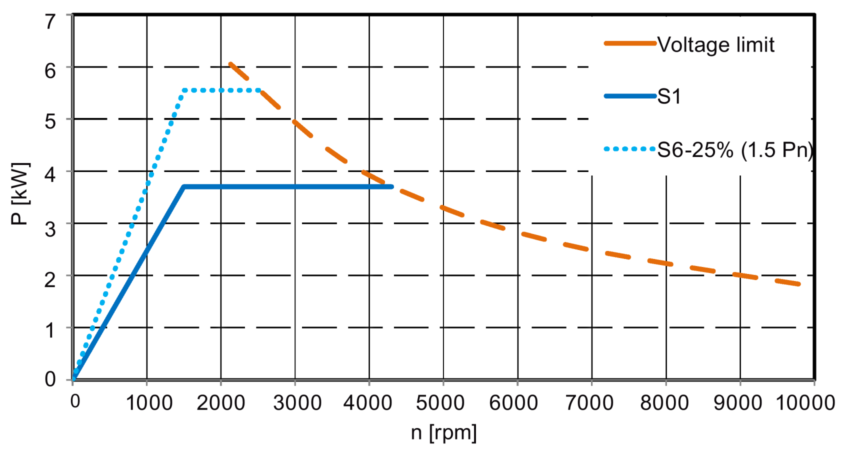
Installation altitude above sea level	Factors for reducing the torque/power according to EN 60034-6		
	40 °C	45 °C	50 °C
3000	0.86	0.82	0.79
3500	0.82	0.79	0.75
4000	0.77	0.74	0.71

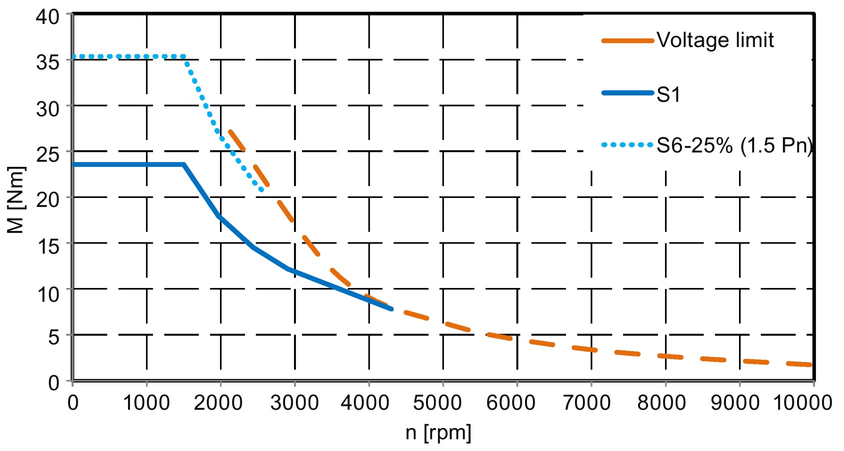
NOTICE
Damage to the motors For surrounding air temperatures > 55 °C, please contact your local Siemens office. The standard motors are not suitable for use in corrosive atmospheres, atmospheres with a high salt content, or in outdoor applications; otherwise, the motors may be damaged.

Torque-speed/power-speed characteristics - SH100

1PH1101-1❑F❑:

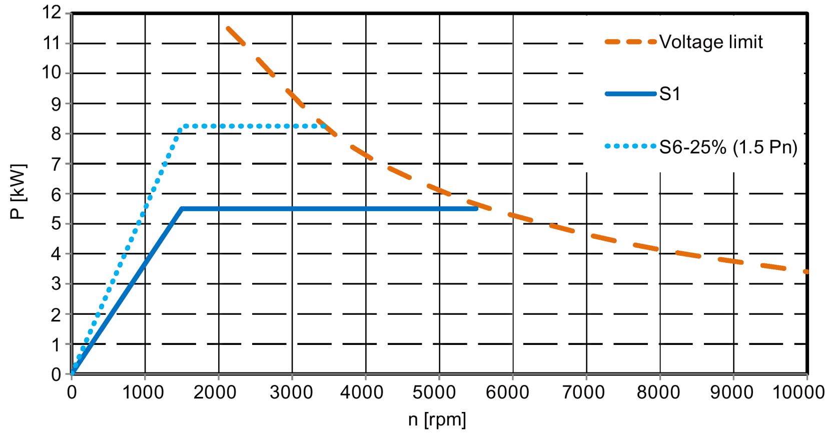
n_N	P_N	M_N	I_N	U_N	f_N	U_{max}	n_2	n_{max}	$P_{s6-25\%}$	$M_{s6-25\%}$	$I_{s6-25\%}$	I_{max}
[rpm]	[kW]	[Nm]	[A]	[V]	[Hz]	[V]	[rpm]	[rpm]	[kW]	[Nm]	[A]	[A]
1500	3.7	24	10.3	326	53.3	355	4300	10000	5.55	36	15	20.6

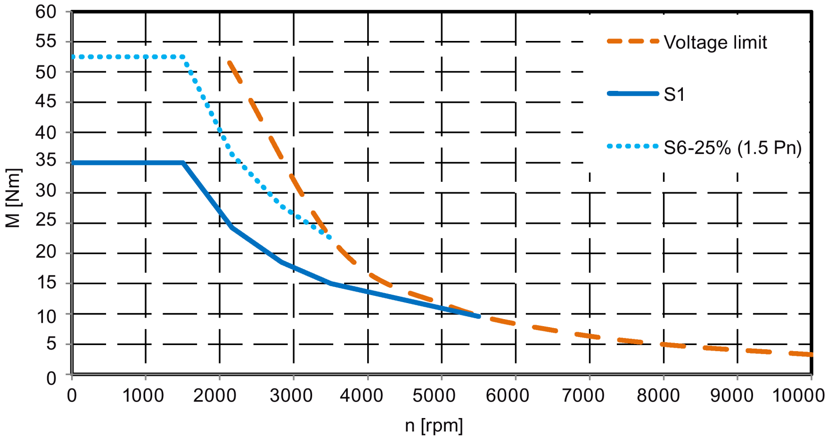




1PH1103-1□F□:

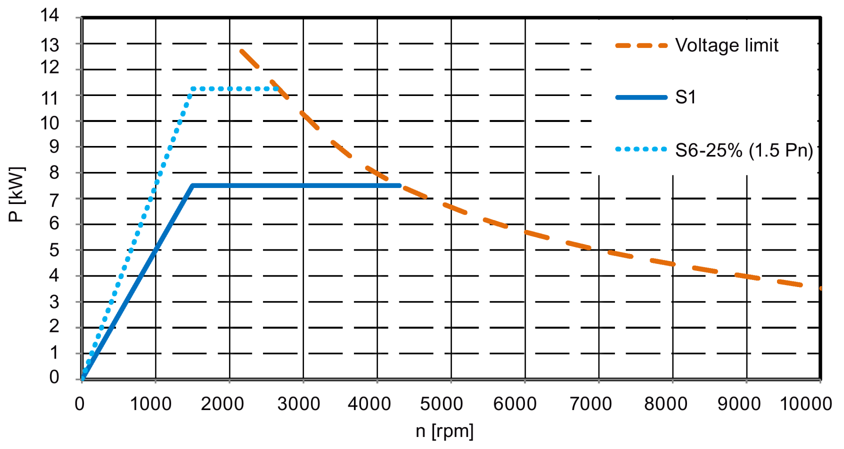
n_N	P_N	M_N	I_N	U_N	f_N	U_{max}	n_2	n_{max}	$P_{s6-25\%}$	$M_{s6-25\%}$	$I_{s6-25\%}$	I_{max}
[rpm]	[kW]	[Nm]	[A]	[V]	[Hz]	[V]	[rpm]	[rpm]	[kW]	[Nm]	[A]	[A]
1500	5.5	35	16.9	290	53	355	5500	10000	8.25	52.5	24	33.8

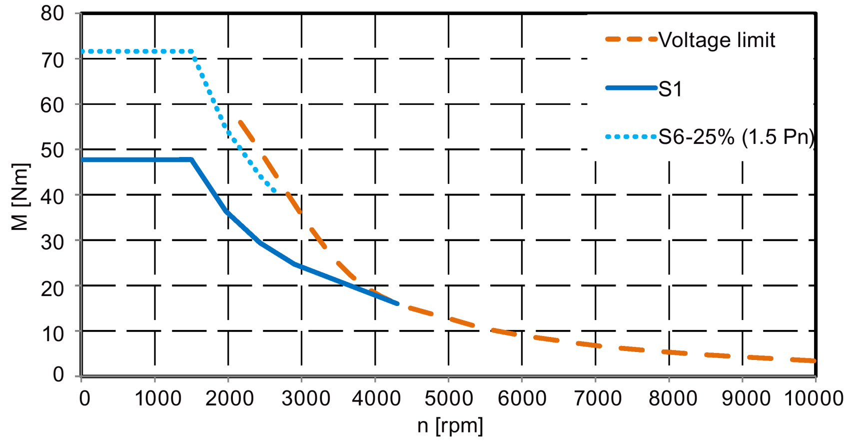




1PH1105-1❑F❑:

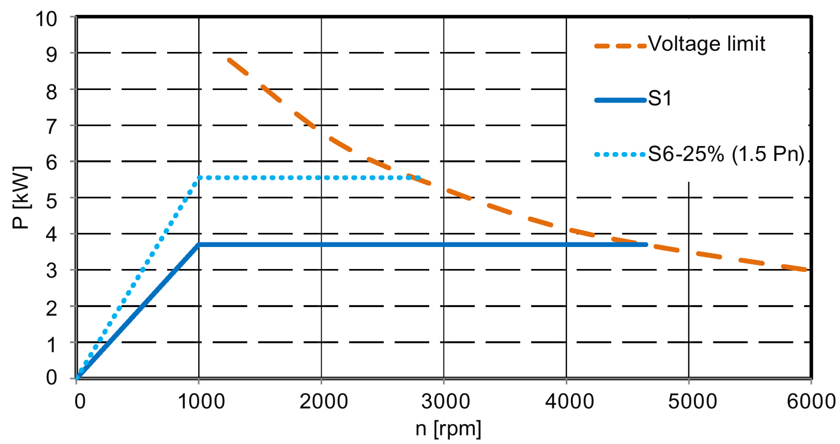
n_N	P_N	M_N	I_N	U_N	f_N	U_{max}	n_2	n_{max}	$P_{s6-25\%}$	$M_{s6-25\%}$	$I_{s6-25\%}$	I_{max}
[rpm]	[kW]	[Nm]	[A]	[V]	[Hz]	[V]	[rpm]	[rpm]	[kW]	[Nm]	[A]	[A]
1500	7.5	48	19.6	327	52.6	355	4300	10000	11.25	72	28	39.2

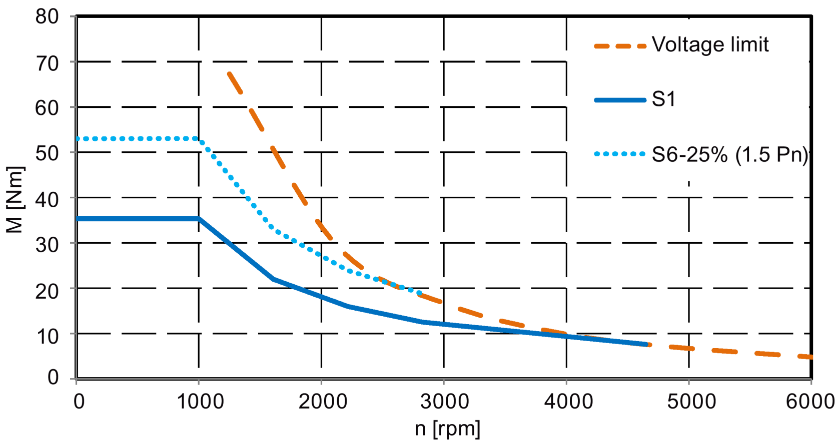




1PH1103-1❑D❑:

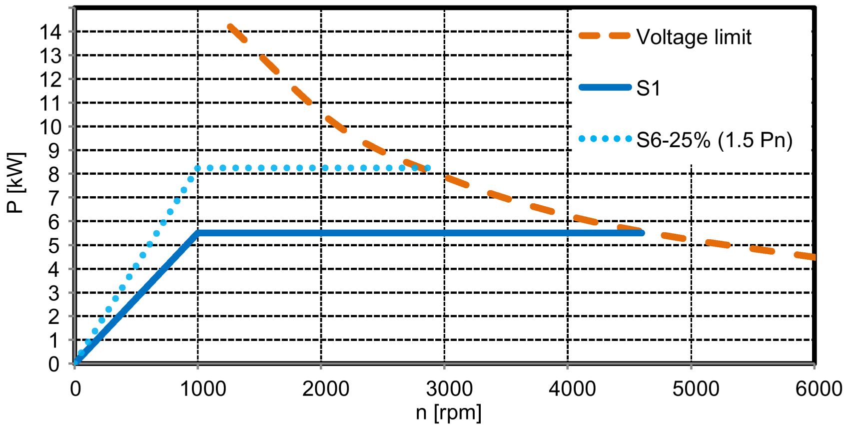
n_N	P_N	M_N	I_N	U_N	f_N	U_{max}	n_2	n_{max}	$P_{s6-25\%}$	$M_{s6-25\%}$	$I_{s6-25\%}$	I_{max}
[rpm]	[kW]	[Nm]	[A]	[V]	[Hz]	[V]	[rpm]	[rpm]	[kW]	[Nm]	[A]	[A]
1000	3.7	35	12.9	269	36.9	355	4600	6000	5.55	52.5	19	25.8

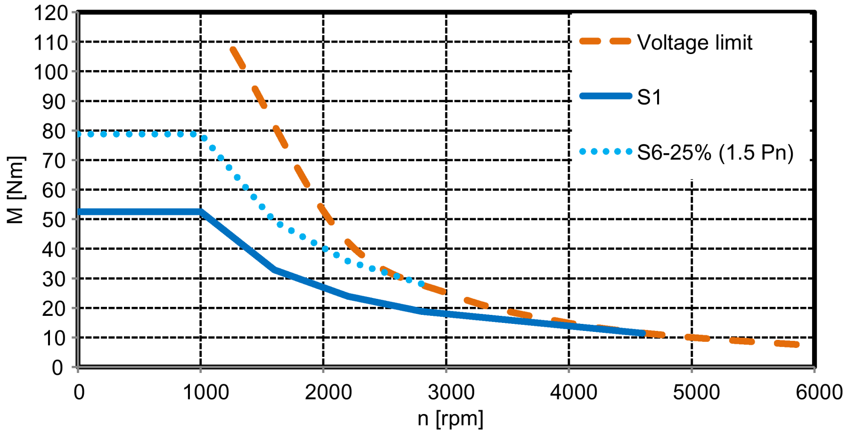




1PH1105-1❑D❑:

n_N	P_N	M_N	I_N	U_N	f_N	U_{max}	n_2	n_{max}	$P_{s6-25\%}$	$M_{s6-25\%}$	$I_{s6-25\%}$	I_{max}
[rpm]	[kW]	[Nm]	[A]	[V]	[Hz]	[V]	[rpm]	[rpm]	[kW]	[Nm]	[A]	[A]
1000	5.5	53	18.8	265	36.4	355	4600	6000	8.25	79.5	27	37.6

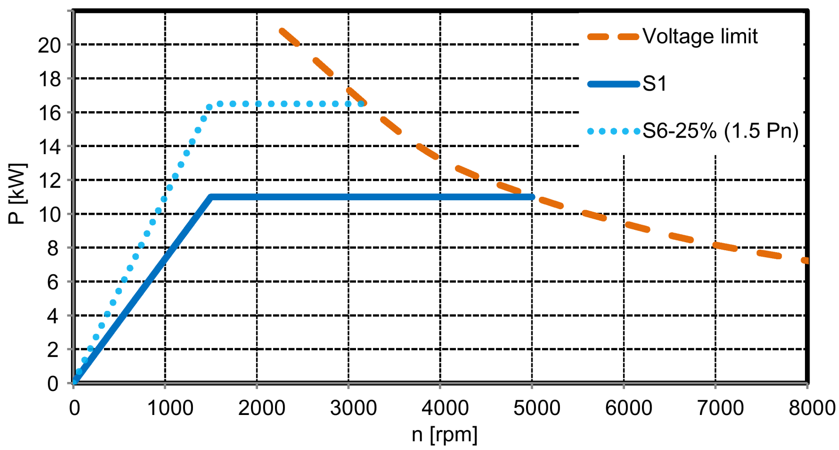


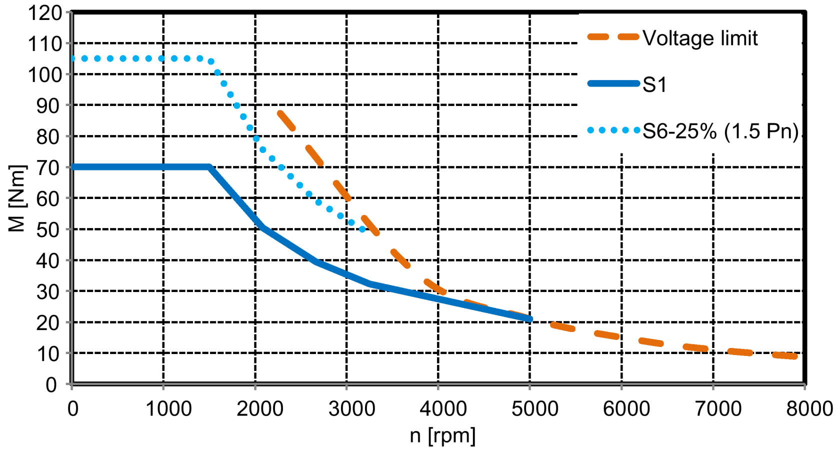


Torque-speed/power-speed characteristics - SH132

1PH1131-1❑F❑:

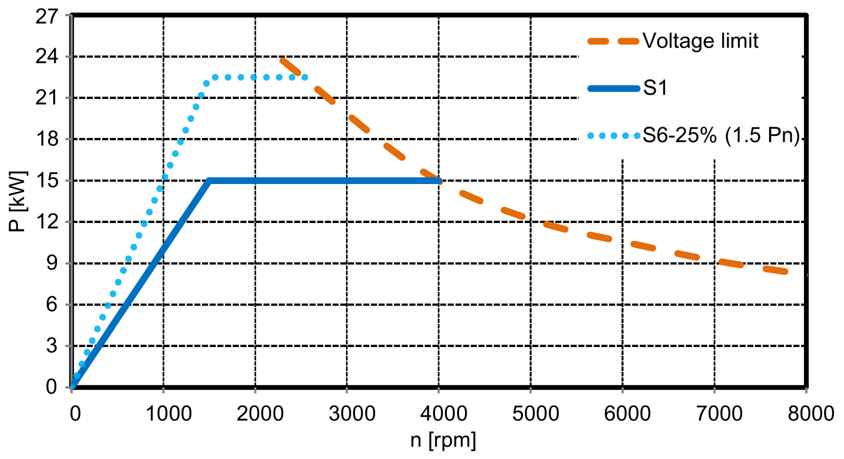
n_N	P_N	M_N	I_N	U_N	f_N	U_{max}	n_2	n_{max}	$P_{s6-25\%}$	$M_{s6-25\%}$	$I_{s6-25\%}$	I_{max}
[rpm]	[kW]	[Nm]	[A]	[V]	[Hz]	[V]	[rpm]	[rpm]	[kW]	[Nm]	[A]	[A]
1500	11	70	28.8	295	51.5	355	5000	8000	16.5	105	41	57.6

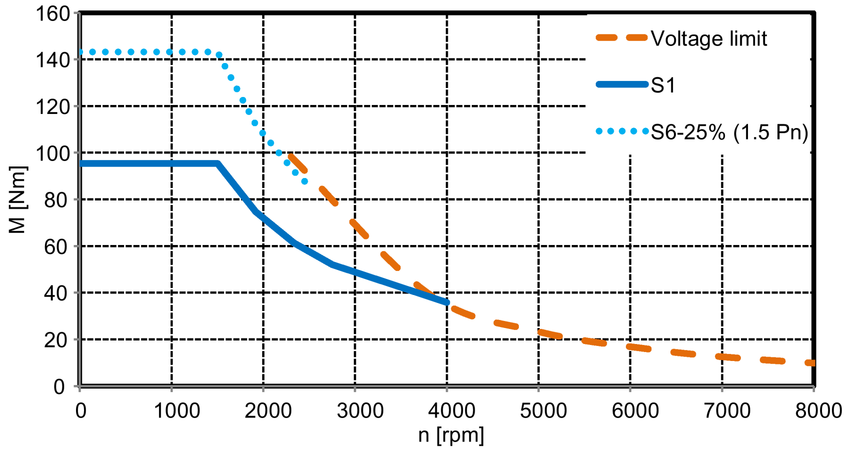




1PH1133-1❑F❑:

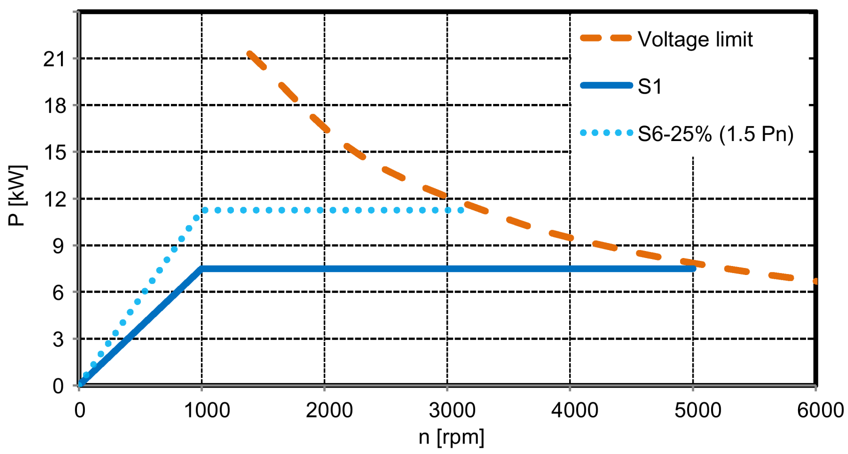
n_N	P_N	M_N	I_N	U_N	f_N	U_{max}	n_2	n_{max}	$P_{s6-25\%}$	$M_{s6-25\%}$	$I_{s6-25\%}$	I_{max}
[rpm]	[kW]	[Nm]	[A]	[V]	[Hz]	[V]	[rpm]	[rpm]	[kW]	[Nm]	[A]	[A]
1500	15	95.5	36.7	317	50.8	355	4000	8000	22.5	143	52	73.4

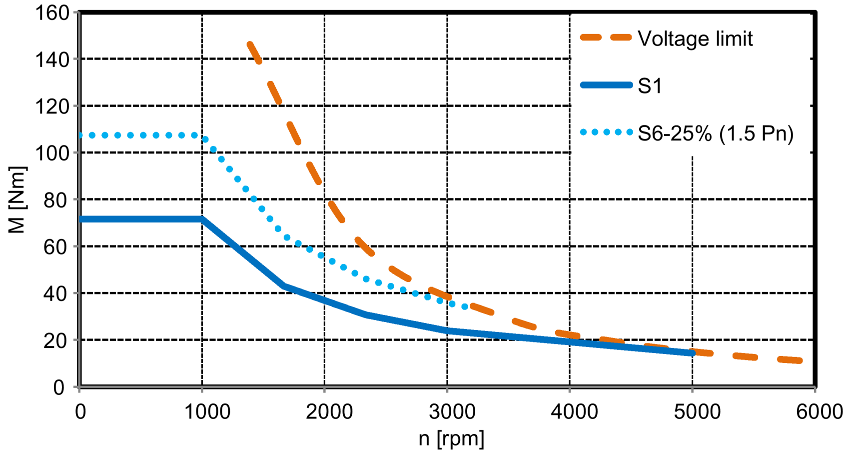




1PH1131-1❑D❑:

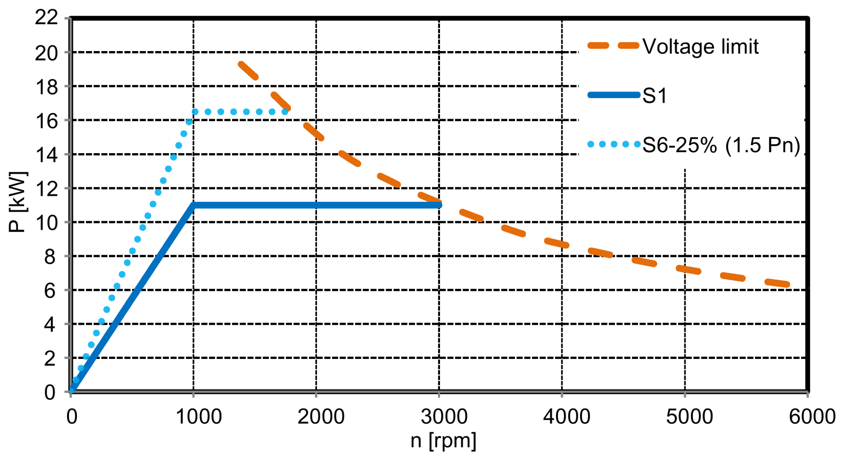
n_N	P_N	M_N	I_N	U_N	f_N	U_{max}	n_2	n_{max}	$P_{s6-25\%}$	$M_{s6-25\%}$	$I_{s6-25\%}$	I_{max}
[rpm]	[kW]	[Nm]	[A]	[V]	[Hz]	[V]	[rpm]	[rpm]	[kW]	[Nm]	[A]	[A]
1000	7.5	71.6	26.6	220	35.2	355	5000	6000	11.25	107	38	53.2

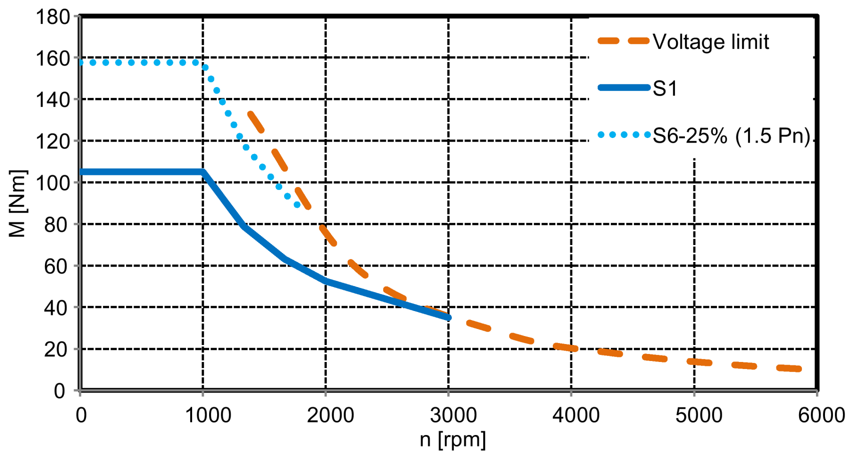




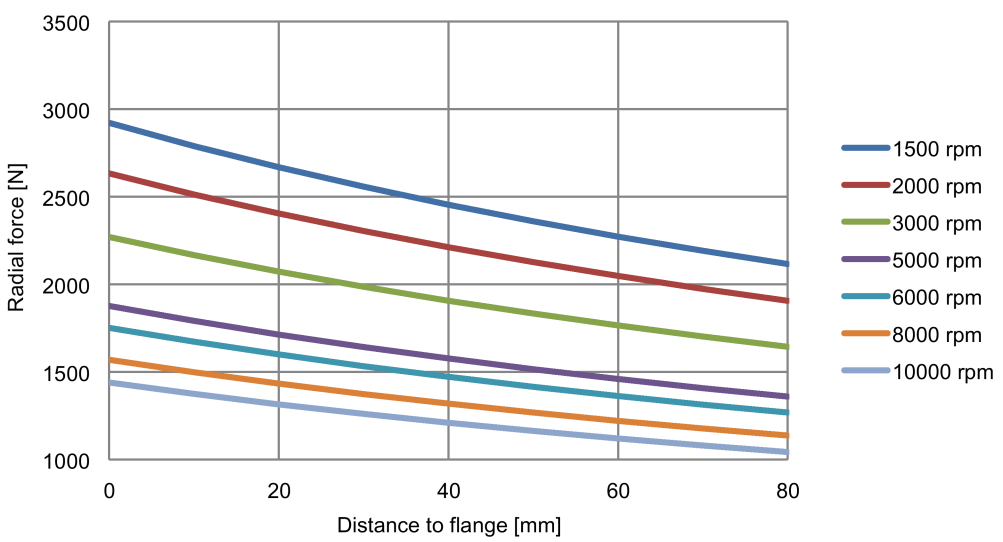
1PH1133-1❑D❑:

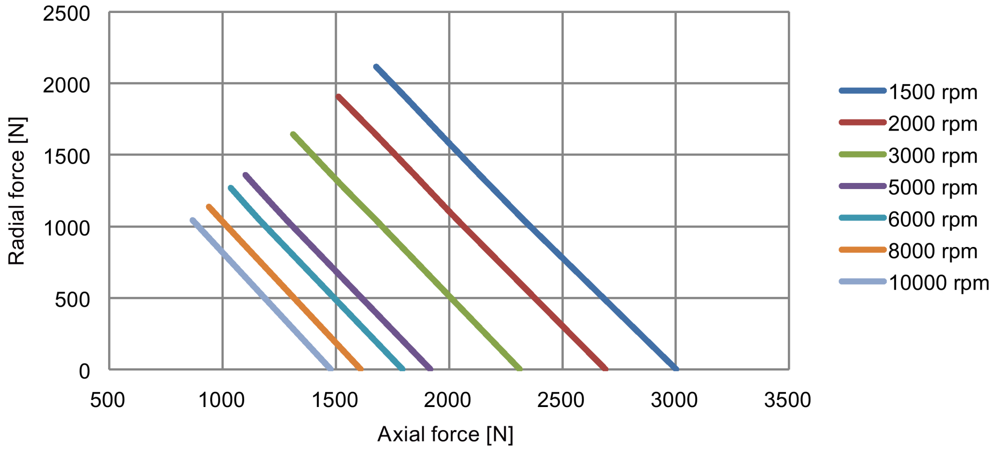
n_N	P_N	M_N	I_N	U_N	f_N	U_{max}	n_2	n_{max}	$P_{s6-25\%}$	$M_{s6-25\%}$	$I_{s6-25\%}$	I_{max}
[rpm]	[kW]	[Nm]	[A]	[V]	[Hz]	[V]	[rpm]	[rpm]	[kW]	[Nm]	[A]	[A]
1000	11	105	28.3	301	35	355	3000	6000	16.5	158	40	56.6



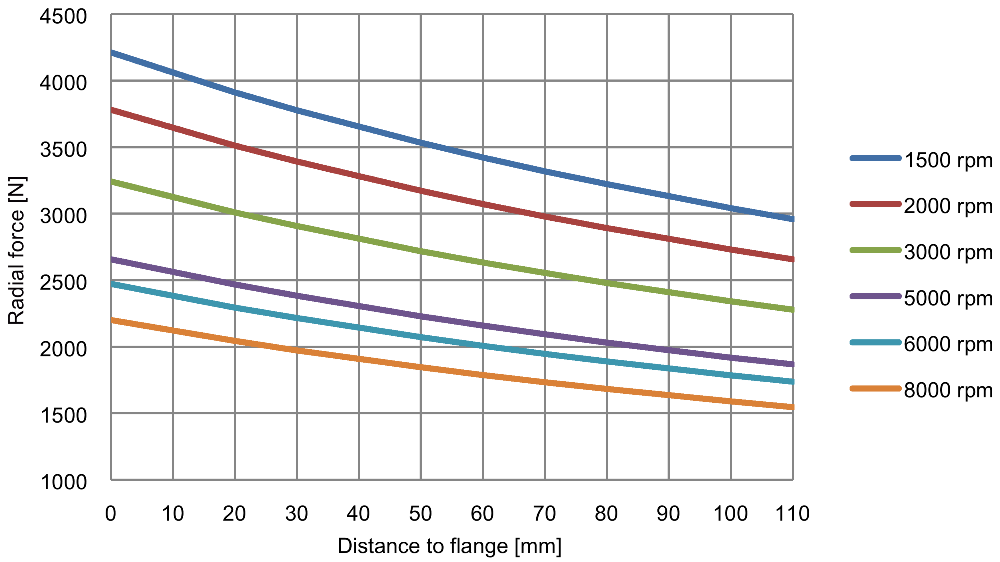


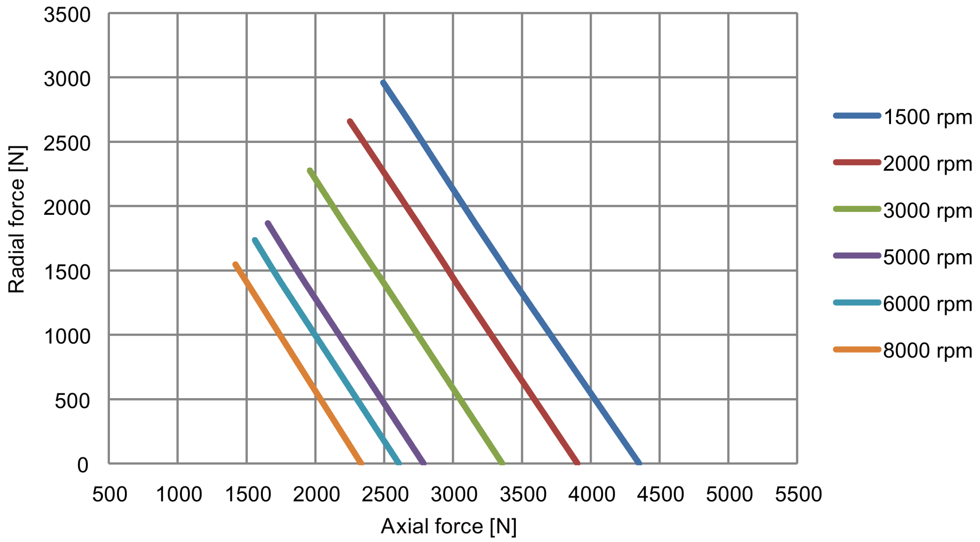
Permissible radial and axial forces - SH100





Permissible radial and axial forces - SH132





15.4 Cables

15.4.1 Drive Bus cable for the SINUMERIK 808D ADVANCED

Parameter	Drive Bus cable
Jacket material	PVC
Degree of protection	IP20
Number of cores	2
Operation voltage	100 V
Operation temperature, static	-40 °C to 80 °C
Shielding	Yes
Minimum bending radius, static	75 mm
Bending cycles	3000000
Oil resistance	Limited mineral oil and fats resistance EN60811-2-1 fulfilled
Flame-retardant	IEC60332-3-24 fulfilled
Certification	RoHS

15.4.2 Cables for the SINAMICS V70 servo system

Cables for the SINAMICS V70 feed servo system

Parameter	MOTION-CONNECT 300 power cable	MOTION-CONNECT 300 encoder cable	MOTION-CONNECT 300 brake cable
Jacket material	PVC		
Degree of protection (motor-side only)	IP65		
Number of cores	4	10	2
Cross-section of cores	4 × 1.5 mm^2 (for FSA) 4 × 2.5 mm^2 (for FSB/FSC)	6 × 0.22 mm^2 + 4 × 0.25 mm^2	2 × 0.75 mm^2
Operation voltage	600 V/1000 V	30 V	30 V
Operation temperature	-25 °C to 80 °C		
Shielding	Yes (coverage ≥ 85%)	Yes	Yes
Minimum bending radius, static	5 × outer diameter		
Minimum bending radius, dynamic	155 mm		
Bending cycles	1000000 (maximum acceleration: 2 m/s^2; maximum speed: 15 m/min)		
Oil resistance	EN60811-2-1 fulfilled		
Flame-retardant	EN60332-1-1 to 1-3 fulfilled		
Certification	RoHS and CE	RoHS	RoHS

Cables for the SINAMICS V70 spindle servo system

Parameter	MOTION-CONNECT 500 power cable	MOTION-CONNECT 300 encoder cable
Jacket material	PVC	
Degree of protection (motor-side only)	-	IP20
Number of cores	4	10
Cross-section of cores	4 × 2.5 mm^2, 4 × 4 mm^2, 4 × 10 mm^2, 4 × 16 mm^2	6 × 0.2 mm^2 + 4 × 0.25 mm^2
Operation voltage	1000 V	30 V
Operation temperature	-20 °C to 80 °C	-30 °C to 60 °C

Parameter	MOTION-CONNECT 500 power cable	MOTION-CONNECT 300 encoder cable
Shielding	Yes (coverage ≥ 80%)	Yes
Minimum bending radius, static	5 × outer diameter	
Minimum bending radius, dynamic	180 mm, 210 mm, 360 mm, 440 mm	20 × outer diameter
Bending cycles	100000	
Oil resistance	DIN VDE 472-803 Part B	EN60811-2-1 fulfilled
Flame-retardant	IEC 332.1	EN60332-1-1 to 1-3 fulfilled
Certification	RoHS and CE	RoHS

15.5 Address of CE-authorized manufacturer

The CE Declaration of Conformity is held on file available to the competent authorities at the following address:

SINUMERIK 808D ADVANCED controller and SINAMICS V70 drive

Siemens AG

Digital Factory

Motion Control

Frauenauracher Straße 80

DE-91056 Erlangen

Germany

SIMOTICS S-1FL6 motor and M-1PH1 main motor

Siemens AG

Digital Factory

Motion Control

Industriestraße 1

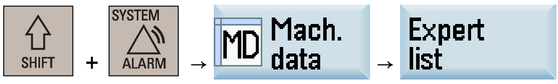
DE-97615 Bad Neustadt a. d. Saale

Germany

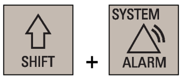
16 Parameter list

16.1 Basic machine data

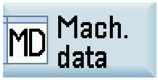
The table below lists the most frequently used machine data only. For more machine data, see SINUMERIK 808D ADVANCED HMI through the following operations:



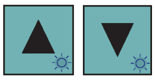
You can also call the help information for the machine data on the PPU by proceeding through the following steps:



1. Select the system data operating area.



2. Press this softkey to open the machine data window.



3. Open the target data list and select the desired data using the cursor keys.

4. Press this key to call the help information for the selected data.

Note: You can further press this softkey in the current help screen to show a complete list of all SINUMERIK 808D ADVANCED machine data. In addition, you can also use the following softkey to search for a specific MD by number in this list:

5. Pressing this softkey exits the help system.

Machine data list

No.	Name	Default	Range	Type	Unit	Activating
11300	JOG_INC_MODE_LEVELTRIGGRD	1	-	BOOL	-	PO
	INC and REF in JOG mode					
14510 *	USER_DATA_INT[0] ... [31]	0	-62,768 to 32,767	DWORD	-	PO
	User data (INT)					
14512 *	USER_DATA_HEX[0] ... [31]	0H	0 to 0x0FF	BYTE	-	PO
	User data (HEX)					
14514 *	USER_DATA_FLOAT[0] ... [7]	0.000000	-3.4e+038 to 3.4e+038	DOUBLE	-	PO
	User data (float)					
20360	TOOL_PARAMETER_DEF_MASK	• Turning: 283H • Milling: 0H	0 to 0x1FFFFF	DWORD	-	PO
	Definition of tool parameters					
20700	REFP_NC_START_LOCK	1	-	BOOL	-	RE

No.	Name	Default	Range	Type	Unit	Activating
	NC start disable without reference point					
30100	CTRLOUT_SEGMENT_NR[0]	-1	1 to 5	BYTE	-	PO
	Setpoint assignment: bus segment number					
30120	CTRLOUT_NR[0]	1		BYTE	-	PO
	Setpoint assignment: Setpoint output on drive submodule/module					
30130	CTRLOUT_TYPE	0	0 to 3	BYTE	-	PO
	Output type of setpoint					
30134	IS_UNIPOLAR_OUTPUT[0]	0	0 to 1	-	-	PO
	Setpoint output is unipolar					
30200	NUM_ENCS	-1	0 to 1	BYTE	-	PO
	Number of encoders					
30210	ENC_SEGMENT_NR[0]	-1	1 to 5	BYTE	-	PO
	Actual value assignment: Bus segment number					
30230	ENC_INPUT_NR[0]	-1	1 to 2	BYTE	-	PO
	Actual value assignment: Input on drive module/meas. circuit board					
30240	ENC_TYPE	0	0 to 5	BYTE	-	PO
	Encoder type of actual value sensing (actual position value)					
30350	SIMU_AX_VDI_OUTPUT	FALSE	-	BOOL	-	PO
	Axis signals output for simulation axes					
30600	FIX_POINT_POS[0] ... [3]	0.000000	-	DOUBLE	mm, degrees	PO
	Fixed-value positions of axis with G75					
31020	ENC_RESOL[0]	10,000		DWORD	-	PO
	Encoder lines per revolution					
31030	LEADSCREW_PITCH	10.000000	≥ 0	DOUBLE	mm	PO
	Pitch of leadscrew					
31040	ENC_IS_DIRECT	FALSE, FALSE	-	BYTE	-	PO
	Direct measuring system (no compilation to load position)					
31050	DRIVE_AX_RATIO_DENOM[0] ... [5]	1	1 to 2,147,000,000	DWORD	-	PO
	Denominator load gearbox					
31060	DRIVE_AX_RATIO_NUMERA[0] ... [5]	1	1 to 2,147,000,000	DWORD	-	PO
	Numerator load gearbox					
32000	MAX_AX_VELO	10,000 (mm/min) 27.77 (rpm)	-	DOUBLE	mm/min, rpm	CF
	Maximum axis velocity					

No.	Name	Default	Range	Type	Unit	Activating
32010	JOG_VELO_RAPID	10,000 (mm/min) 27.77 (rpm)	-	DOUBLE	mm/min, rpm	RE
	Rapid traverse in JOG mode					
32020	JOG_VELO	• Feed axis: 2,000 (mm/min) • Spindle: 100 (rpm)	-	DOUBLE	mm/min, rpm	RE
	Jog axis velocity					
32060	POS_AX_VELO	10,000 (mm/min) 27.77 (rpm)	-	DOUBLE	mm/min, rpm	RE
	Initial setting for positioning axis velocity					
32100	AX_MOTION_DIR	1	-1 to 1	DWORD	-	PO
	Traversing direction (not control direction)					
32110	ENC_FEEDBACK_POL[0]	1	-1 to 1	DWORD	-	PO
	Sign actual value (control direction)					
32200	POSCTRL_GAIN[0] ... [5]	1.000000	0.000000 to 2000.000000	DOUBLE	User defined	CF
	Servo gain factor					
32250	RATED_OUTVAL[0]	100	0.0 to 200	DOUBLE	%	CF
	Rated output voltage					
32260	RATED_VELO[0]	2,000.0	-	DOUBLE	rpm	CF
	Rated motor speed					
32300	MAX_AX_ACCEL[0] ... [4]	• Feed axis: 1.0 • Spindle: – [0]...[2]: 10 – [3]...[4]: 2.778	≥ 0.001	DOUBLE	mm/s^2, rev/s^2	CF
	Maximum axis acceleration					
32450	Backlash[0]	0.0	-	DOUBLE	mm	CF
	Backlash					
32700	ENC_COMP_ENABLE[0]	0	-	BOOL	-	CF
	Encoder/spindle error compensation					
34000	REFP_CAM_IS_ACTIVE	1	-	BOOL	-	RE
	Axis with reference point cam					
34010	REFP_CAM_DIR_IS_MINUS	0	-	BOOL	-	RE
	Approach reference point in minus direction					
34020	REFP_VELO_SEARCH_CAM	5,000.0 (mm/min) 13.88 (rpm)	-	DOUBLE	mm/min, rpm	RE
	Reference point approach velocity					

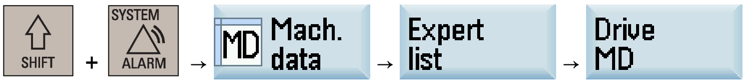
No.	Name	Default	Range	Type	Unit	Activating
34040	REFP_VELO_SEARCH_MARKER[0]	300.0 (mm/min) 0.833 (rpm)	-	DOUBLE	mm/min, rpm	RE
	Creep velocity					
34050	REFP_SEARCH_MARKER_REVERSE[0]	0	-	BOOL	-	RE
	Direction reversal to reference cam					
34060	REFP_MAX_MARKER_DIST[0]	20.0	-	DOUBLE	mm, degrees	RE
	Maximum distance to reference mark					
34070	REFP_VELO_POS	10,000.00 (mm/min) 27.77 (rpm)	-	DOUBLE	mm/min, rpm	RE
	Reference point positioning velocity					
34080	REFP_MOVE_DIST[0]	-2.0	-	DOUBLE	mm, degrees	RE
	Reference point distance					
34090	REFP_MOVE_DIST_CORR[0]	0.0	-	DOUBLE	mm, degrees	RE
	Reference point offset/absolute offset					
34092	REFP_CAM_SHIFT	0.000000	-	DOUBLE	mm	RE
	Electronic cam offset for incremental measuring system					
34093	REFP_CAM_MARKER_DIST[0]	0	-	DOUBLE	mm	PO
	Reference cam/reference mark distance					
34100	REFP_SET_POS[0] ... [3]	0.0	-	DOUBLE	mm, degrees	RE
	Reference point for incremental system					
34200	ENC_REFP_MODE[0]	1	0 to 8	BYTE	-	PO
	Referencing mode					
34210	ENC_REFP_STATE[0]	0	0 to 3	BYTE	-	IM
	Adjustment status of the absolute encoder					
34220	ENC_ABS_TURNS_MODULO[0]	-1	1 to 100000	DWORD	-	PO
	Modulo range for the rotary absolute encoder					
34230	ENC_SERIAL_NUMBER[0]	0	-	DWORD	-	PO
	Encoder serial number					
35010	GEAR_STEP_CHANGE_ENABLE	0	-	BOOL	-	RE
	Parameterize gear stage change					
35100 *	SPIND_VELO_LIMIT	10,000.0	-	DOUBLE	rpm	PO
	Maximum spindle speed					

No.	Name	Default	Range	Type	Unit	Activating
35110	GEAR_STEP_ MAX_VELO[0] ... [5]	[0]...[1]: 500 [2]: 1,000 [3]: 2,000 [4]: 4,000 [5]: 8,000	-	DOUBLE	rpm	CF
	Maximum speed for gear stage change					
35120	GEAR_STEP_ MIN_VELO[0] ... [5]	[0]...[1]: 50 [2]: 400 [3]: 800 [4]: 1,500 [5]: 3,000	-	DOUBLE	rpm	CF
	Minimum speed for gear stage change					
35130	GEAR_STEP_ MAX_VELO_LI MIT[0] ... [5]	[0]...[1]: 500 [2]: 1,000 [3]: 2,000 [4]: 4,000 [5]: 8,000	-	DOUBLE	rpm	CF
	Maximum speed for gear stage					
35140	GEAR_STEP_ MIN_VELO_LI MIT[0] ... [5]	[0]...[1]: 5 [2]: 10 [3]: 20 [4]: 40 [5]: 80	-	DOUBLE	rpm	CF
	Minimum speed for gear stage					
36100	POS_LIMIT_MI NUS	-100,000,000	-	DOUBLE	mm, degrees	RE
	1st software limit switch minus					
	Access level: Manufacturer					
36110	POS_LIMIT_PL US	100,000,000	-	DOUBLE	mm, degrees	RE
	1st software limit switch plus					
36200	AX_VELO_LIMI T[0] ... [5]	11,500 (mm/min) 31,944 (rpm)	-	DOUBLE	mm/min, rpm	CF
	Threshold value for velocity monitoring					
36300	ENC_FREQ_LI MIT[0]	3.33e5	-	DOUBLE	-	PO
	Encoder limit frequency					
38000	MM_ENC_CO MP_MAX_POI NTS	• Turning: 125 • Milling: 200	-	DWORD	-	PO
	Number of intermediate for interpolar compensation (SRAM)					

The machine data followed by an asterisk (*) have the access level of "**Customer**", while those without an asterisk have the access level of "**Manufacturer**".

16.2 SINAMICS V70 parameters

This section lists only the parameters displayed on the drive BOP and those frequently used for drive commissioning. For more parameters of the servo drive, see SINUMERIK 808D ADVANCED HMI through the following operations:



All parameters beginning with "p" are editable parameters, for example, p29000.

All parameters beginning with "r" are read-only parameters, for example, r0018.

Effective

Indicates the conditions for making parameterization effective. Two conditions are possible:

- IM (**Im**mediately): Parameter value becomes effective immediately after changing.
- RE (**Re**set): Parameter value becomes effective after repower-on.

Can be changed

Indicates the state in which a parameter is changeable. Two states are possible:

- **U** (R**u**n): Can be changed in the "**Running**" state when the enable signal is available. The "RDY" LED indicator lights up green.
- **T** (Ready **t**o run): Can be changed in the "**Ready**" state when the enable signal is missing. The "RDY" LED indicator lights up red.

Note

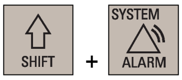
When judging the state of the drive according to the "RDY" LED indicator, ensure that no faults or alarms exist.

Data type

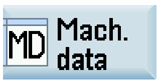
Type	Description
I16	16-bit integer
I32	32-bit integer
U16	16 bits without sign
U32	32 bits without sign
Uint16	16-bit unsigned integer
Uint32	32-bit unsigned integer
Float	32-bit floating point number

Calling help information for V70 parameters

You can call the help information for the V70 drive parameters on the PPU by proceeding through the following steps:

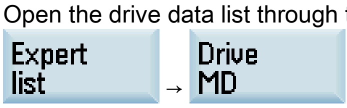


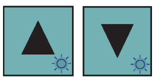
1. Select the system data operating area.



2. Press this softkey to open the machine data window.

3. Open the drive data list through the following softkey operations:





4. Select the desired parameter using the cursor keys.

5. Press this key to call the help information for the selected parameter.

Note: You can further press this softkey in the current help screen to show a complete list of all SINAMICS V70 parameters. In addition, you can also use the following softkey to search for a specific parameter by number in this list:

6. Pressing this softkey exits the help system.

16.2.1 V70 parameters on BOP

The table below lists the parameters displayed on the drive BOP only.

Par. No.	Name	Min	Max	Factory setting	Unit	Data type	Effective	Can be changed
r0020	Speed setpoint smoothed	-	-	-	rpm	Float	-	-
	Description: Displays the currently smoothed speed setpoint at the input of the speed controller or U/f characteristic (after the interpolator). Smoothing time constant = 100 ms The signal is not suitable as a process quantity and may only be used as a display quantity.							
r0021	Actual speed smoothed	-	-	-	rpm	Float	-	-
	Description: Displays the smoothed actual value of the motor speed. Smoothing time constant = 100 ms The signal is not suitable as a process quantity and may only be used as a display quantity.							
r0026	DC link voltage smoothed	-	-	-	V	Float	-	-
	Description: Displays the smoothed actual value of the DC link voltage. Smoothing time constant = 100 ms The signal is not suitable as a process quantity and may only be used as a display quantity.							
r0027	Absolute actual current smoothed	-	-	-	Arms	Float	-	-
	Description: Displays the smoothed absolute actual current value. Smoothing time constant = 100 ms The signal is not suitable as a process quantity and may only be used as a display quantity.							
	Dependency: r0068							
r0029	Current actual value field-generating smoothed	-	-	-	Arms	Float	-	-
	Description: Displays the smoothed field-generating actual current. Smoothing time constant = 100 ms The signal is not suitable as a process quantity and may only be used as a display quantity.							
r0030	Current actual value torque-generating smoothed	-	-	-	Arms	Float	-	-

Par. No.	Name	Min	Max	Factory setting	Unit	Data type	Effective	Can be changed
	Description: Displays the smoothed torque-generating actual current. Smoothing time constant = 100 ms The signal is not suitable as a process quantity and may only be used as a display quantity.							
r0031	Actual torque smoothed	-	-	-	Nm	Float	-	-
	Description: Displays the smoothed torque actual value. Smoothing time constant = 100 ms The signal is not suitable as a process quantity and may only be used as a display quantity.							
r0032	Active power actual value smoothed	-	-	-	kW	Float	-	-
	Description: Displays the smoothed actual value of the active power. Significance for the drive: Power output at the motor shaft							
r0033	Torque utilization smoothed	-	-	-	%	Float	-	-
	Description: Displays the smoothed torque utilization as a percentage. Smoothing time constant = 100 ms The signal is not suitable as a process quantity and may only be used as a display quantity.							
r0037[0...19]	Servo drive temperatures	-	-	-	°C	Float	-	-
	Description: Displays the temperatures in the servo drive. • [0] = Inverter, maximum value • [1] = Depletion layer maximum value • [2] = Rectifier maximum value • [3] = Air intake • [4] = Interior of servo drive • [5] = Inverter 1 • [6] = Inverter 2 • [7] = Inverter 3 • [8] = Inverter 4 • [9] = Inverter 5 • [10] = Inverter 6 • [11] = Rectifier 1 • [12] = Rectifier 2 • [13] = Depletion layer 1 • [14] = Depletion layer 2 • [15] = Depletion layer 3 • [16] = Depletion layer 4 • [17] = Depletion layer 5 • [18] = Depletion layer 6 • [19] = Cooling system liquid intake The value of -200 indicates that there is no measuring signal. • r0037[0]: Maximum value of the inverter temperatures (r0037[5...10]). • r0037[1]: Maximum value of the depletion layer temperatures (r0037[13...18]). • r0037[2]: Maximum value of the rectifier temperatures (r0037[11...12]). The maximum value is the temperature of the hottest inverter, depletion layer, or rectifier.							
r0068	Absolute current actual value	-	-	-	Arms	Float	-	-

Par. No.	Name	Min	Max	Factory setting	Unit	Data type	Effective	Can be changed
	Description: Displays actual absolute current. For A_INF, S_INF the following applies: • The value is updated with the current controller sampling time. The following applies for SERVO: • The value is updated with a sampling time of 1 ms. • Absolute current value = sqrt(Iq^2 + Id^2) • The absolute current actual value is available smoothed (r0027) and unsmoothed (r0068).							
	Dependency: r0027							
r0069[0...6]	Phase current actual value	-	-	-	A	Float	-	-
	Description: Displays the measured actual phase currents as peak value. • [0] = Phase U • [1] = Phase V • [2] = Phase W • [3] = Phase U offset • [4] = Phase V offset • [5] = Phase W offset • [6] = Total U, V, W In indices 3 ... 5, the offset currents of the 3 phases, which are added to correct the phase currents, are displayed. The sum of the 3 corrected phase currents is displayed in index 6.							
r0079[0...1]	Torque setpoint total	-	-	-	Nm	Float	-	-
	Description: Displays the torque setpoint at the output of the speed controller (before clock cycle interpolation). • [0]: Unsmoothed • [1]: Smoothed							
r0632	Motor temperature model, stator winding temperature	-	-	-	°C	Float	-	-
	Description: Displays the stator winding temperature of the motor temperature model.							
p0918	Drive Bus address	10	16	10	-	U16	RE	T
	Description: Displays or sets the Drive Bus address for Drive Bus interface on the servo drive. The address can be set as follows: Using p0918 • Only if the address 00 hex, 7F hex, 80 hex, or FF hex has been set using the address switch. • The address is saved in a non-volatile fashion using the function "copy from RAM to ROM". • A change only becomes effective after a POWER ON.							
p1058	Jog 1 speed setpoints	0	210000.000	100	rpm	Float	IM	T
	Description: Sets the speed/velocity for jog 1. Jogging is level-triggered and allows the motor to be incrementally moved.							
p1082	Maximum speed	0.000	210000.000	1500.000	rpm	Float	IM	T
	Description: Sets the highest possible speed.							
	Dependency: p0322							
p1083	Speed limit in positive direction of rotation	0.000	210000.000	210000.000	rpm	Float	IM	T, U
	Description: Sets the maximum speed for the positive direction.							

Par. No.	Name	Min	Max	Factory setting	Unit	Data type	Effective	Can be changed
p1086	Speed limit in negative direction of rotation	-210000.000	0.000	-210000.000	rpm	Float	IM	T, U
	Description: Sets the speed limit for the negative direction.							
p1120	Ramp-function generator ramp-up time	0.000	999999.000	10.000	s	Float	IM	T, U
	Description: The ramp-function generator ramps-up the speed setpoint from standstill (setpoint = 0) up to the maximum speed (p1082) in this time.							
	Dependency: p1082							
p1121	Ramp-function generator ramp-down time	0.000	999999.000	10.000	s	Float	IM	T, U
	Description: The ramp-function generator ramps-down the speed setpoint from the maximum speed (p1082) down to standstill (setpoint = 0) in this time. Further, the ramp-down time is always effective for OFF1.							
	Dependency: p1082							
p1215	Motor holding brake configuration	0	3	0	-	I16	IM	T
	Description: Sets the holding brake configuration. • 0: No motor holding brake being used • 1: Motor holding brake according to sequence control • 2: Motor holding brake always open • 3: Motor holding brake like sequence control							
	Dependency: p1216, p1217, p1226, p1227, p1228							
p1216	Motor holding brake, opening time	0	10000	100	ms	Float	IM	T, U
	Description: Sets the time to open the motor holding brake. After controlling the holding brake (opens), the speed/velocity setpoint remains at zero for this time. After this, the speed/velocity setpoint is enabled. This time should be set longer than the actual opening time of the brake, which ensures that the drive cannot accelerate when the brake is applied.							
	Dependency: p1215, p1217							
p1217	Motor holding brake closing time	0	10000	100	ms	Float	IM	T, U
	Description: Sets the time to apply the motor holding brake. After OFF1 or OFF3 and the holding brake is controlled (the brake closes), then the drive remains closed-loop controlled for this time stationary with a speed setpoint/velocity setpoint of zero. The pulses are suppressed when the time expires. This time should be set longer than the actual closing time of the brake, which ensures that the pulses are only suppressed after the brake has closed.							
	Dependency: p1215, p1216							
p1226	Threshold for zero speed detection	0.00	210000.00	20.00	rpm	Float	IM	T, U

Par. No.	Name	Min	Max	Factory setting	Unit	Data type	Effective	Can be changed
	Description: Sets the speed threshold for the standstill identification. Acts on the actual value and setpoint monitoring. • When braking with OFF1 or OFF3, when the threshold is undershot, standstill is identified. The following applies when the brake control is activated: • When the threshold is undershot, the brake control is started and the system waits for the brake closing time in p1217. The pulses are then suppressed. If the brake control is not activated, the following applies: • When the threshold is undershot, the pulses are suppressed and the drive coasts down.							
	Dependency: p1215, p1216, p1217, p1227							
p1227	Zero speed detection moni-toring time	0.000	300.000	300.000	s	Float	IM	T, U
	Description: Sets the monitoring time for the standstill identification. When braking with OFF1 or OFF3, standstill is identified after this time has expired, after the setpoint speed has fallen below p1226. After this, the brake control is started, the system waits for the closing time in p1217 and then the pulses are suppressed.							
	Dependency: p1215, p1216, p1217, p1226							
p1228	Pulse suppres-sion delay time	0.000	299.000	0.000	s	Float	IM	T, U
	Description: Sets the delay time for pulse suppression. After OFF1 or OFF3 and zero speed detection, the system waits for this time to expire and the pulses are then suppressed. Standstill is identified in the following cases: • The speed actual value falls below the speed threshold in p1226 and the time started after this in p1228 has expired. • The speed setpoint falls below the speed threshold in p1226 and the time started after this in p1227 has expired.							
	Dependency: p1226, p1227							
p1414	Speed setpoint filter activation	-	-	0000 bin	-	U16	IM	T, U
	Description: Setting for activating/de-activating the speed setpoint filter. If only one filter is required, filter 1 should be activated and filter 2 de-activated, to avoid excessive pro-cessing time.							
	Dependency: The individual speed setpoint filters are parameterized as of p1415.							
p1415	Speed setpoint filter 1 type	0	2	0	-	I16	IM	T, U
	Description: Sets the type for speed setpoint filter 1. • 0: Low pass: PT1 • 1: Low pass: PT2 • 2: General 2nd-order filter							
	Dependency: • PT1 low pass: p1416 • PT2 low pass: p1417, p1418 • General filter: p1417 ... p1420							
p1416	Speed setpoint filter 1 time con-stant	0.00	5000.00	0.00	ms	Float	IM	T, U
	Description: Sets the time constant for the speed setpoint filter 1 (PT1). This parameter is only effective if the filter is set as a PT1 low pass.							
	Dependency: p1414, p1415							

Par. No.	Name	Min	Max	Factory setting	Unit	Data type	Effective	Can be changed
p1417	Speed setpoint filter 1 denominator natural frequency	0.5	16000.0	1999.0	Hz	Float	IM	T, U
	Description: Sets the denominator natural frequency for speed setpoint filter 1 (PT2, general filter). This parameter is only effective if the speed filter is parameterized as a PT2 low pass or as general filter. The filter is only effective if the natural frequency is less than half of the sampling frequency.							
	Dependency: p1414, p1415							
p1418	Speed setpoint filter 1 denominator damping	0.001	10.000	0.700	-	Float	IM	T, U
	Description: Sets the denominator damping for velocity setpoint filter 1 (PT2, general filter). This parameter is only effective if the speed filter is parameterized as a PT2 low pass or as general filter.							
	Dependency: p1414, p1415							
p1419	Speed setpoint filter 1 numerator natural frequency	0.5	16000.0	1999.0	Hz	Float	IM	T, U
	Description: Sets the numerator natural frequency for speed setpoint filter 1 (general filter). This parameter is only effective if the speed filter is set as a general filter. The filter is only effective if the natural frequency is less than half of the sampling frequency.							
	Dependency: p1414, p1415							
p1420	Speed setpoint filter 1 numerator damping	0.000	10.000	0.700	-	Float	IM	T, U
	Description: Sets the numerator damping for speed setpoint filter 1 (general filter). This parameter is only effective if the speed filter is set as a general filter.							
	Dependency: p1414, p1415							
p1460	Speed controller P gain adaptation speed, lower	0.000	999999.000	0.300	Nms/rad	Float	IM	T, U
	Description: Sets the P gain of the speed controller before the adaptation speed range. This value corresponds to the basic setting of the P gain of the speed controller without adaptation.							
p1462	Speed controller integral time adaptation speed lower	0.00	100000.00	20.00	ms	Float	IM	T, U
	Description: Sets the integration time of the speed controller before the adaptation speed range. This value corresponds to the basic setting of the integral time of the speed controller without adaptation.							
p1520	Torque limit upper/motoring	-1000000.00	20000000.00	0.00	Nm	Float	IM	T, U
	Description: Sets the fixed upper torque limit or the torque limit when motoring.							
	Note: Negative values when setting the upper torque limit (p1520 < 0) can result in the motor accelerating in an uncontrollable fashion. The maximum value depends on the maximum torque of the connected motor.							
	Dependency: p1521							
p1521	Torque limit lower/regenerative	-20000000.00	1000000.00	0.00	Nm	Float	IM	T, U
	Description: Sets the fixed lower torque limit or the torque limit when regenerating.							

Par. No.	Name	Min	Max	Factory setting	Unit	Data type	Effective	Can be changed
	Note: Positive values when setting the lower torque limit (p1521 > 0) can result in the motor accelerating in an uncontrollable fashion. The maximum value depends on the maximum torque of the connected motor.							
	Dependency: p1520							
p1656	Activates current setpoint filter	-	-	0001 bin	-	U16	IM	T, U
	Description: Setting for activating/de-activating the current setpoint filter. If not all of the filters are required, then the filters should be used consecutively starting from filter 1.							
	Dependency: The individual current setpoint filters are parameterized as of p1657.							
p1657	Current setpoint filter 1 type	1	2	1	-	I16	IM	T, U
	Description: Sets the current setpoint filter 1 as low pass (PT2) or as extended general 2nd-order filter. • 1: Low pass: PT2 • 2: General 2nd-order filter							
	Dependency: Current setpoint filter 1 is activated via p1656.0 and parameterized via p1657 ... p1661.							
p1658	Current setpoint filter 1 denominator natural frequency	0.5	16000.0	1999.0	Hz	Float	IM	T, U
	Description: Sets the denominator natural frequency for current setpoint filter 1 (PT2, general filter).							
	Dependency: Current setpoint filter 1 is activated via p1656.0 and parameterized via p1657 ... p1661.							
p1659	Current setpoint filter 1 denominator damping	0.001	10.000	0.700	-	Float	IM	T, U
	Description: Sets the denominator damping for current setpoint filter 1.							
	Dependency: Current setpoint filter 1 is activated via p1656.0 and parameterized via p1657 ... p1661.							
p1660	Current setpoint filter 1 numerator natural frequency	0.5	16000.0	1999.0	Hz	Float	IM	T, U
	Description: Sets the numerator natural frequency for current setpoint filter 1 (general filter)							
	Dependency: Current setpoint filter 1 is activated via p1656.0 and parameterized via p1657 ... p1661.							
p1661	Current setpoint filter 1 numerator damping	0.000	10.000	0.700	-	Float	IM	T, U
	Description: Sets the numerator damping for current setpoint filter 1.							
	Dependency: Current setpoint filter 1 is activated via p1656.0 and parameterized via p1657 ... p1661.							
r2114[0...1]	System runtime total	-	-	-	-	U32	-	-
	Description: Displays the total system runtime for the drive unit. The time comprises r2114[0] (milliseconds) and r2114[1] (days). After r2114[0] has reached a value of 86.400.000 ms (24 hours) this value is reset and r2114[1] is incremented. • [0] = Milliseconds • [1] = Days							
p2153	Speed actual value filter time constant	0	1000000	0	ms	Float	IM	T, U
	Description: Sets the time constant of the PT1 element to smooth the speed/velocity actual value. The smoothed actual speed/velocity is compared with the threshold values and is only used for messages and signals.							

Par. No.	Name	Min	Max	Factory setting	Unit	Data type	Effective	Can be changed
p29000	Motor type selection	0	54251	-	-	U16	IM	T
	Description: Motor type number is printed on the motor rating plate as motor ID. For a motor with an incremental encoder, you need to manually input the parameter value, ranging from 18 to 39. For a motor with an absolute encoder, the drive reads the parameter value automatically, ranging from 10009 to 10048.							
p29002	BOP operating display selection	0	2	0	-	U16	IM	T, U
	Description: BOP operating display selection. • 0: Actual speed • 1: DC voltage • 2: Actual torque							
r29018[0...1]	Firmware version	-	-	-	-	U32	-	-
	Description: Firmware version. • [0]: Firmware version number • [1]: Build increment number							
	Note: Index [1] only applies to V70 firmware versions higher than 1.00. For example, when r29018[0] = 10100 and r29018[1] = 10, the firmware version is displayed as 1.01.00.10 on the HMI.							

16.2.2 Drive basic list on HMI

The drive basic list on HMI contains the most frequently used drive parameters for commissioning. You can also view them through the following operations:

SHIFT + SYSTEM ALARM → Mach. data → Drv basic list

Par. No.	Name	Min	Max	Factory setting	Unit	Data type	Effective	Can be changed
p0977	Save all parameters	0	1013	[0] 0	-	U16	IM	T, U
	Description: Saves all parameters of the drive system to the non-volatile memory. When saving, only the adjustable parameters intended to be saved are taken into account.							
	Dependency: p0976							
	Caution: Memory card inserted: The drive parameterization is also saved on the card. Any backed-up data is overwritten!							
	Notice: The Control Unit power supply may only be powered down after data has been saved (i.e. after data save has been started, wait until the parameter again has the value 0). Writing to parameters is inhibited while saving.							
	Note: Parameters saved with p0977 = 10, 11 or 12 can be downloaded again with p0976 = 10, 11 or 12.							
p1460[0...n]	Speed controller P gain adaptation speed lower	0.000	999999.000	0.300	Nms/rad	Float	IM	T, U
	Description: Sets the P gain of the speed controller before the adaptation speed range (0 ... p1464). This value corresponds to the basic setting of the P gain of the speed controller without adaptation (p1461 = 100 %).							
	Dependency: p1461							

Par. No.	Name	Min	Max	Factory setting	Unit	Data type	Effective	Can be changed
	Note: When automatically calculating the speed controller, only the motor moment of inertia is taken into account (p0341). For higher load moments of inertia (p0342 > 1 or p1498 > 0), you are advised to check the speed controller gain.							
p1461[0...n]	Speed controller Kp adaptation speed upper scaling	0.0	200000.0	[0] 100.0	[%]	Float	IM	T, U
	Description: Sets the P gain of the speed controller for the upper adaptation speed range (> p1465). The entry is made referred to the P gain for the lower adaptation speed range of the speed controller (% referred to p1460).							
	Dependency: p1460							
	Note: When automatically calculating the speed controller, only the motor moment of inertia is taken into account (p0341). For higher load moments of inertia (p0342 > 1 or p1498 > 0), you are advised to check the speed controller gain.							
p1462	Speed controller integral time adaptation speed lower	0.00	100000.00	20.00	ms	Float	IM	T, U
	Description: Sets the integration time of the speed controller before the adaptation speed range (0 ... p1464). This value corresponds to the basic setting of the integral time of the speed controller without adaptation (p1461 = 100 %).							
	Dependency: p1463							
p1821[0...n]	Direction of rotation	0	1	[0] 0	-	I16	IM	-
	Description: Setting to change the direction of rotation. If the parameter is changed, it reverses the direction of rotation of the motor and the encoder actual value without changing the setpoint.							
	Dependency: F07434							
	Caution: Changing the direction using p1820 or p1821 is not recognized by the "Safe Direction without encoder". As a consequence, the limit provided by SDI (Safe Direction) from r9733 no longer functions.							
	Notice: An appropriate fault is output for a drive data set changeover where the direction of rotation changes and the pulses are enabled.							
	Note: For operation with the phase sequence U/V/W, the direction of rotation is defined when viewing the face side of the motor output shaft. When changing the direction of rotation, the rotating field direction of the current controller is reversed. The speed actual value (e.g. r0063) is also reversed so that the control sense is kept and internally causing the direction of rotation to be reversed with the same setpoint. Further, the position actual values of the actual encoder are reversed (e.g. r0482[0...2]).							
p29000	Motor ID	0	54251	[0] 0	-	U16	IM	T
	Description: Motor type number is printed on the motor rating plate as motor ID. For a motor with an incremental encoder, users need to manually input the parameter value, ranging from 18 to 39. For a motor with an absolute encoder, the drive automatically reads the parameter value, ranging from 10009 to 10048.							
	Dependency: -							
r3998[0...n]	First drive commissioning	0	65535	-	-	U16	IM	-
	Description: Displays whether the drive still has to be commissioned for the first time. 0 = Yes 2 = No							
	Dependency: -							

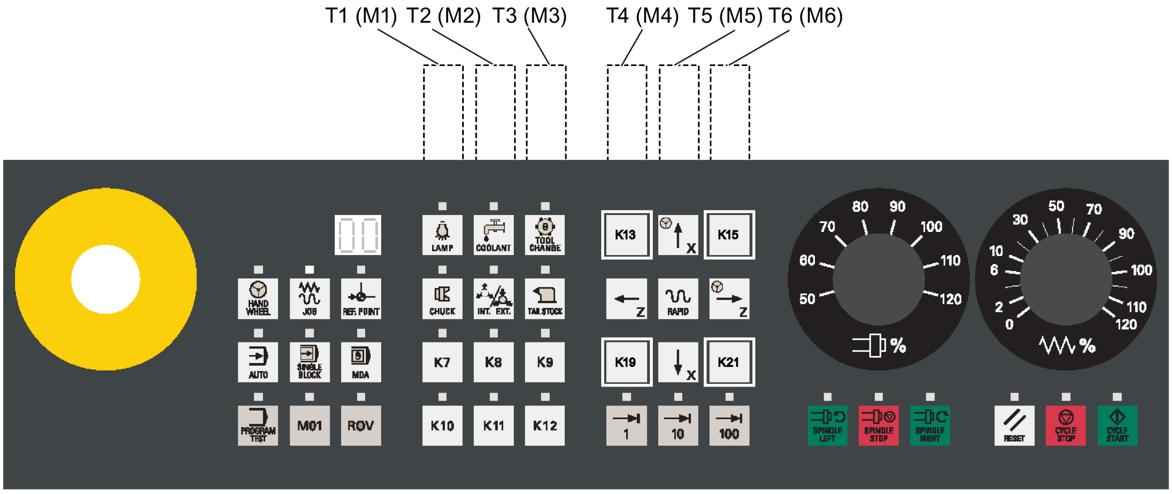
17 PLC user interface

17.1 Signals from/to the MCP

Horizontal MCP with override switches

The figure below takes the horizontal MCP variant with override switches as an example. The vertical MCP variants share the same PLC interface addresses for the corresponding keys.

Note that labels K13, K15, K19, and K21 are not included in the pre-inserted labeling strips for keys of the MCP. The figure includes these labels so that when you read the information in the following two tables, you know which keys on the MCP it refers to.



From the MCP

DB1000	From the MCP [r]							
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	M01	PROGRAM TEST	MDA	SINGLE BLOCK	AUTO	REF. POIN T	JOG	HAND WHEEL
1	Key 7	TAIL STOCK	INT. EXT.	CHUCK	TOOL CHANGE	COOLANT	LAMP	ROV
2	100 (INC)	10 (INC)	1 (INC)	Key 12	Key 11	Key 10	Key 9	Key 8
3	Axis trav-ersing key (↑x)	Key 13	CYCLE START	CYCLE STOP	RESET	SPINDLE RIGHT	SPINDLE STOP	SPINDLE LEFT
4		Key 21	Axis trav-ersing key (↓x)	Key 19	Axis trav-ersing key (→z)	RAPID	Axis trav-ersing key (←z)	Key 15
8				Feed override value (in Gray code)				
9					Spindle override value (in Gray code)			

To the MCP

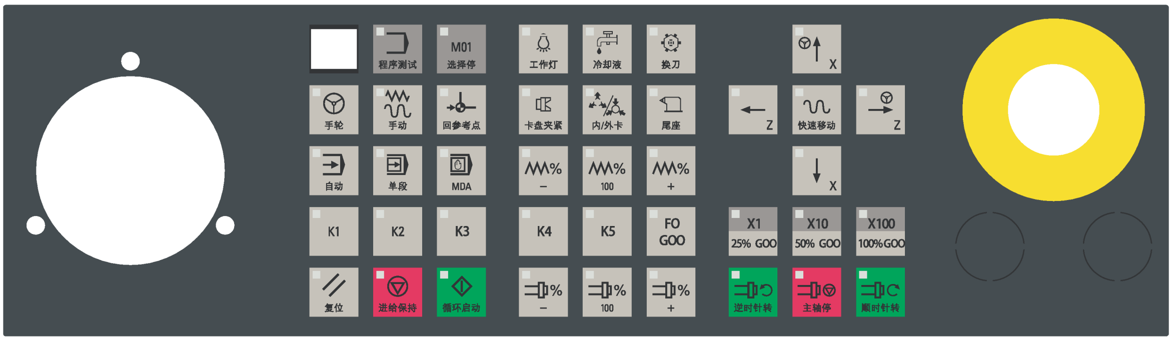
DB1100	To the MCP [r/w]							
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	M01	PROGRAM TEST	MDA	SINGLE BLOCK	AUTO	REF. POINT	JOG	HAND WHEEL
1	Key 7	TAIL STOCK	INT. EXT.	CHUCK	TOOL CHANGE	COOLANT	LAMP	ROV
2	100 (INC)	10 (INC)	1 (INC)	Key 12	Key 11	Key 10	Key 9	Key 8

3	Axis trav-ersing key (↑x)	Key 13	CYCLE START	CYCLE STOP	RESET	SPINDLE RIGHT	SPINDLE STOP	SPINDLE LEFT
4		Key 21	Axis trav-ersing key (↓x)	Key 19	Axis trav-ersing key (→z)	RAPID	Axis trav-ersing key (←z)	Key 15
8			1 [1)]	1 [1)]	7 SEG LED1 [2)]			
9			1 [1)]	1 [1)]	7 SEG LED2 [2)]			

[1)] To ensure the correct display of the active tool number, make sure that you set Bit 4 and Bit 5 to 1.

[2)] You can set only values 0 to 9 for each 7-segment LED (LED1 and LED2).

Horizontal MCP with a reserved slot for the handwheel



From the MCP

DB1000	From the MCP [r]							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0	Key 2	Key 1	MDA	SINGLE BLOCK	AUTO	REF. POIN T	JOG	HAND WHEEL
1	Feed over-ride key (-)	TAIL STOCK	INT. EXT.	CHUCK	TOOL CHANGE	COOLANT	LAMP	Key 3
2	100 (INC) / 100% G00	10 (INC) / 50% G00	1 (INC) / 25% G00	F0 G00	Key 5	Key 4	Feed over-ride key (+)	Feed over-ride key (100%)
3	Axis trav-ersing key (↑x)	Spindle override key (-)	CYCLE START	CYCLE STOP	RESET	SPINDLE RIGHT	SPINDLE STOP	SPINDLE LEFT
4	M01	PROGRAM TEST	Axis trav-ersing key (↓x)	Spindle override key (+)	Axis trav-ersing key (→z)	RAPID	Axis trav-ersing key (←z)	Spindle override key (100%)
8								
9								

To the MCP

DB1100	To the MCP [r/w]							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0	Key 2	Key 1	MDA	SINGLE BLOCK	AUTO	REF. POIN T	JOG	HAND WHEEL
1	Feed over-ride key (-)	TAIL STOCK	INT. EXT.	CHUCK	TOOL CHANGE	COOLANT	LAMP	Key 3
2	100 (INC) / 100% G00	10 (INC) / 50% G00	1 (INC) / 25% G00	F0 G00	Key 5	Key 4	Feed over-ride key (+)	Feed over-ride key (100%)

3	Axis trav-ersing key (↑x)	Spindle override key (-)	CYCLE START	CYCLE STOP	RESET	SPINDLE RIGHT	SPINDLE STOP	SPINDLE LEFT
4	M01	PROGRAM TEST	Axis trav-ersing key (↓x)	Spindle override key (+)	Axis trav-ersing key (→z)	RAPID	Axis trav-ersing key (←z)	Spindle override key (100%)
8			1 [1]	1 [1]	7 SEG LED1 [2]			
9			1 [1]	1 [1]	7 SEG LED2 [2]			

[1] To ensure the correct display of the active tool number, make sure that you set Bit 4 and Bit 5 to 1.

[2] You can set only values 0 to 9 for each 7-segment LED (LED1 and LED2).

17.2 Reading/Writing NC data

17.2.1 Reading/writing NC data: Job

DB1200	**Reading/writing NC data [r/w]** PLC → NCK interface							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0							Write varia-ble	Start
1	Number of variables							
2								
3								

DB1200 ... 1203	**Reading/writing NC data [r/w]** PLC → NCK interface							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
1000	Variable index							
1001	Area number							
1002	Line index for the NCK variable x (WORD)							
1004	Column index for the NCK variable x (WORD)							
1006								
1008	Writing: data to NCK variable x (data type of the variables: 1 to 4 bytes)							

17.2.2 Reading/writing NC data: Result

DB1200	**Reading/writing NC data [r]** NCK → PLC interface							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
2000							Error in job	Job com-pleted
2001								
2002								

DB1200 ... 1203	**Reading/writing NC data [r]** NCK → PLC interface							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
3000							Error has occurred	Valid varia-ble
3001	Access result [1]							
3002								
3004	Reading: data from NCK variable x (data type of the variables: 1 to 4 bytes)							

[1] 0: no error; 3: illegal access to object; 5: invalid address; 10: object does not exist

17.3 PI Service

17.3.1 PI service: Job

DB1200	PI service [r/w] PLC → NCK interface							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
4000								Start
4001	PI index							
4002								
4003								
4004	PI parameter 1							
4006	PI parameter 2							
4008	PI parameter 3							
4010	PI parameter 4							
4012	PI parameter 5							
4014	PI parameter 6							
4016	PI parameter 7							
4018	PI parameter 8							
4020	PI parameter 9							
4022	PI parameter 10							

17.3.2 PI service: Result

DB1200	Reading / writing NC data [r] NCK → PLC interface							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
5000							Error in job	Job com-pleted
5001								
5002								

17.4 Retentive data area

DB1400	Retentive data [r/w]							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
	User data							
0								
	User data							
1								
	User data							
2								
	...							
...								
32								
	...							
...								
	User data							
126								
	User data							
127								

17.5 User Alarms

17.5.1 User alarms: Activating

DB1600	**Activating alarm [r/w]** PLC -> HMI interface							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0	Activation of alarm no.							
	700007	700006	700005	700004	700003	700002	700001	700000
1	Activation of alarm no.							
	700015	700014	700013	700012	700011	700010	700009	700008
2	Activation of alarm no.							
	700023	700022	700021	700020	700019	700018	700017	700016
3	Activation of alarm no.							
	700031	700030	700029	700028	700027	700026	700025	700024
4	Activation of alarm no.							
	700039	700038	700037	700036	700035	700034	700033	700032
5	Activation of alarm no.							
	700047	700046	700045	700044	700043	700042	700041	700040
...	...							
15	Activation of alarm no.							
	700127	700126	700125	700124	700123	700122	700121	700120

17.5.2 Variables for user alarms

DB1600	**Variables for user alarms [r32/w32]** PLC -> HMI interface							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
DBD1000	Variable for alarm 700000							
DBD1004	Variable for alarm 700001							
DBD1008	Variable for alarm 700002							
…	…							
DBD1500	Variable for alarm 700125							
DBD1504	Variable for alarm 700126							
DBD1508	Variable for alarm 700127							

17.5.3 Active alarm response

DB1600	**Active alarm response [r]** PLC -> HMI interface							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
2000	Acknowledge POWER ON	Acknowledge with DB1600DBX3000.0		PLC STOP	EMERGENCY STOP	Feedrate disable all axes	Read-in disable	NC start disable
2001								
2002								
2003								

17.5.4 Alarm acknowledgement

DB1600	**Alarm acknowledgement [r/w]** PLC -> HMI interface							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
3000								Ack
3001								
3002								
3003								

17.6 Signals from/to HMI

17.6.1 Program control signals from the HMI (retentive area)

DB1700	**Signals, HMI [r/w]** HMI -> PLC interface							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0		Dry run feedrate selected	M01 selected		DRF selected			
1	Program test selected				Feedrate override selected for rapid traverse			
2	Skip block 7 selected	Skip block 6 selected	Skip block 5 selected	Skip block 4 selected	Skip block 3 selected	Skip block 2 selected	Skip block 1 selected	Skip block 0 selected
3	Measurement in JOG active	Calculation of measurement value not finished					Skip block 9 selected	Skip block 8 selected
4								
5								
6								
7	Reset				NC stop		NC start	

17.6.2 Program selection from PLC (retentive area)

DB1700	**Program selection [r/w]** PLC -> HMI interface							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
1000	Program selection from the PLC: Program number							
1001	Command job from the PLC: Command							
1002								
1003								

17.6.3 Checkback signal: Program selection from HMI (retentive area)

DB1700	**Program selection [r]** HMI -> PLC interface						
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
2000							Error program selection	Program selected
2001							Error command execution	Execute command
2002								
2003								

17.6.4 Signals from HMI

DB1800	**Signals from HMI [r]** HMI -> PLC interface (signals are only present for PLC cycle)							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0	Reset	Start measurement in JOG				JOG	Mode MDI	AUTOMATIC
1						Active the machine function		
						REF		
2								
3								

17.6.5 Signals from PLC

DB1800	**Signals from PLC [r]**							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
1000		Commissioning archive has been read in					Boot with saved data	Boot with default values
1001								
1002								
1003								
1004	PLC cycle in μs [DINT]							
1008	Year: Tens digit, BCD				Year: Units digit, BCD			
1009	Month: Tens digit, BCD				Month: Units digit, BCD			
1010	Day: Tens digit, BCD				Day: Units digit, BCD			
1011	Hour: Tens digit, BCD				Hour: Units digit, BCD			
1012	Minute: Tens digit, BCD				Minute: Units digit, BCD			
1013	Second: Tens digit, BCD				Second: Units digit, BCD			
1014	Millisecond: Hundreds digit, BCD				Millisecond: Tens digit, BCD			
1015	Millisecond: Units digit, BCD				Weekday, BCD {1, 2, ... 7} (1 = Sunday)			

17.6.6 Signals to maintenance planners

DB1800	Deactivation [r/w]							
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
2000	Deactivation 8	Deactivation 7	Deactivation 6	Deactivation 5	Deactivation 4	Deactivation 3	Deactivation 2	Deactivation 1
2001	Deactivation 16	Deactivation 15	Deactivation 14	Deactivation 13	Deactivation 12	Deactivation 11	Deactivation 10	Deactivation 9
2002	Deactivation 24	Deactivation 23	Deactivation 22	Deactivation 21	Deactivation 20	Deactivation 19	Deactivation 18	Deactivation 17
2003	Deactivation 32	Deactivation 31	Deactivation 30	Deactivation 29	Deactivation 28	Deactivation 27	Deactivation 26	Deactivation 25

DB1800	Deactivation [r/w]							
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
4000	Acknowledgement 8	Acknowledgement 7	Acknowledgement 6	Acknowledgement 5	Acknowledgement 4	Acknowledgement 3	Acknowledgement 2	Acknowledgement 1
4001	Acknowledgement 16	Acknowledgement 15	Acknowledgement 14	Acknowledgement 13	Acknowledgement 12	Acknowledgement 11	Acknowledgement 10	Acknowledgement 9
4002	Acknowledgement 24	Acknowledgement 23	Acknowledgement 22	Acknowledgement 21	Acknowledgement 20	Acknowledgement 19	Acknowledgement 18	Acknowledgement 17
4003	Acknowledgement 32	Acknowledgement 31	Acknowledgement 30	Acknowledgement 29	Acknowledgement 28	Acknowledgement 27	Acknowledgement 26	Acknowledgement 25

DB1800	Deactivation [r/w]							
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
5000	Acknowledgement 8	Acknowledgement 7	Acknowledgement 6	Acknowledgement 5	Acknowledgement 4	Acknowledgement 3	Acknowledgement 2	Acknowledgement 1
5001	Acknowledgement 16	Acknowledgement 15	Acknowledgement 14	Acknowledgement 13	Acknowledgement 12	Acknowledgement 11	Acknowledgement 10	Acknowledgement 9
5002	Acknowledgement 24	Acknowledgement 23	Acknowledgement 22	Acknowledgement 21	Acknowledgement 20	Acknowledgement 19	Acknowledgement 18	Acknowledgement 17
5003	Acknowledgement 32	Acknowledgement 31	Acknowledgement 30	Acknowledgement 29	Acknowledgement 28	Acknowledgement 27	Acknowledgement 26	Acknowledgement 25

17.6.7 Signals from maintenance planners

DB1800	Warnings/Alarms [r]							
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
3000	Alarm 8	Alarm 7	Alarm 6	Alarm 5	Alarm 4	Alarm 3	Alarm 2	Alarm 1
3001	Alarm 16	Alarm 15	Alarm 14	Alarm 13	Alarm 12	Alarm 11	Alarm 10	Alarm 9
3002	Alarm 24	Alarm 23	Alarm 22	Alarm 21	Alarm 20	Alarm 19	Alarm 18	Alarm 17
3003	Alarm 32	Alarm 31	Alarm 30	Alarm 29	Alarm 28	Alarm 27	Alarm 26	Alarm 25

17.6.8 Signals from operator panel (retentive area)

DB1900	**Signals from operator panel [r/w]** HMI -> PLC interface						
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0	Switch over Ma-chine/Work	Simulation active						
1								
2								
3								
4								
6								
7								

17.6.9 General selection/status signals from HMI (retentive area)

DB1900	**Signals from HMI [r]** HMI -> PLC interface							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
1000								
1001								
1002								
1003					Axis number for handwheel 1			
	Machine axis	Handwheel selected	Contour handwheel			C	B	A
1004					Axis number for handwheel 2			
	Machine axis	Handwheel selected	Contour handwheel			C	B	A
1005								
1006								
1007								

17.6.10 General selection/status signals to HMI (retentive area)

DB1900	**Signals to HMI [r/w]** PLC -> HMI interface							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
5000								
5001								
5002								Enable measure-ment in JOG
5003								
5004 ... 5007	T-number for tool measurement in JOG (DINT)							
5008 ... 5011								

5012 ... 5015	
5016 ... 5019	

17.7 Auxiliary functions transfer from NC channel

17.7.1 Overview

DB2500	**Auxiliary functions from NCK channel [r]** NCK -> PLC interface						
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0								
1								
2								
3								
4				M fct. 5 change	M fct. 4 change	M fct. 3 change	M fct. 2 change	M fct. 1 change
5								
6								S fct. 1 change
7								
8								T fct. 1 change
9								
10								D fct. Change
11								
12						H fct. 3 change	H fct. 2 change	H fct. change
13								
14								
15								
16								
17								
18								
19								

17.7.2 Decoded M signals (M0 to M99)

Note

The signals are output for the duration of a PLC cycle.

DB2500	**M functions from NCK channel [r]** 1) 2) NCK -> PLC interface							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
1000	Dynamic M functions							
	M7	M6	M5	M4	M3	M2	M1	M0
1001	Dynamic M functions							
	M15	M14	M13	M12	M11	M10	M9	M8

1002	Dynamic M functions							
	M23	M22	M21	M20	M19	M18	M17	M16
…	...							
1012	Dynamic M functions							
					M99	M98	M97	M96
1013								
1014								
1015								

1) As the PLC user, you must generate basic functions yourself from the dynamic M functions.

2) The basic program decodes dynamic M functions (M0 to M99).

17.7.3 Transferred T functions

DB2500	T functions from NCK channel [r] NCK -> PLC interface							
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
2000	T function 1 (DINT)							
2004								
2005								
2006								
2007								

17.7.4 Transferred M functions

DB2500	M functions from NCK channel [r] NCK -> PLC interface							
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
3000	M function 1 (DINT)							
3004	Extended address M function 1 (byte)							
3008	M function 2 (DINT)							
3012	Extended address M function 2 (byte)							
3016	M function 3 (DINT)							
3020	Extended address M function 3 (byte)							
3024	M function 4 (DINT)							
3028	Extended address M function 4 (byte)							
3032	M function 5 (DINT)							
3036	Extended address M function 5 (byte)							

17.7.5 Transferred S functions

DB2500	S functions from NCK channel [r] NCK -> PLC interface							
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
4000	S function 1 (REAL) (DINT)							
4004	Extended address S function 1 (byte)							
4008	S function 2 (REAL)							
4012	Extended address S function 2 (byte)							
4016								
4020								

17.7.6 Transferred D functions

DB2500	**D functions from NCK channel [r]** NCK -> PLC interface							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
5000	D function 1 (DINT)							
5004								

17.7.7 Transferred H functions

DB2500	**H functions from NCK channel [r]** NCK -> PLC interface							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
6000	H function 1 (REAL) (DINT)							
6004	Extended address H function 1 (byte)							
6008	H function 2 (REAL)							
6012	Extended address H function 2 (byte)							
6016	H function 3 (REAL)							
6020	Extended address H function 3 (byte)							

17.8 NCK signals

17.8.1 General signals to NCK

DB2600	**General signals to NCK [r/w]** PLC → NCK interface							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0	Protection level Keyswitch position 0 to 3					Acknowledge EMERGENCY STOP	EMERGENCY STOP	Braking along the contour in case of EMERGENCY STOP
	4	5	6	7				
1						Request axis distances to go	Request axis actual values	INC inputs in mode signal range active [1]
2								
3								

[1] Refer to mode signals

17.8.2 General signals from NCK

DB2700	**General signals from NCK [r/w]** NCK -> PLC interface							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0							EMERGENCY OFF active	
1	Inch measuring system						Probe actuated	
							Probe 2	Probe 1

2	NC ready	Drive ready	Drives in cyclic operation					
3		Air temperature alarm						NCK alarm is active
4								
5								
6								
7								
8								
9								
10								
11								
12	Change counter for motion, handwheel 1							
13	Modification counter for motion, handwheel 2							
14								
15	Change counter , inch/metric measuring system							
16								
17								
18								
19								

17.8.3 Signals at fast inputs and outputs

DB2800	**Signals at fast inputs and outputs [r/w]** PLC -> NCK interface							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0	Block digital NCK inputs							
	Input 8	Input 7	Input 6	Input 5	Input 4	Hardware input		
1	Value from PLC for NCK inputs							
	Input 8	Input 7	Input 6	Input 5	Input 4	Hardware input		
4	Block digital NCK outputs							
	Output 8	Output 7	Output 6	Output 5	Output 4	Output 3	Output 2	Hardware output
5	Overwrite mask for digital NCK outputs							
	Output 8	Output 7	Output 6	Output 5	Output 4	Output 3	Output 2	Hardware output
6	Value from PLC for digital NCK outputs							
	Output 8	Output 7	Output 6	Output 5	Output 4	Output 3	Output 2	Hardware output
7	Setting mask for NCK outputs							
	Output 8	Output 7	Output 6	Output 5	Output 4	Output 3	Output 2	Hardware output

17.8.4 Signals from fast inputs and outputs

DB2900	**Signals from fast inputs and outputs [r]** NCK -> PLC interface							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0	Actual value for digital NCK inputs							

	Input 8	Input 7	Input 6	Input 5	Input 4	Hardware input		
4	Setpoint for digital NCK outputs							
	Output 8	Output 7	Output 6	Output 5	Output 4	Output 3	Output 2	Hardware output

DB3000	**Mode signals to NCK [r/w]** PLC -> NCK interface							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0	Reset			Mode change block		Mode		
						JOG	MDI	AUTO
1	Single block					Machine function		
	Type A	Type B				REF		
2	Machine function [1]							
		Continuous traversing	Var. INC	10000 INC	1000 INC	100 INC	10 INC	1 INC
3								

[1] To use the machine function signals in DB3000.DBB2, you must set the "INC inputs in the operating-mode signal range active" signal (DB2600.DBX1.0) to "1".

DB3100	**Mode signals from NCK [r]** NCK -> PLC interface							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0	Reset				808 READY	Mode		
						JOG	MDI	AUTO
1						Active machine function		
						REF		
2	Machine function							
		Continuous traversing active	Var. INC active	10000 INC active	1000 INC active	100 INC active	10 INC active	1 INC active
3								

17.9 Channel signals

17.9.1 Signals to NC channel

Control signals to NC channel

DB3200	**Signals to NCK channel [r/w]** PLC -> NCK interface							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0		Activate test run feedrate	Activate M01	Activate single block [1]	Activate DRF	Activate traverse forwards	Activate traverse backwards	
1	Activate program test						Enable protection zones	Activate referencing
2	Activate skip block							

	7	6	5	4	3	2	1	0
3								
4	Feedrate offset [2]							
	H	G	F	E	D	C	B	A
5	Rapid traverse override							
	H	G	F	E	D	C	B	A
6	Feedrate override active [3]	Rapid trav-erse over-ride active	Path veloci-ty limiting	Program level abort	Delete number of subroutine cycles	Delete distance - to-go	Read-in disable	Federate disable
7			Suppress start lock	NC stop axes plus spindle	NC stop	NC stop at block limit	NC start	NC start disable
8	Activate machine-related protection zone							
	Area 8	Area 7	Area 6	Area 5	Area 4	Area 3	Area 2	Area 1
9	Activate machine-related protection zone							
							Area 10	Area 9
10	Activate channel-specific protection zone							
	Area 5	Area 5	Area 5	Area 5	Area 5	Area 5	Area 5	Area 5
11	Activate channel-specific protection zone							
							Area 10	Area 9
12								
13	Do not block tool		Deactivate workpiece counter		Activate fixed feedrate			
					Feed 4	Feed 3	Feed 2	Feed 1
14	No tool change commands	JOG circle	Activate associated M01	Negative direction for contour handwheel simulation	Simulate contour handwheel	Activate contour handwheel (bit/binary coded)		
							Handwheel 2	Handwheel 1
15	Activate skip block 9	Activate skip block 8	Invert con-tour hand-wheel direction					
16								Program branches (GOTOS) control
17								
18								
19								

1) Select single-block type selection using the softkey.

2) 31 positions (Gray code)

Controls signals to axes in Work

DB3200	Signals to NCK channel [r/w] PLC -> NCK interface							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
1000	**Axis 1 in Work**							
	Traversing keys		Rapid traverse override	Traversing key distance disable	Feedrate stop	Activate handwheel (bit/binary coded) [1]		
	Plus	Minus					2	1
1001	**Axis 1 in Work** Machine function [2]							
		Continuous traversing	Var. INC	10000 INC	1000 INC	100 INC	10 INC	1 INC
1002								
1003								
								Handwheel direction of rotation inverted
1004	**Axis 2 in Work**							
	Traversing keys		Rapid travers override	Traversing key disable	Feedrate stop	Activate handwheel (bit/binary coded)		
	Plus	Minus					2	1
1005	**Axis 2 in Work** Machine function [2]							
		Continuous traversing	Var. INC	10000 INC	1000 INC	100 INC	10 INC	1 INC
1006								
1007								
								Invert handwheel direction
1008	**Axis 3 in Work**							
	Traversing keys		Rapid traverse override	Traversing key disable	Feedrate stop	Activate handwheel (bit/binary coded)		
	Plus	Minus					2	1
1009	**Axis 3 in Work** Machine function [2]							
		Continuous traversing	Var. INC	10000 INC	1000 INC	100 INC	10 INC	1 INC
1010								
1011								Invert handwheel direction

1) The handwheel number is represented according to the $MD_HANDWH_VDI_REPRESENTATION machine data in a bit-coded (=0) or binary-coded (=1) manner.

2) Machine function: the machine function is only entered if the "INC inputs in the operating-mode signal range active" signal (DB2600.DBX1.0) is not set.

17.9.2 Signals from NC channel

Status signals from NC channel

DB3300	Signals from NCK channel [r] NCK → PLC interface							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0		Last action block active	M0/M1 active	Approach block active	Action block active	Forwards traverse active	Backwards traverse active	Execution from external active
1	program test active		M2/M30 active	Block search active	Handwheel override active	Rev. federate active		Referencing active
2								
3	Channel status			Program status				
	Reset	Interrupted	Active	Aborted	Interrupted	Stopped	Waiting	Running
4	NCK alarm with processing stop present	Channel specific NCK alarm is active	Channel operational		All axes		Stop request	Start request
					Stationary	Referenced		
5						Contour handwheel active (bit/binary coded)		
							Handwheel 2	Handwheel 1
6								
7			Invert contour handwheel direction					Protection zone not guaranteed
8	Machine-related protection zone pre-activated							
	Area 8	Area 7	Area 6	Area 5	Area 4	Area 3	Area 2	Area 1
9	Machine-related protection zone pre-activated							
							Area 10	Area 9
10	Channel-specific protection zone pre-activated							
	Area 8	Area 7	Area 6	Area 5	Area 4	Area 3	Area 2	Area 1
11	Channel-specific protection zone pre-activated							
							Area 10	Area 9
12	Machine-related protection zone violated							
	Area 8	Area 7	Area 6	Area 5	Area 4	Area 3	Area 2	Area 1
13	Machine-related protection zone violated							
							Area 10	Area 9
14	Channel-specific protection zone violated							
	Area 8	Area 7	Area 6	Area 5	Area 4	Area 3	Area 2	Area 1
15	Channel-specific protection zone violated							
							Area 10	Area 9

Status signals, axes in Work

DB3300	Signals from NCK channel [r] NCK → PLC interface							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
1000	**Axis 1 in Work**							
	Travel command		Travel request			Handwheel active (bit/binary coded) [1]		
	Plus	Minus	Plus	Minus			2	1
1001	**Axis 1 in Work** Machine function [2]							
		Continuous traversing	Var. INC	10000 INC	1000 INC	100 INC	10 INC	1 INC
1002								
1003								
								Contour handwheel direction of rotation inverted
1004	**Axis 2 in Work**							
	Traversing command		Travel request			Handwheel active (bit/binary coded)		
	Plus	Minus	Plus	Minus			2	1
1005	**Axis 2 in Work** Machine function							
		Continuous traversing	Var. INC	10000 INC	1000 INC	100 INC	10 INC	1 INC
1006								
1007								
								Contour handwheel direction of rotation inverted
1008	**Axis 3 in Work**							
	Traversing command		Travel request			Handwheel active (bit/binary coded)		
	Plus	Minus	Plus	Minus			2	1
1009	**Axis 3 in Work** Machine function							
		Continuous traversing	Var. INC	10000 INC	1000 INC	100 INC	10 INC	1 INC
1010								
1011								Contour handwheel direction of rotation inverted

Additional status signals from NC channel

DB3300	Signals from NCK channel [r] NCK → PLC interface							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
4000								G00 active
4001			Travel request, drive test present				Workpiece setpoint reached	External language mode active
4002		Dry run feedrate Active	Associated M01/M00 Active	STOP_DELAYED				ASUP is stopped
4003	No tool change command active	DELAY FST SUPPRESS		DELAY FST				
4004	ProgEvent display							
				Start after block search	Boot	Operator panel Reset	Part program End	Part program Start from RESET
4005		Jog circle Active					Stop condition	StopByColl Danger
4006							Dormant ASUP Active	ASUP active
4007								
4008	Active transformation number							
4009	Reserved							
4010	Reserved							
4011	Reserved							

Asynchronous subroutines (ASUPs): Job

DB3400	ASUP: Result [r/w] PLC → NCK interface							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0								INT1 Start
1								INT2 Start
2								
3								

Asynchronous subroutines (ASUPs): Result

DB3400	ASUP: Result [r] NCK → PLC interface							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
1000	INT1							
					ASUP execution not possible	Interrupt no. not allocated	ASUP is being executed	ASUP ended
1001	INT2							
					ASUP execution not possible	Interrupt no. not allocated	ASUP is being executed	ASUP ended
1002								
1003								

G functions from NCK channel

DB3500	G functions from NCK channel [r] NCK → PLC interface							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0	Active G function of group 1 (8 bit int)							
1	Active G function of group 2 (8 bit int)							
2	Active G function of group 3 (8 bit int)							
...	...							
62	Active G function of group 63 (8 bit int)							
63	Active G function of group 64 (8 bit int)							

17.10 Axis/spindle signals

17.10.1 Transferred M and S functions, axis specific

DB3700 … 3705	M, S functions [r] NCK -> PLC interface							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0	M function for spindle (DINT)							
4	S function for spindle (REAL)							

17.10.2 Signals to axis/spindle

Common signals to axis/spindle

DB3800 ... 3805	Signals to axis/spindle [r/w] PLC -> NCK interface							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0	Feedrate override							
	H	G	F	E	D	C	B	A
1	Override active	Position measuring system 2	Position measuring system 1	Follow up mode	Axis spindle disable			
2	Reference point value				Clamping in progress	Distance-to-go/spindle reset	Drive enable	
	4	3	2	1				

3	Axis/spindle enable program test	Velocity/spindle speed limiting	Activate fixed feedrate				Enable approach to fixed stop	
			Feed 4	Feed 3	Feed 2	Feed 1		
4	Traversing keys		Rapid traverse override	Traverse key disable	Feedrate stop/spindle stop	Activate handwheel		
	Plus	Minus					2	1
5	Machine function 1)							
		Continuous traversing	Var. INC	10000 INC	1000 INC	100 INC	10 INC	1 INC
6								
7								Contour-handwheel direction of rotation inverted
8	Request PLC axis/spindle			Activation signal when this byte is changed				Request NC axis/spindle
9								
10								
11								

1) The machine function is only entered if the signal "INC inputs in the operating-mode signal range active" (DB2600.DBX1.0) is not set.

Signals to axis

DB3800 ... 3805	**Signals to axis [r/w]** PLC -> NCK interface							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
1000	Delay Ref. pt. approach			Module limit enabled	Software limit switch		Hardware limit switch	
					Plus	Minus	Plus	Minus
1001								
1002							Activate program test	Suppress program test
1003								

Signals to spindle

DB3800 ... 3805	**Signals to axis [r/w]** PLC -> NCK interface							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
2000	Delete S value	No speed monitoring for gear change	Resynchronize spindle		Gear changed	Actual gear stage		
			2	1		C	B	A
2001		Invert M3/M4		Resynchronize during positioning				Feedrate override for spindle valid

2002	Setpoint direction of rotation		Oscillation speed	Oscillation controlled by PLC				
	Counter-clockwise	Clockwise						
2003	Spindle override							
	H	G	F	E	D	C	B	A

Signals to PLC axis

DB3800 ... 3805	**Signals to PLC axis [r/w]** PLC -> NCK interface							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
3000	Start axis positioning	Start spindle positioning	Start spindle rotation	Start spindle oscillation				
3001			Stop spindle rotation	Stop spindle oscillation				
3002	Automatic gear selection	Constant cutting rate	Direction of rotation as for M4		Handwheel override	Traversing dimension, inches (not metric)	Distance condition, shortest distance (DC)	Distance condition, incremental (IC)
3003	Indexing position						Distance condition, absolute positive direction (ACP)	Distance condition, absolute negative direction (ACN)
3004	Position (REAL, with indexing axis: DINT)							
3008	Feedrate velocity (REAL), if < 0, the value is taken from machine data POS_AX_VELO							

Signals to drive

DB3800 ... 3805	**Signals to axis/spindle [r/w]** PLC -> NCK interface							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
4000			Holding brake					
4001	Pulse enable	Integrator disable speed controller						
4002								
4003								

Signals to technology functions

DB3800 ... 3805	**Signals to axis/spindle [r/w]** PLC -> NCK interface							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
5000				Torque equalization controller on				

5001								
5002								
5003	Stop HIAxMove							Resume DEPMCS
5004								
5005								
5006 (spindle)				Spindle positioning	Automatic gear stage change	Setpoint direction of rotation		Spindle stop
						Counter-clockwise	Clockwise	
5007 (couplings)	Delete synchronism override							
5008 (SISITECH)								
5009 (SISITECH)								
5010								
5011								

17.10.3 Signals from axis/spindle

General signals from axis/spindle

DB3900 ... 3905	**Signals from axis/spindle [r]** NCK -> PLC interface							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0	Position reached		Referenced		Encoder limit freq. exceeded			Spindle/no axis
	With exact/ stop, fine	With exact stop, coarse	Synchronized 2	Synchronized 1	2	1		
1	Current controller active	Speed controller active	Position controller active	Axis/spindle stationary ($n < n_{mm}$)	Follow up mode active	Axis ready for operation		Traversing requests
2		Force fixed stop limited	Fixed stop reached	Activate travel to fixed stop	Measurement active		Handwheel override active	
3						AxStop active		
4	Travel command		Travel request			Handwheel active (bit/binary coded)		
	Plus	Minus	Plus	Minus			2	1
5	Active machine function							
		Continuous	Var. INC	10000 INC	1000 INC	100 INC	10 INC	1 INC
6								
7								Contour-handwheel direction of rotation inverted

8	PLC axis/ spindle	Neutral axis/ spindle	Axis interchange possible	New type requested from PLC				NC axis/spindle
9								
10								
11			POS_RESTO					
			RED 2	RED 1				

Signals from axis

DB3900 ... 3905	**Signals from axis [r]** NCK -> PLC interface							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
1000				Module limit enabled active				
1001								
1002	Rotary axis in position	Indexing axis in position	Positioning axis	Path axis				Lubrication pulse
1003								

Signals from spindle

DB3900 ... 3905	**Signals from spindle [r]** NCK -> PLC interface							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
2000					Change gear stage	Setpoint gear stage		
						C	B	A
2001	Actual direction of rotation, clockwise	Speed monitoring	Spindle in setpoint range	Overlay range limit violated		Setpoint		Speed limit exceeded
						Increased	Limited	
2002	Active spindle mode				Rigid tapping		GWPS active	Const. Cutting velocity active
	Control mode	Oscillation mode	Positioning mode					
2003			Spindle in position reached					Tool with dynamic limiting

Signals from PLC axis

DB3900 ... 3905	**Signals from PLC axis [r]** NCK -> PLC interface							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
3000	Positioning axis active	Position reached					Error while traversing	Axis cannot be started
3001								
3002								
3003	Error number							

Signals from drive

DB3900 ... 3905	**Signals from axis/spindle [r]** NCK -> PLC interface							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
4000			Holding brake opened	RLI active				
4001	Pulse enabled	Speed controller integrator disabled	Drive ready					
4002		nact = n_{set}	$n_{act} < n_x$	$n_{act} < n_{min}$	$M_d < M_{dx}$	Ramp-up completed		
4003					Generator operation, minimum speed falled below			VDClink < alarm threshold

Signals from technology functions

DB3900 ... 3905	**Signals from axis/spindle [r]** NCK -> PLC interface							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
5000								
5001								
5002		Acceleration warning threshold reached	Velocity warning threshold reached	Superimposed motion		Actual value coupling	Synchronous operation Coarse	Synchronous operation Fine
5003		Max. acceleration reached	Max. velocity reached	Synchronization in progress	Axis is accelerating	Synchronism override travel		
5004								
5005								
5006								
5007								Synchronism override is factored in
5008 (grinding)	Active special axis							
			Axis 6	Axis 5	Axis 4	Axis 3	Axis 2	Axis 1

17.11 PLC machine data

17.11.1 INT values (MD 14510 USER_DATA_INT)

DB4500	**Signals from NCK [r16]** NCK -> PLC interface							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0	Int value (WORD/2 byte)							
2	Int value (WORD/2 byte)							
4	Int value (WORD/2 byte)							

6	Int value (WORD/2 byte)
...	...
60	Int value (WORD/2 byte)
62	Int value (WORD/2 byte)

17.11.2 HEX values (MD 14512 USER_DATA_HEX)

DB4500	**Signals from NCK [r8]** NCK -> PLC interface							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
1000	Hex value (BYTE)							
1001	Hex value (BYTE)							
1002	Hex value (BYTE)							
1003	Hex value (BYTE)							
...	...							
1030	Hex value (BYTE)							
1031	Hex value (BYTE)							

17.11.3 FLOAT values (MD 14514 USER_DATA_FLOAT)

DB4500	**Signals from NCK [r32]** NCK -> PLC interface							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
2000	Float value (REAL/4 byte)							
2004	Float value (REAL/4 byte)							
2008	Float value (REAL/4 byte)							
2012	Float value (REAL/4 byte)							
2016	Float value (REAL/4 byte)							
2020	Float value (REAL/4 byte)							
2024	Float value (REAL/4 byte)							
2028	Float value (REAL/4 byte)							

17.11.4 User alarm: Configuring (MD 14516 USER_DATA_PLC_ALARM)

DB4500	**Signals from NCK [r8]** NCK -> PLC interface							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
3000	Alarm response/cancel criteria, alarm 700000							
3001	Alarm response/cancel criteria, alarm 700001							
3002	Alarm response/cancel criteria, alarm 700002							
...	...							
3247	Alarm response/cancel criteria, alarm 700247							

Note

For more information about how to configure user alarms, see Section "Editing PLC alarm texts (Page 209)".

17.12 Signals, synchronized actions

17.12.1 Signals, synchronized actions to channel

DB4600	**Signals, synchronized actions to channel [r/w]** PLC -> HMI interface							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0	Deactivate synchronized action with ID...							
	ID8	ID7	ID6	ID5	ID4	ID3	ID2	ID1
1	Deactivate synchronized action with ID...							
	ID16	ID15	ID14	ID13	ID12	ID11	ID10	ID9
2	Deactivate synchronized action with ID...							
	ID24	ID23	ID22	ID21	ID20	ID19	ID18	ID17

17.12.2 Signals, synchronized actions from channel

DB4700	**Signals, synchronized actions from channel [r]** NCK -> PLC interface							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0	Synchronized action with ID...can be blocked from the PLC							
	ID8	ID7	ID6	ID5	ID4	ID3	ID2	ID1
1	Synchronized action with ID...can be blocked from the PLC							
	ID16	ID15	ID14	ID13	ID12	ID11	ID10	ID9
2	Synchronized action with ID...can be blocked from the PLC							
	ID24	ID23	ID22	ID21	ID20	ID19	ID18	ID17

17.12.3 Reading and writing PLC variables

DB4900	**PLC variables [r/w]** PLC interface							
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0	Offset [0]							
1	Offset [1]							
2	Offset [2]							
…	…							
4094	Offset [4094]							
4095	Offset [4095]							

Note

The programming engineer (NCK and PLC) is responsible for organizing (structuring) this memory area. Every storage position in the memory can be addressed provided that the limit is selected according to the appropriate data format (i.e. a 'DWORD' for a 4byte limit, a WORD for a 2byte limit, etc.). The memory area is always accessed with the information about the data type and the position offset within the memory area. The PLC variables can be read or written in the NC program $A_DBB[n] ("n" stands for the position offset in bytes).

17.13 Axis actual values and distance-to-go

DB5700 ... 5704	Signals from axis/spindle [r] NCK -> PLC interface							
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Axis actual value (REAL)							
4	Axis distance-to-go (REAL)							

Note

The axis actual values and distances-to-go can be separately requested:

- DB2600.DBX0001.1 Request axis actual values
- DB2600.DBX0001.2 Request axis distances-to-go

If the particular request is set, then the NCK supplies these values for all axes.

17.14 Maintenance scheduler: User interface

17.14.1 Initial (start) data

DB9903	Initial data table [r16]							
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Interval 1 [h]							
2	Time of first warning 1 [h]							
4	Number of warnings to be output 1							
6	Reserved 1							
8	Interval 2 [h]							
10	Time of first warning 2 [h]							
11	Number of warnings to be output 2							
14	Reserved 2							
...	...							
248	Interval 32 [h]							
250	Time of first warning 32 [h]							
252	Number of warnings to be output 32							
254	Reserved 32							

17.14.2 Actual data

DB9904	Actual data table [r16]							
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Interval 1 [h]							
2	Number of warnings to be output 1							
4	Reserved_1 1							
6	Reserved_2 1							
8	Interval 2 [h]							
10	Number of warnings to be output 2							
11	Reserved_1 2							
14	Reserved_2 2							
...	...							
248	Interval 32 [h]							
250	Number of warnings to be output 32							
252	Reserved_1 32							
254	Reserved_2 32							

17.15 User interface for ctrl energy

Energy saving profile

DB9906	Ctrl energy							
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Control signals							
							Set time to pre-warning limit	Immediately activate energy saving profile
1	Control signals (HMI -> PLC)							
								Immediately activate energy saving profile
2	Signals to check/test the energy-saving profile							
							PLC user signal	Master computer signal
3	Reserved							
4	Status signal							
							Activation time T1 expired	Energy saving profile active
5	Reversed							
6	Actual value: actual value T1							
8	Actual value: actual value T2							
10	Effectiveness, profile							
							Disable energy saving profile	Energy saving profile configured
11	State conditions (HMI -> PLC)							
						Screen change	Data transfer	Operator panel
12	State conditions (HMI -> PLC)							
								Machine control panel
13	State conditions (HMI -> PLC)							
								NC channel 1 in reset
14								

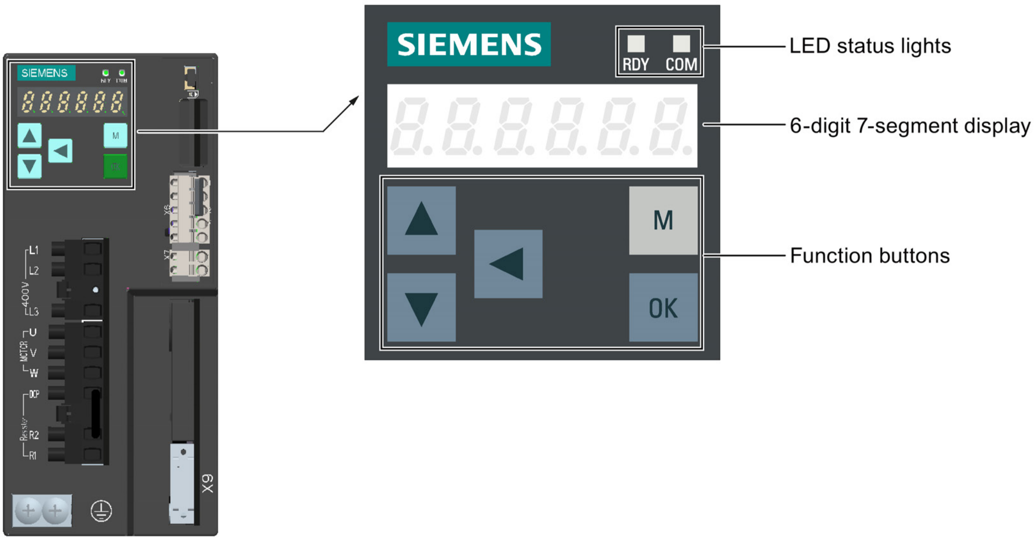
15	State conditions (HMI -> PLC)							
							PLC user signal	Master computer signal
16	State conditions (HMI -> PLC) Activation time T1							
18	State conditions (HMI -> PLC) Activation time T2							

A Appendix

A.1 Operating the SINAMICS V70 Basic Operator Panel (BOP)

A.1.1 BOP overview

The SINAMICS V70 servo drive has been designed with a Basic Operator Panel (BOP) on the front of the drive:



You can use the BOP for following operations:

- Standalone commissioning
- Diagnosis
- Parameter access
- Parameter settings
- SD card operation
- Drive restart

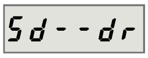
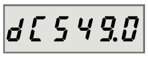
Button functions

Button	Description	Remarks
M	M button	• Exits from current menu • Switches between operating modes in the top level menu
OK	OK button	Short-pressing: • Confirms selection or input • Enters sub menu • Acknowledges faults Long-pressing: Activates auxiliary functions • Sets Drive Bus address • Jog • Saves parameter set in drive (RAM to ROM) • Sets parameter set to default • Transfers data (drive to SD card) • Transfers data (SD card to drive) • Updates firmware
▲	UP button	• Navigates to next item • Increases a value • JOG in CW (clockwise)
▼	DOWN button	• Navigates to previous item • Decreases a value • JOG in CCW (counter-clockwise)
◀	SHIFT button	Moves the cursor from digit to digit for single digit editing, including the digit of positive/negative signs
Button combinations		
OK + M	Press this button combination for four seconds to restart the drive.	
▲ + ◀	Moves the current display to the left page when ⌜ is displayed at the upper right corner, for example 00.000⌜.	
▼ + ◀	Moves the current display to the right page when ⌟ is displayed at the lower right corner, for example 00 10⌟.	

BOP display

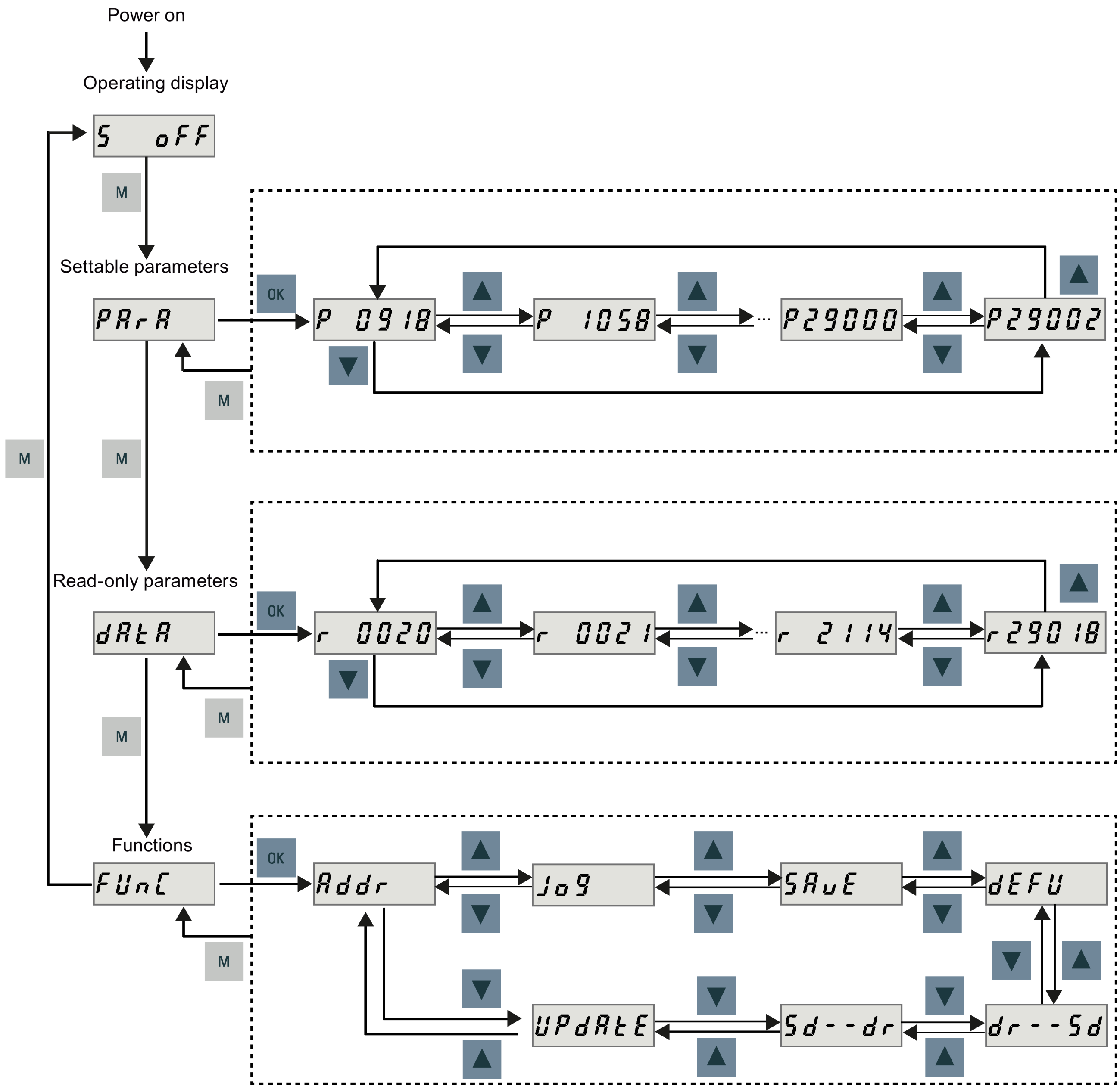
Display	Example	Description	Remarks
8.8.8.8.8.8.	8.8.8.8.8.8.	Drive is in startup state	Takes 20 s to 30 s
------	------	Drive is busy	In the case of a task being executed
Fxxxxx	F 7985	Fault code	In the case of a single fault

Display	Example	Description	Remarks
F.xxxxx.		Fault code of the first fault	In the case of multiple faults
Fxxxxx.		Fault code	In the case of multiple faults
Axxxxx		Alarm code	In the case of a single alarm
A.xxxxx.		Alarm code of the first alarm	In the case of multiple alarms
Axxxxx.		Alarm code	In the case of multiple alarms
Rxxxxx		Parameter number	Read-only parameter
Pxxxxx		Parameter number	Editable parameter
P.xxxxx		Parameter number	Editable parameter; the dot means that at least one parameter has been changed
In xx		Indexed parameter	Figure after "In" indicates the number of indi-ces. For example, "In 01" means that this indexed parameter is 1.
xxx.xxx		Negative parameter value	-
xxx.xx<>		Current display can be moved to left or right	-
xxxx.xx>		Current display can be moved to right	-
xxxx.xx<		Current display can be moved to left	-
S Off		Operating display: servo off	-
Para		Editable parameter group	-
P.ara		Editable parameter group	The dot means that at least one parameter has been changed without saving
Data		Read-only parameter group	-
Func		Function group	See Section "Auxiliary functions (Page 449)".
Addr		Set Drive Bus address	See Section "Setting Drive Bus address (Page 450)".

Display	Example	Description	Remarks
Jog		Jog function	See Section "Jog (Page 450)".
Save		Save data in drive	See Section "Saving parameter set in drive (RAM to ROM) (Page 451)".
defu		Restore drive to default settings	See Section "Setting parameter set to default (Page 451)".
dr--sd		Save data from drive to SD card	See Section "Transferring data (drive to SD card) (Page 452)".
sd--dr		Upload data from SD card to drive	See Section "Transferring data (SD card to drive) (Page 452)".
Update		Update firmware	See Section "Updating firmware (Page 453)".
r xxx		Actual speed (positive direction)	-
r -xxx		Actual speed (negative direction)	-
T x.x		Actual torque (positive direction)	-
T -x.x		Actual torque (negative direction)	-
DCxxx.x		Actual DC link voltage	-
run		The motor is running	-
Con		The Drive Bus communication between the NC and the servo drive is established. In this case, the BOP is protected from any operations except clearing alarms and acknowledging faults.	-

A.1.2 Parameter structure

You can navigate through the parameter structure by pressing the keys as shown in the sequences below.



A.1.3 Actual status display

You can monitor the following drive states by using the operating panel after power-on:

- Servo off
- Actual speed
- Torque
- Voltage

If the servo enable signal is available, actual drive speed is displayed by default; otherwise, "**S OFF**" (servo off) is displayed.

With p29002, you define which of the following drive operating status data is to be displayed on the BOP.

Value	Meaning
0 (default)	Actual speed
1	DC voltage
2	Actual torque

Note

Make sure you save p29002 after modification.

A.1.4 Basic operations

Editable parameters

All **P** parameters under the "Para" menu are editable parameters.

Read-only parameters

All **r** parameters under the "Data" menu are read-only parameters.

Parameters with index

Some parameters have several indices. Each index has its own meaning and corresponding value.

Parameters without index

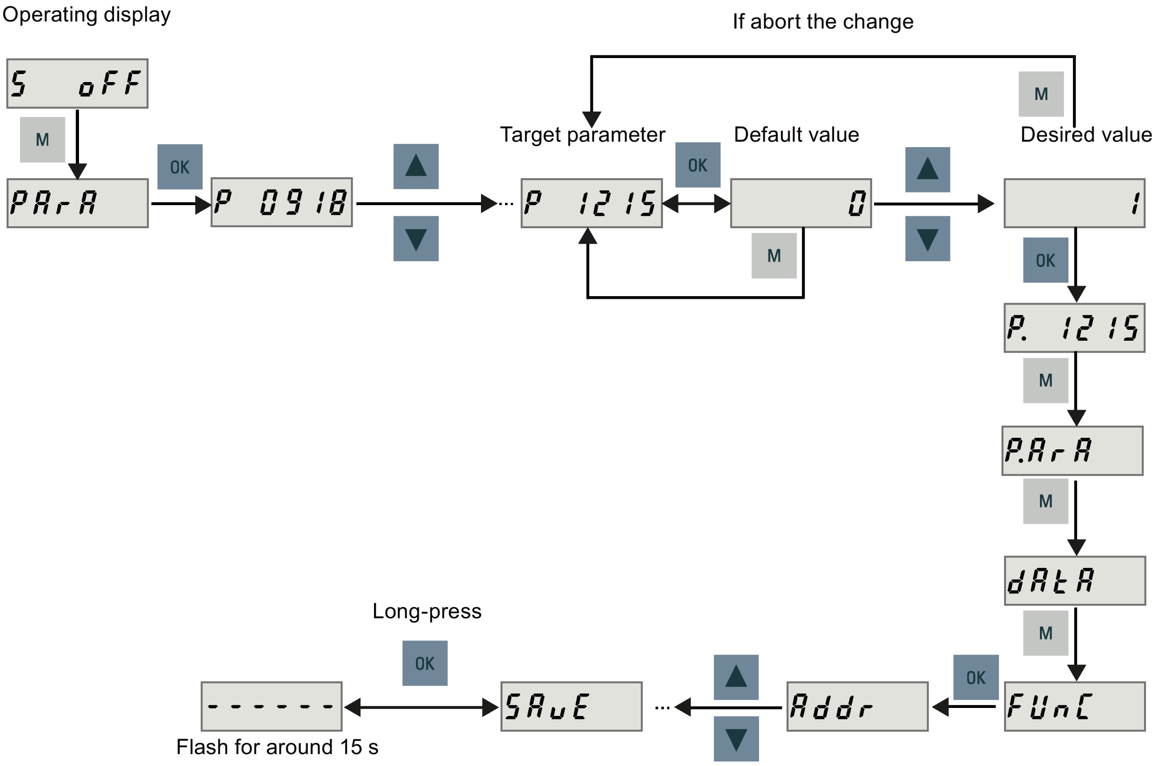
All parameters that do not have indices are parameters without index.

A.1.4.1 Editing parameters

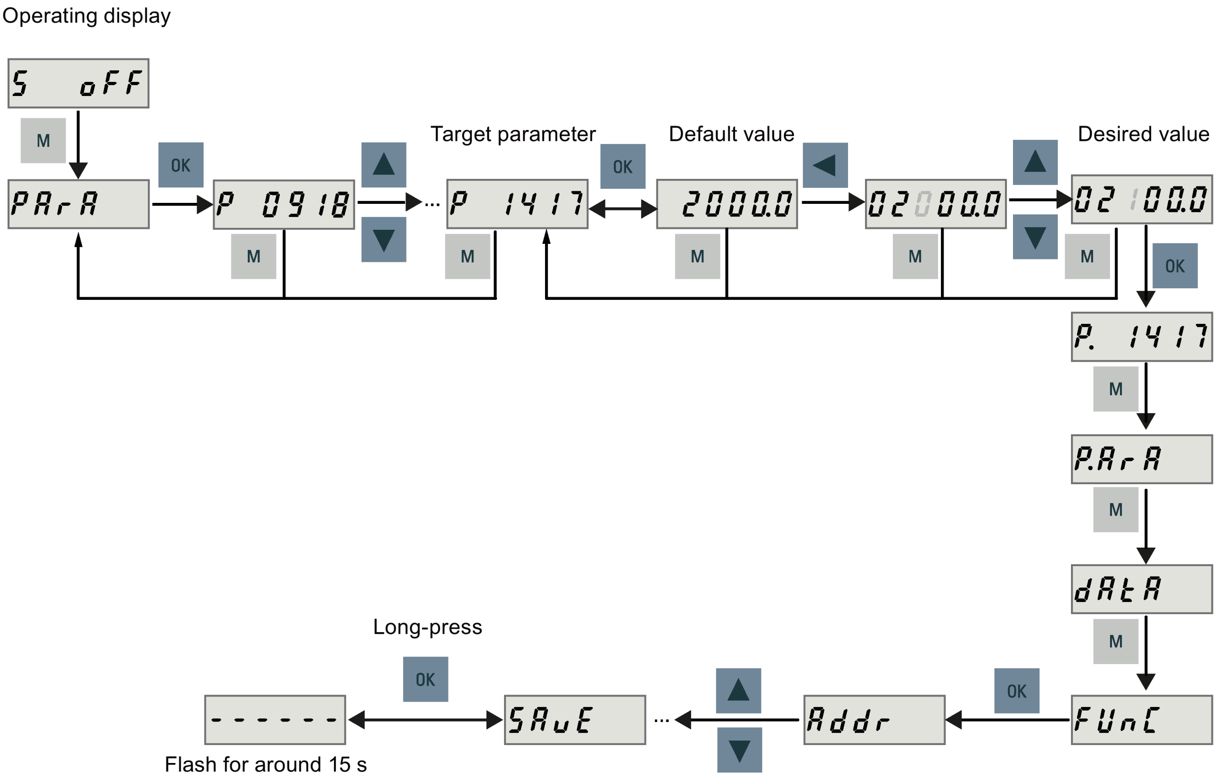
You can edit a parameter value in two methods:

- Method 1: change the value directly with the **UP** or **DOWN** button
- Method 2: move the cursor to a digit with the **SHIFT** button, then change the digit value with the **UP** or **DOWN** button

If you change a parameter value with method 1, proceed as follows:



To change a parameter value digit by digit, proceed as follows:

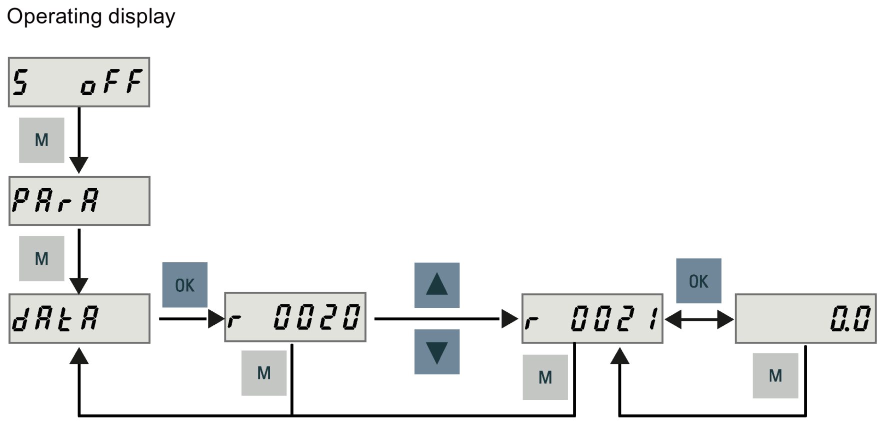


Note

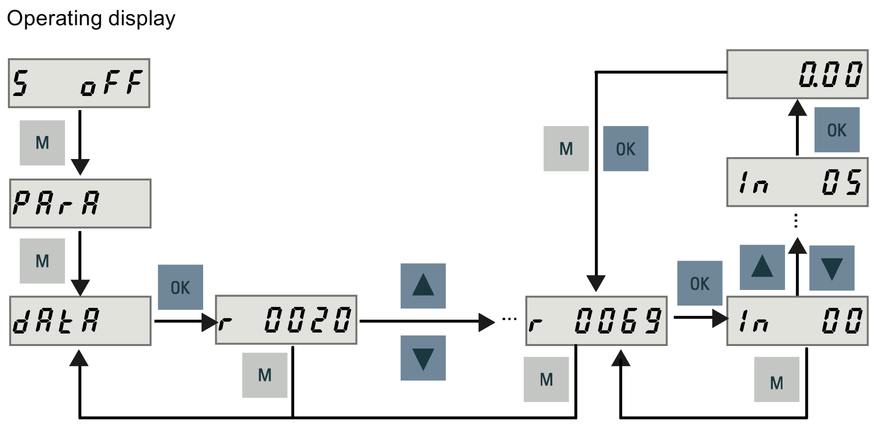
You cannot change parameters p1414 and p1656 with the **SHIFT** button.

A.1.4.2 Viewing parameters

If a parameter has no index, view its value as follows:

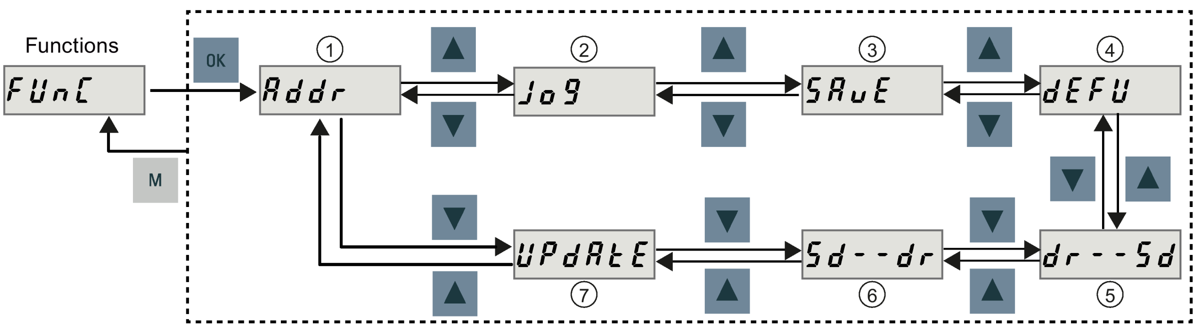


If a parameter has indices, view its value as follows:



A.1.5 Auxiliary functions

Seven BOP functions in total are available:



①	Set Drive Bus address	⑤	Copy parameter set from drive to an SD card
②	Jog	⑥	Copy parameter set from an SD card to drive
③	Save parameter set in drive	⑦	Update firmware
④	Set parameter set to default		

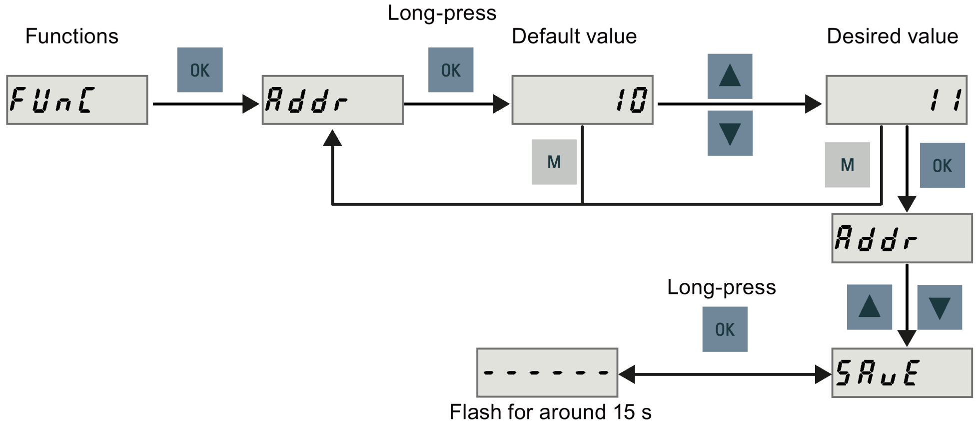
A.1.5.1 Setting Drive Bus address

When connecting the SINAMICS V70 to the SINUMERIK 808D ADVANCED, you must set the Drive Bus address with the BOP. Six addresses in total are available. You must set a proper address according to the actual application of the drive.

- 11: X axis
- 12: Y axis (or additional axis for the turning variant of the control system)
- 13: Z axis
- 14: Digital spindle (SINAMICS V70 spindle drive only)
- 15: Additional axis 1 *
- 16: Additional axis 2 *

* Note that Drive Bus addresses 15 and 16 are not supported on the control system with PPU15x.3. In addition, to use Drive Bus address 16, the drive firmware version must be 1.05.00.02 or higher.

To set Drive Bus address with the BOP, proceed as follows.



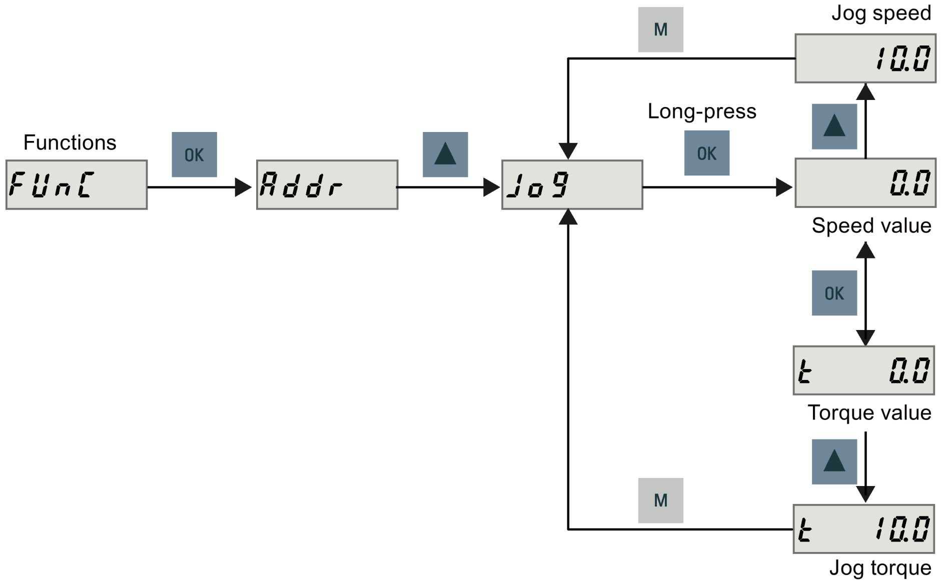
Note

After setting a proper address, you must restart the drive to apply your setting.

For more information, see Section "Configuring Drive Bus addresses (Page 119)".

A.1.5.2 Jog

To run the connected motor with the Jog function and view the Jog speed or Jog torque, proceed as follows:

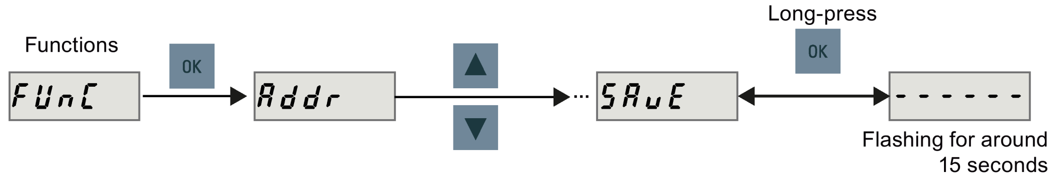


For more information, see Section "Jog test (Page 117)".

A.1.5.3 Saving parameter set in drive (RAM to ROM)

This function is used for saving a parameter set from drive RAM to drive ROM.

To use this function, proceed as follows:



Note

Plugging or unplugging the SD card will cause saving failure.

Do not plug or unplug the SD card during saving; otherwise, the saving operation will fail.

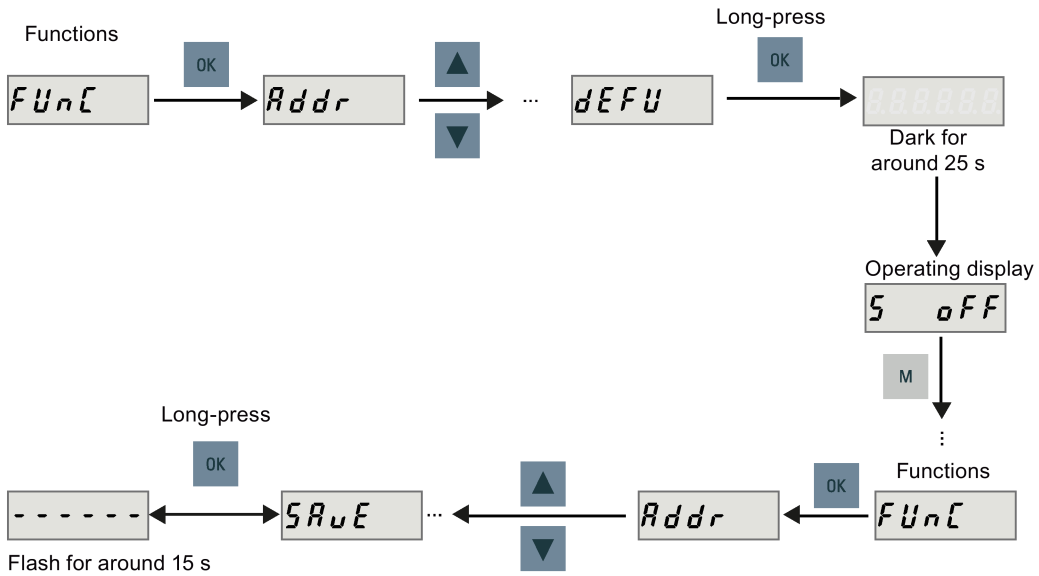
Note

If an SD card has been inserted, the parameter set will be saved onto the SD card simultaneously.

A.1.5.4 Setting parameter set to default

This function is used to reset all parameters to their default values.

To reset all parameters to their default values, proceed as follows:

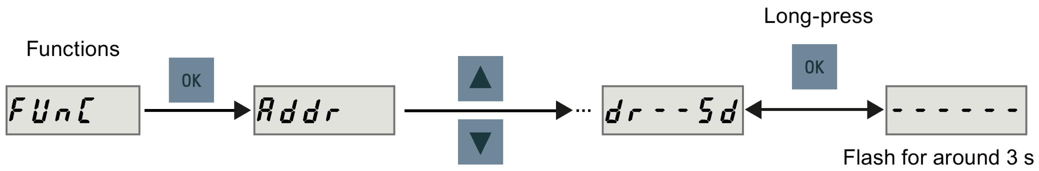


Note

You **must** save the parameter set after resetting it; otherwise, the default values will not be activated.

A.1.5.5 Transferring data (drive to SD card)

You can transfer the parameter set from the drive to an SD card with the BOP. To do this, proceed as follows:



Note

Data transfer between the drive and the SD card is possible only when the drive is in "S OFF" state.

Note

Plugging or unplugging the SD card will cause transferring failure.

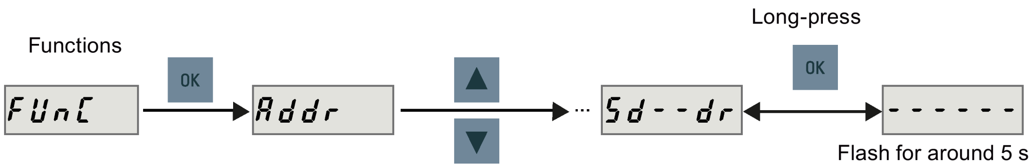
Do not plug or unplug the SD card during transferring; otherwise, the transferring operation will fail.

Note

Write protection function is not supported by the SINAMICS V70. Data in the SD card will be overwritten even if the write protection function of the SD card is enabled.

A.1.5.6 Transferring data (SD card to drive)

You can also transfer the parameter set from an SD card to the drive. To do this, proceed as follows:



Note

Data transfer between the drive and the SD card is possible only when the drive is in "S OFF" state.

Note

Plugging or unplugging the SD card will cause transferring failure.

Do not plug or unplug the SD card during transferring; otherwise, the transferring operation will fail.

Note

Parameter inconsistency

If the parameters on the SD card are inconsistent with existing parameters in the drive memory, you **must** save and restart the servo drive to apply the changes.

A.1.5.7 Updating firmware

Note

Drive data backup before firmware update

Before updating the firmware, back up the drive data through any of the following methods:

- Backing up the drive data via the control system

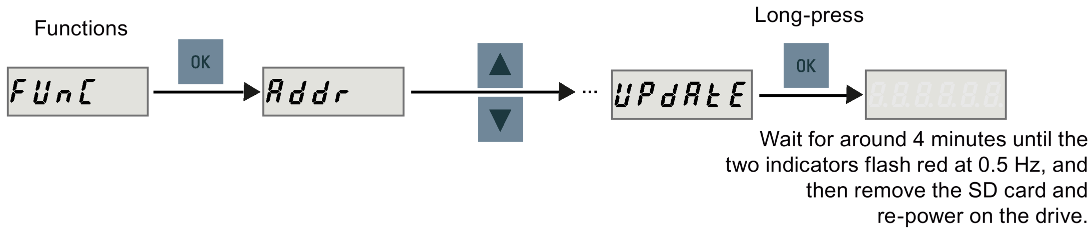
  For more information about external data backup in a data archive, see the SINUMERIK 808D ADVANCED Operating and Programming manuals.
- Backing up the drive data via the SD card

  For more information, see Section "Transferring data (drive to SD card) (Page 452)".

Note

Before performing the firmware update, Siemens recommends you to disable the communication between the drive and the control system by removing the Drive Bus cable from the drive; otherwise, after the firmware update you may need to power off/on the control system to clear possible alarms.

Store the new firmware file onto an SD card and insert the card into the SD card slot. After that, proceed as follows:



After the above BOP operations, wait for around four minutes until the two indicators flash red at 0.5 Hz, and then remove the SD card and re-power on the drive. After a successful firmware update, you must reset all parameters to their default values (see Section "Setting parameter set to default (Page 451)" for details).

Note

Possible update failure

If the update fails, the RDY indicator flashes red at 2 Hz and the COM indicator becomes red on.

An update failure is probably caused by improper firmware files or files missing:

- If the firmware files on the SD card are corrupt, the servo drive **cannot** start up after power-on.
- If the firmware on the SD card is the same with the current firmware of the servo drive, **only** a restart is performed.

When a failure occurs, try to update the firmware again with proper firmware files. If the failure persists, contact your local distributor.

Note

Update the firmware by restarting the drive

With the SD card containing proper firmware files inserted, you can also update the firmware by restarting the drive.

Note

Drive data restoring after firmware update

After updating the firmware, you must restore the drive data through any of the following methods:

- Restoring the drive data via the control system

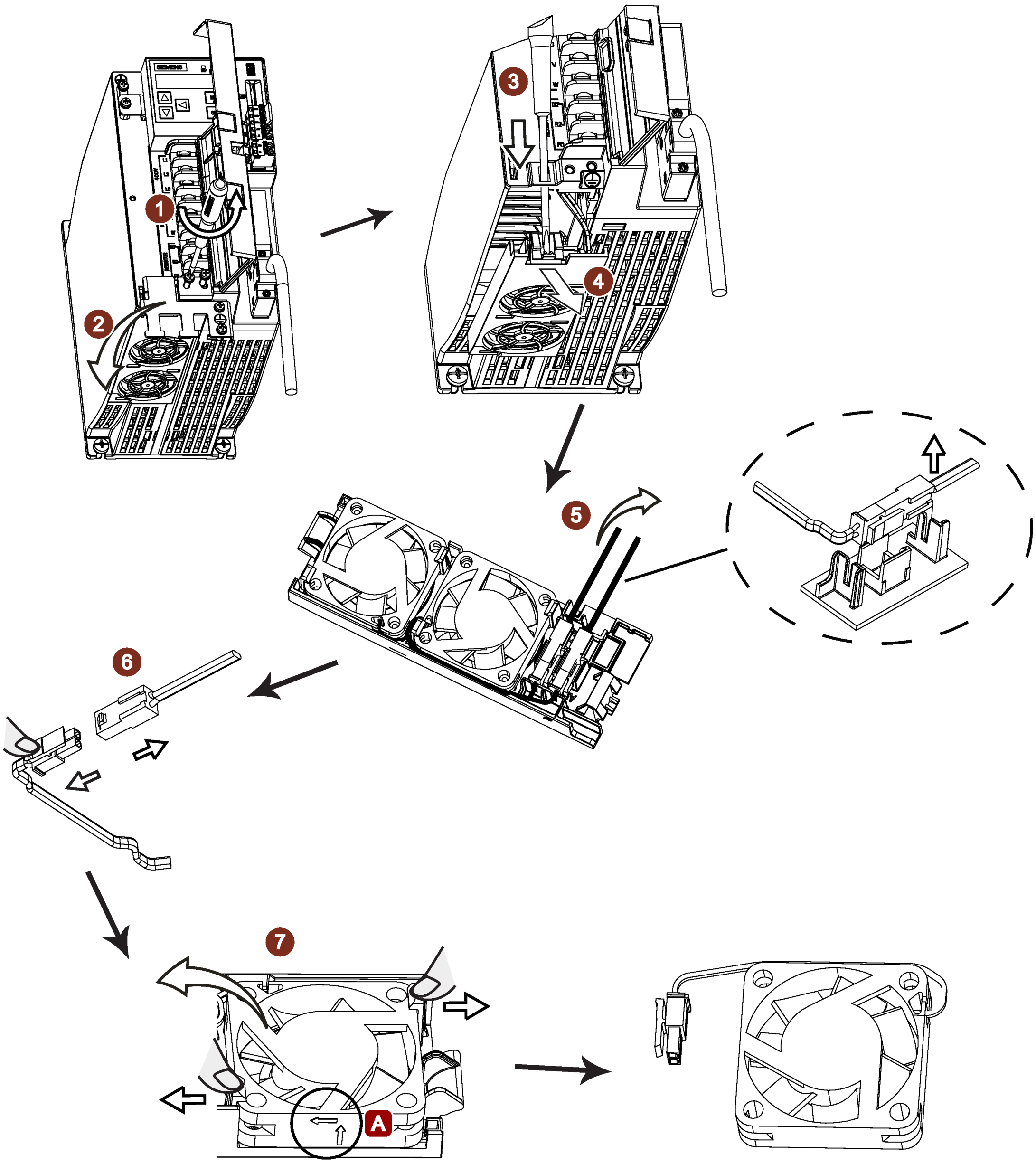
  For more information about restoring a startup archive, see the SINUMERIK 808D ADVANCED Operating and Programming manuals.
- Restoring the drive data via the SD card

  For more information, see Section "Transferring data (SD card to drive) (Page 452)".

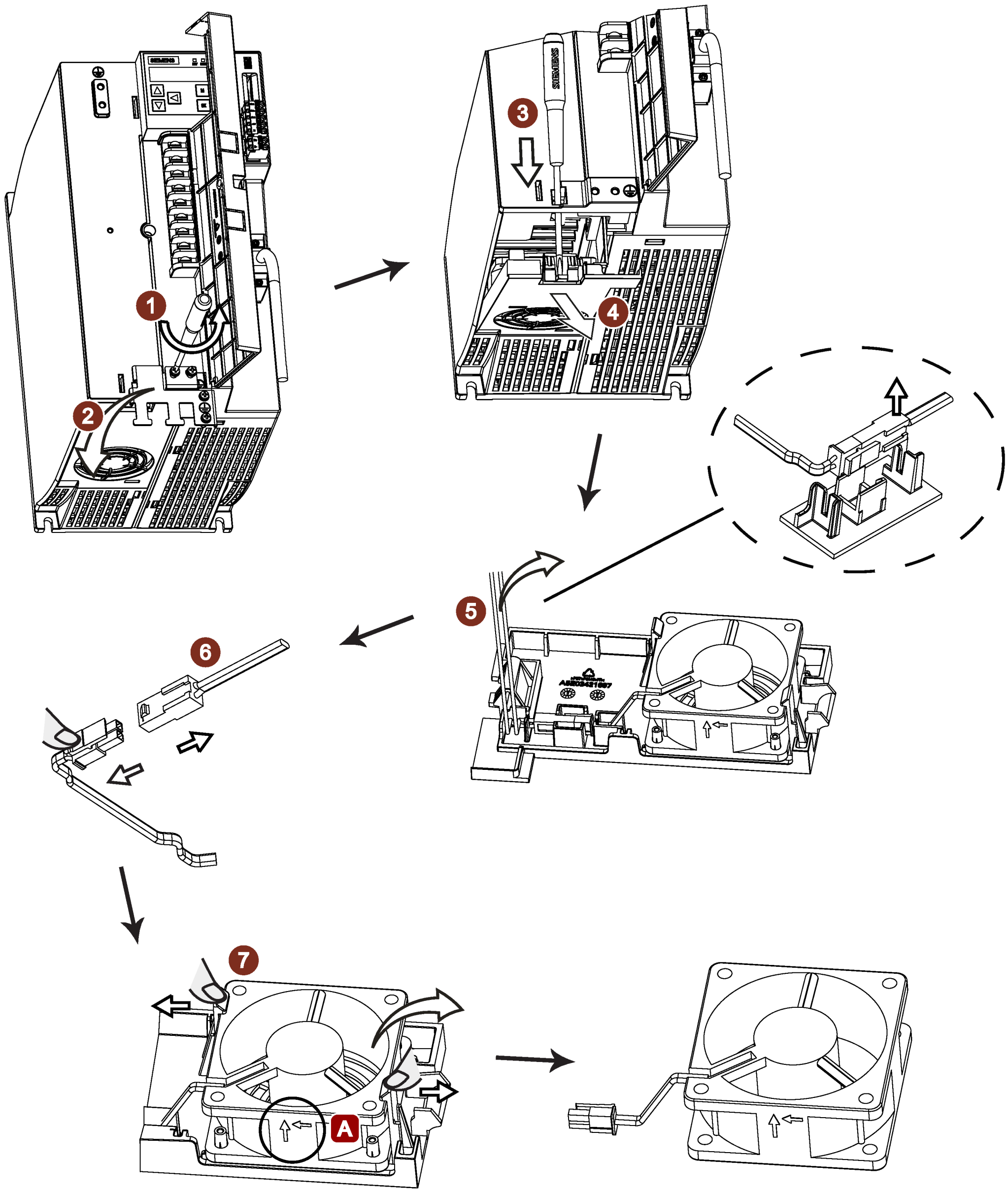
A.2 Replacing the fan for the V70 drive

Proceed as illustrated below to remove the fan from the drive. To re-assemble the fan, proceed in reverse order. When re-assembling the fan, make sure that the arrow symbol ("**A**" in the illustration) on the fan points to the drive rather than the fan housing.

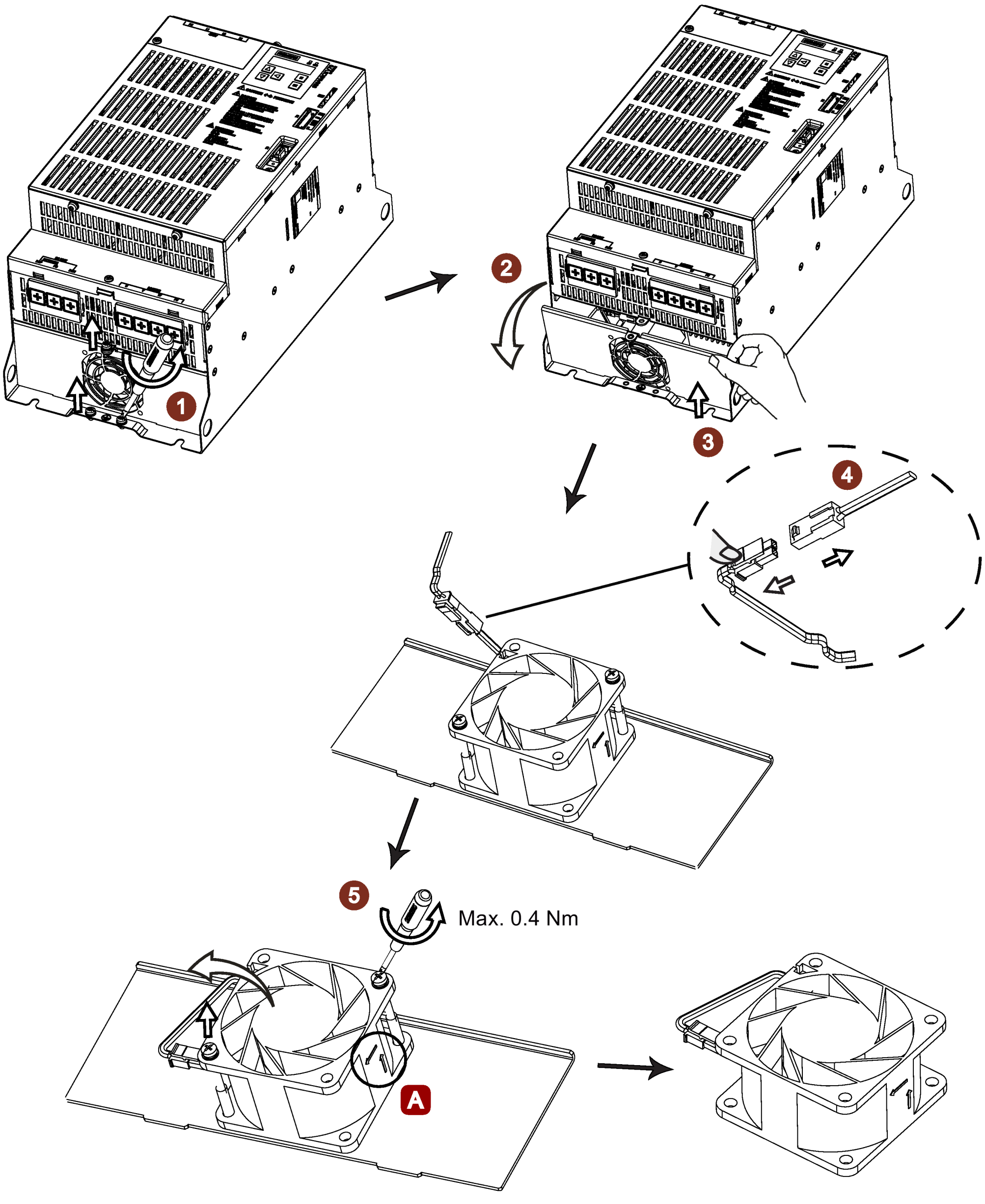
Replacing the fan for V70 FSB



Replacing the fan for V70 FSC

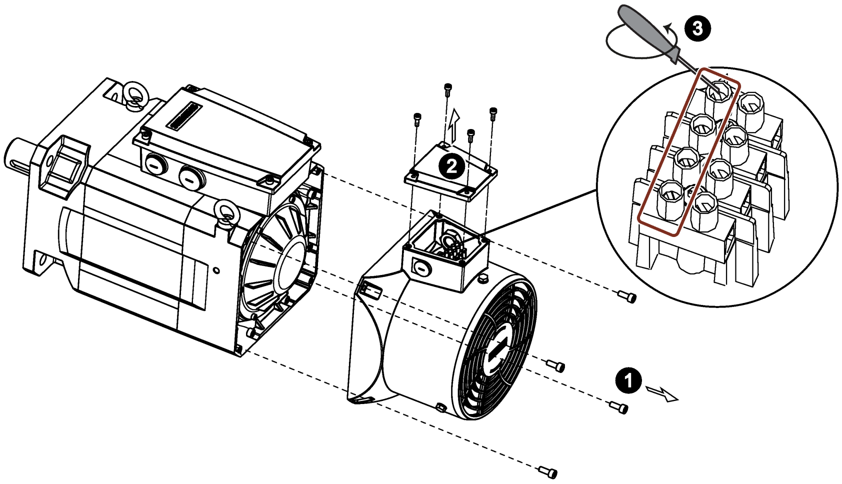


Replacing the fan for V70 FSD

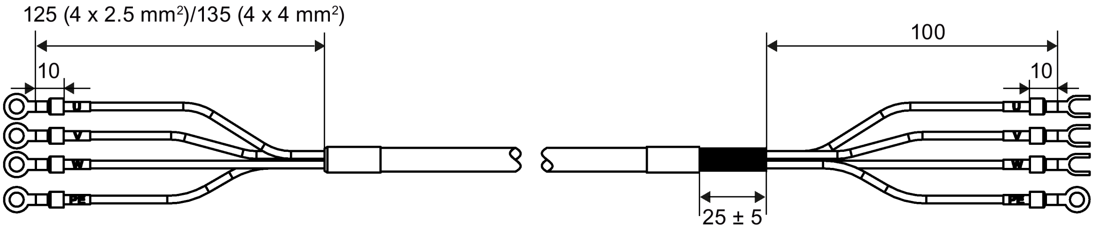


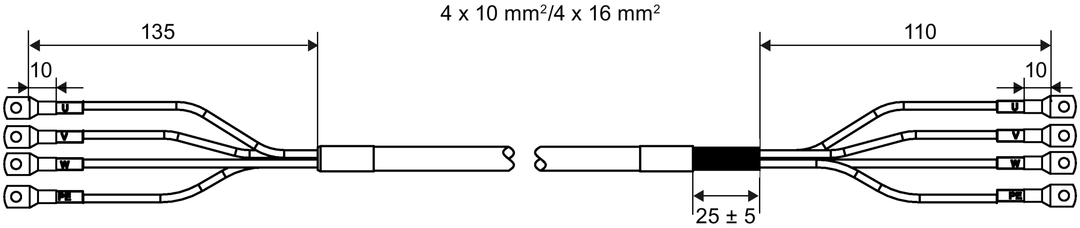
A.3 Replacing the fan for the 1PH1 motor

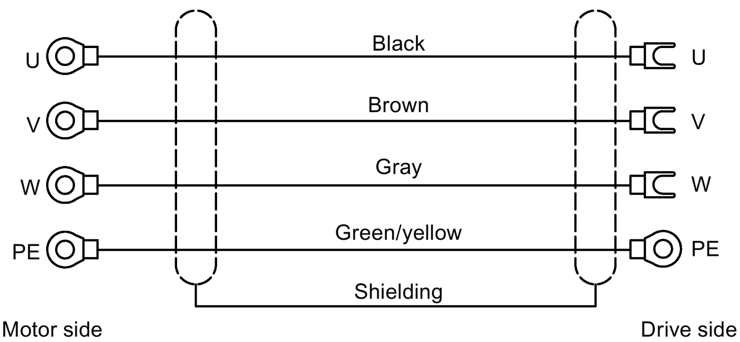
Proceed through the steps as illustrated below to remove the fan from the motor. To reassemble the fan, proceed in reverse order.



A.4 Assembling the power cable for the 1PH1 motor





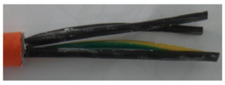
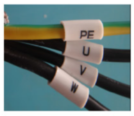


Signal definition (example)

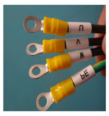
For more information about selecting a proper power cable for the 1PH1 motor, see Section "Cables and connectors (Page 28)".

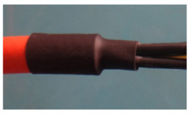
Assembling procedure

<table>
<tr><td>Motor side</td><td>

1 2 3 4

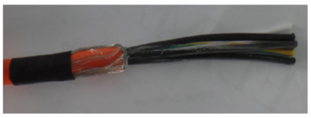





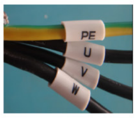
5 6 7 8

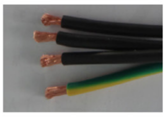
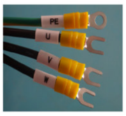
1. Strip the specified length (see below) of the outer sheath at the end of the cable.
4 x 2.5 mm² power cable: 125 mm
all other power cables: 135 mm
2. Cut off the exposed braided shield in its entirety.
3. Strip the inner sheath without damage to the insulation of each cable conductor.
4. Pass white cable marker tubes through corresponding cable conductors.
5. Strip 10 mm of the insulation at the end of each cable conductor.
6. Insert cable wires into individual conductor terminals. Use a crimping tool to crimp the terminals (minimum tensile strength: 350 N).
7. (This step is necessary only for 4 x 10 mm²/4 x 16 mm² power cables. Skip this step if you assemble 4 x 2.5 mm²/4 x 4 mm² power cables.) Pass each conductor terminal through a heat-shrinkable tube, which must completely cover the bending area of the terminal. Heat the tube until it shrinks to wrap tightly around the terminal.
8. Pass all cable conductors through a heat-shrinkable tube. Heat the tube until it shrinks to wrap tightly around the cable.
</td></tr>
<tr><td>Drive side</td><td>





1 2 3 4



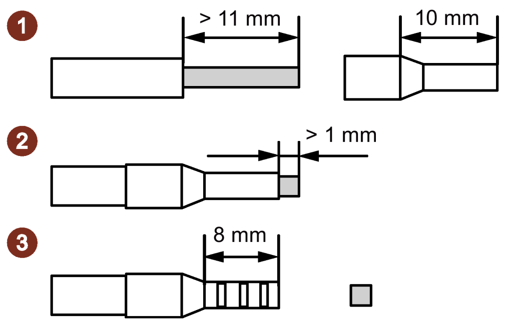
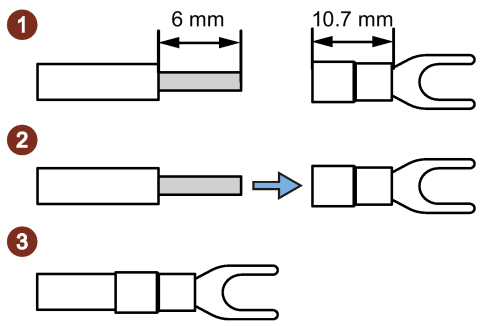



5 6 7 8 9

1. Strip the specified length (see below) of the outer sheath at the end of the cable.
4 x 2.5 mm²/4 x 4 mm² power cable: 100 mm
4 x 10 mm²/4 x 16 mm² power cable: 110 mm
2. Keep the exposed braided shield as long as 25 mm (± 5 mm) and cut off the rest of the shield. Fold the braided shield backwards.
3. Pass the cable through a heat-shrinkable tube. Heat the tube until it shrinks to wrap tightly around the cable.
4. Strip the inner sheath without damage to the insulation of each cable conductor.
5. Pass white cable marker tubes through corresponding cable conductors.
6. Strip 10 mm of the insulation at the end of each cable conductor.
7. Insert cable wires into individual conductor terminals. Use a crimping tool to crimp the terminals (minimum tensile strength: 350 N).
8. (This step is necessary only for 4 x 10 mm²/4 x 16 mm² power cables. Skip this step if you assemble 4 x 2.5 mm²/4 x 4 mm² power cables.) Pass each conductor terminal through a heat-shrinkable tube, which must completely cover the bending area of the terminal. Heat the tube until it shrinks to wrap tightly around the terminal.
9. Use a hose clamp to secure the power cable to the drive.
</td></tr>
</table>

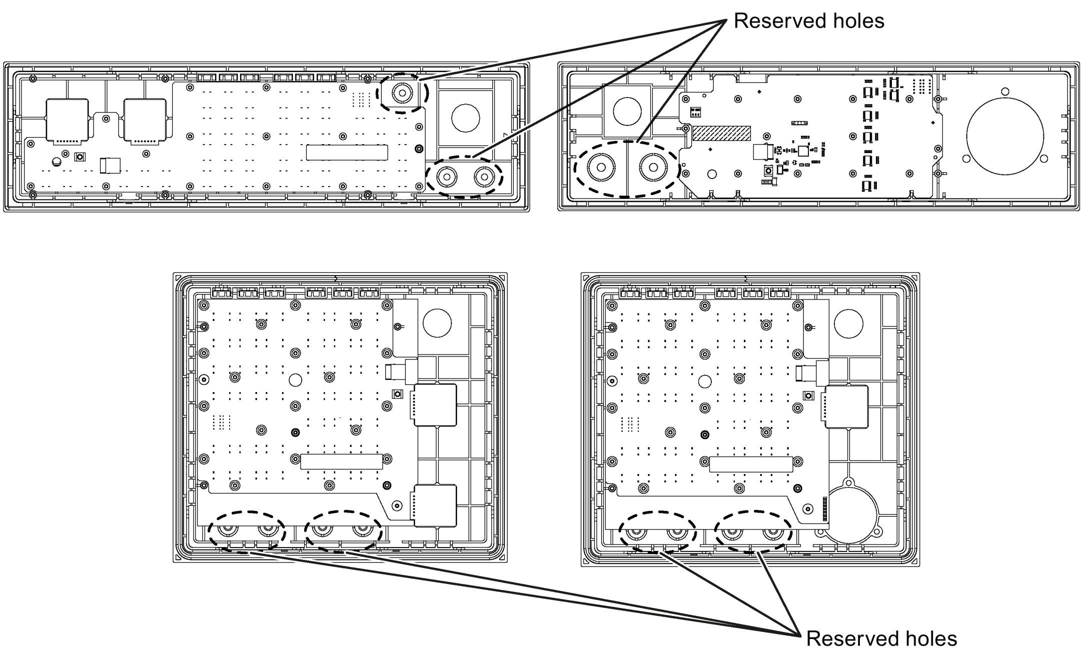
For more information about the connectors and hose clamps, such as recommended suppliers and article numbers, see Section "Cables and connectors (Page 28)".

A.5 Assembling the line supply terminal for the drive

Drive variant	Assembling procedure	Illustration
SINAMICS V70 FSA	1. Strip the specified length (see illustration) of the insulation at the end of the wire. 2. Insert the stripped end into the pin-type terminal. 3. Crimp the terminal using a crimping tool, and cut off the excess part of the wire.	
SINAMICS V70 FSB/FSC/FSD	1. Strip the specified length (see illustration) of the insulation at the end of the wire. 2. Insert the stripped end into the fork-type terminal. 3. Crimp the terminal using a crimping tool. (Note: Coat any exposed wires with tin.)	

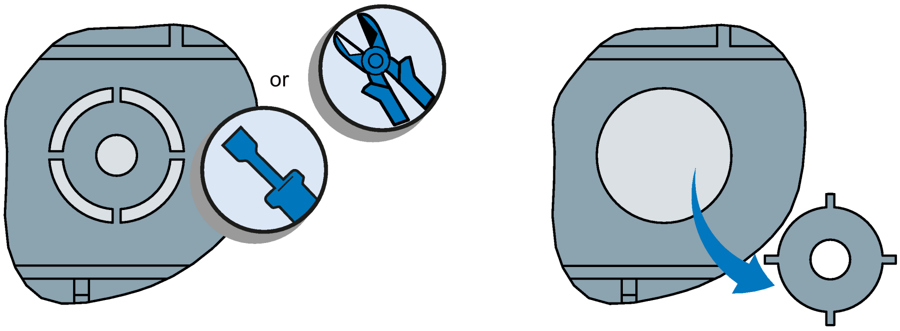
A.6 Cutting reserved holes in the MCP

There are four variants of MCP, two horizontal variants and two vertical variants. On the horizontal variant with override switches, there are three reserved holes with a standard diameter of **16 mm**, and on the horizontal variant with a reserved slot for the handwheel, there are two reserved holes with a standard diameter of **22.5 mm**; on each vertical variant, there are four holes with a standard diameter of **16 mm**. They are available for you to install necessary devices according to your own needs:

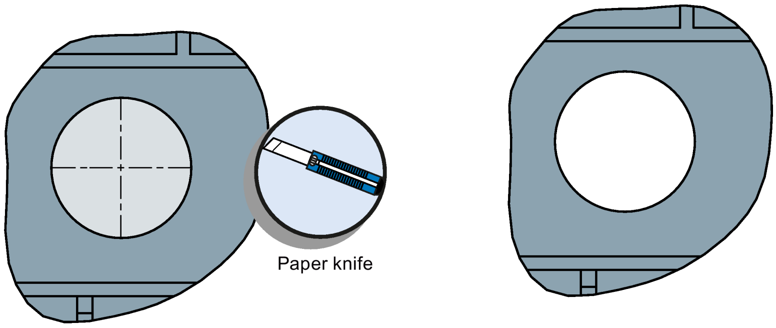


To cut a reserved hole, proceed as follows:

1 Prise the plastic ring with a slotted screwdriver or cut it off with a diagonal cutting nippers.



2 Cut the film off with a paper knife. It is recommended to cut the center firstly, then cut the film off right around the hole edge.



A.7 Customizing pre-defined labeling strips for keys of the MCP

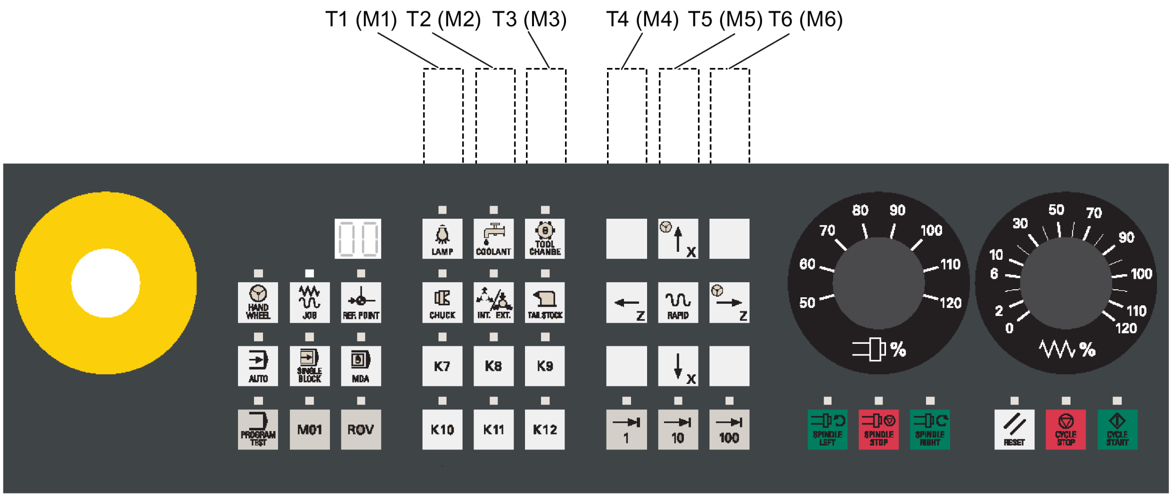
Note

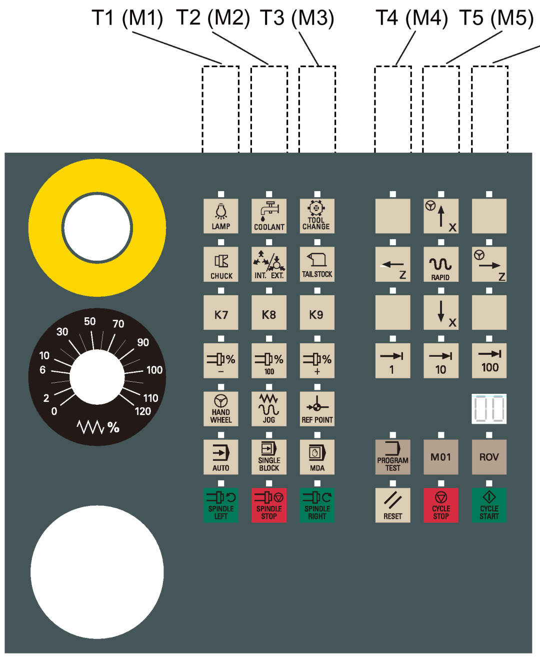
The horizontal MCP with a reserved slot for the handwheel is designed for turning machines only. The customization of the pre-defined labeling strips for keys is not supported by this MCP variant.

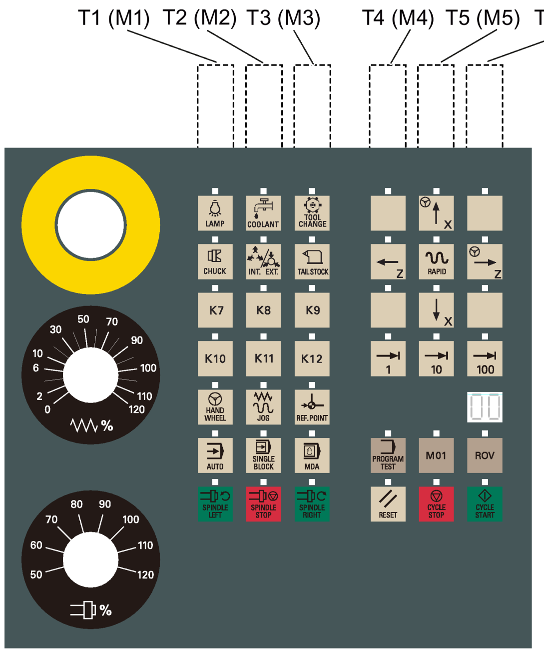
Replacing the MCP strips

The MCP strips of the turning version are already pre-assembled into the MCP. If you are using the control system of milling version, you need to take these pre-defined labeling strips out firstly, and then insert the MCP strips of the milling version delivered in MCP package into the MCP.

To insert the MCP strips, follow the order shown as follows with reference to the marks (M1 to M6, T1 to T6) on the strips:







Printing customized MCP strips

Siemens provides you a symbol library for customized MCP keys. You can print customized strips with the A4-size blank paper included in the delivered MCP package. You can find the symbol library in the Toolbox (...\examples\SINUMERIK_808D\MCP).

Siemens also provides you with a template file for printing customized strips. Key positions in the template accord with real key layout on the MCP. You can copy symbols from the symbol library and paste them to the key positions where you want to use customized symbols. You can find the template file in the Toolbox (...\examples\SINUMERIK_808D\MCP).

Cutting customized MCP strips

The delivered A4-size paper has been pre-cut with boundaries. You just need to tear them off after printing customized symbols.

A.8 Diagnostics

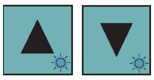
A.8.1 SINUMERIK 808D ADVANCED alarms

Some alarms may occur during the commissioning work. For more information about the alarms, see the SINUMERIK 808D ADVANCED Diagnostics Manual.

Calling help information for an alarm

You can call the help information for an active alarm on the PPU by proceeding through the following steps:

1. Select the alarm operating area.



2. Select the desired alarm using the cursor keys.

3. Press this key to call the help information for the selected alarm.

Note: You can further press this softkey in the current help screen to show a complete list of all SINUMERIK 808D ADVANCED alarms. In addition, you can also use the following softkey to search for a specific alarm by number in this list:

4. Pressing this softkey exits the help system.

A.8.2 SINAMICS V70 faults and alarms

A.8.2.1 General information about faults and alarms

Differences between faults and alarms

The differences between faults and alarms are as follows:

Type	Description
Faults	**What happens when a fault occurs?** • If the servo motor is running, it stops running. • If the servo motor is not running, it cannot run. **How to eliminate a fault?** • Remove the cause of the fault. • Acknowledge the fault.
Alarms	**What happens when an alarm occurs?** • The servo motor can run normally. **How to eliminate an alarm?** • The alarm acknowledges itself. If the cause of the alarm is no longer present, it automatically resets itself.

Fault reactions

The following fault reactions are defined:

Reaction	Description
NONE	No reaction when a fault occurs.
OFF1	Servo motor ramps down to stop.
OFF2	Servo motor coasts down to stop.
OFF3	Servo motor stops quickly.
ENCODER	Encoder fault causes OFF2.

Fault acknowledgements

The acknowledgement methods for faults are specified as follows:

Acknowledgement	Description
POWER ON	The fault is acknowledged by a POWER ON (switch servo drive off and on again). **NOTE:** If this action has not eliminated the fault cause, the fault is displayed again immediately after power-on.

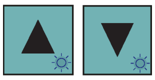
Acknowledgement	Description
IMMEDIATELY	Faults disappear immediately after the fault causes have been eliminated. **NOTE:** • These faults can also be acknowledged by a POWER ON operation. • If this action has not eliminated the fault cause, the fault will continue to be displayed after acknowledgment.
PULSE INHIBIT	The fault can only be acknowledged with a pulse inhibit. The same options are available for acknowledging as described under acknowledgment with IMMEDIATELY.

A.8.2.2 List of faults and alarms

This section lists common faults and alarms that can occur on SINAMICS V70. In case of other faults and alarms not listed below, you can call the help information on the PPU by proceeding through the following steps:

1. Select the alarm operating area.

2. Press this softkey to display all faults and alarms occured. Note that the drive faults and alarms begin with "2" instead of "F" or "A" in this window.



3. Select the desired alarm using the cursor keys.

4. Press this key to call the help information for the selected alarm.

Note: You can further press this softkey in the current help screen to show a complete list of all V70 faults and alarms. In addition, you can also use the following softkey to search for a specific fault or alarm by number in this list:

5. Pressing this softkey exits the help system.

Fault list

Fault	Cause	Remedy
F1000: Internal software error Reaction: OFF2 Acknowledgement: POWER ON	An internal software error has occurred.	• Evaluate fault buffer. • Carry out a POWER ON (power off/on) for all components. • Upgrade firmware to later version. • Contact the Hotline. • Replace the Control Unit.
F1001: Floating Point exception Reaction: OFF2 Acknowledgement: POWER ON	An exception occurred during an operation with the Floating Point data type.	• Carry out a POWER ON (power off/on) for all components. • Upgrade firmware to later version. • Contact the Hotline.
F1002: Internal software error Reaction: OFF2 Acknowledgement: IMMEDIATELY	An internal software error has occurred.	• Carry out a POWER ON (power off/on) for all components. • Upgrade firmware to the latest version. • Contact the Hotline.

Fault	Cause	Remedy
F1003: Acknowledgement delay when accessing the memory Reaction: OFF2 Acknowledgement: IMMEDIATELY	A memory area was accessed that does not return a "READY".	• Carry out a POWER ON (power off/on) for all components. • Contact the Hotline.
F1015: Internal software error Reaction: OFF2 Acknowledgement: POWER ON	An internal software error has occurred.	• Carry out a POWER ON (power off/on) for all components. • Upgrade firmware to the latest version. • Contact the Hotline.
F1018: Booting has been interrupted several times Reaction: NONE Acknowledgement: POWER ON	Module booting was interrupted several times. As a consequence, the module boots with the factory setting. Possible reasons for booting being interrupted: • Power supply interrupted. • CPU crashed. • Parameterization invalid. After this fault is output, then the module is booted with the factory settings.	• Carry out a POWER ON (power off/on). After switching on, the module reboots from the valid parameterization (if available). • Restore the valid parameterization. Examples: • Carry out a first commissioning, save, carry out a POWER ON (switch-off/switch-on). • Load another valid parameter backup (e.g. from the memory card), save, carry out a POWER ON (switch-off/switch-on). Note: If the fault situation is repeated, then this fault is again output after several interrupted boots.
F1030: Sign-of-life failure for master control Reaction: OFF3 Acknowledgement: IMMEDIATELY	For active PC master control, no sign-of-life was received within the monitoring time.	Contact the Hotline.
F1611: SI CU: Defect detected Reaction: OFF2 Acknowledgement: IMMEDIATELY	The drive-integrated "Safety Integrated" (SI) function on the Control Unit (CU) has detected an error and initiated an STO	• Make sure that the high level duration of the inut pulse is larger than 500 ms. • Carry out a POWER ON (power off/on) for all components. • Upgrade software. • Replace the Control Unit.
F1910: Drive Bus: Setpoint timeout Reaction: OFF3 Acknowledgement: IMMEDIATELY	The reception of setpoints from the Drive Bus interface has been interrupted. • Bus connection interrupted. • Controller switched off. • Controller set into the STOP state.	Restore the bus connection and set the controller to RUN.
F1911: Drive Bus clock cycle synchronous operation clock cycle failure Reaction: OFF1 Acknowledgement: IMMEDIATELY	The global control telegram to synchronize the clock cycles has failed - in cyclic operation - for several Drive Bus clock cycles or has violated the time grid specified in the parameterizing telegram over several consecutive Drive Bus clock cycles.	• Check the physical bus configuration (cable, connector, Drive Bus terminator, shielding, etc.). • Check whether communication was briefly or permanently interrupted. • Check the bus and controller for utilization level (e.g. bus cycle time was set too short).

Fault	Cause	Remedy
F1912: Clock cycle synchronous operation sign-of-life failure Reaction: OFF1 Acknowledgement: IMMEDIATELY	The maximum permissible number of errors in the controller sign-of-life (clock synchronous operation) has been exceeded in cyclic operation.	• Physically check the bus (cables, connectors, terminating resistor, shielding, etc.). • Correct the interconnection of the controller sign-of-life. • Check whether the controller correctly sends the sign-of-life. • Check the permissible telegram failure rate. • Check the bus and controller for utilization level (e.g. bus cycle time was set too short).
F7011: Motor overtemperature Reaction: OFF2 Acknowledgement: IMMEDIATELY	• Motor overloaded • Motor surrounding air temperature too high • Wire breakage or sensor not connected • Motor temperature model incorrectly parameterized	• Reduce the motor load. • Check the surrounding air temperature and the motor ventilation. • Check the wiring and the connection. • Check the motor temperature model parameters.
F7085: Open-loop/closed-loop control parameters changed Reaction: NONE Acknowledgement: IMMEDIATELY	Open-loop/closed-loop control parameters have had to be changed for the following reasons: • As a result of other parameters, they have exceeded the dynamic limits. • They cannot be used due to the fact that the hardware detected not having certain features.	It is not necessary to change the parameters as they have already been correctly limited.
F7403: Lower DC link voltage threshold reached Reaction: OFF1 Acknowledgement: IMMEDIATELY	The DC link voltage monitoring is active and the lower DC link voltage threshold was reached in the "Operation" state.	• Check the line supply voltage. • Check the infeed. • Reduce the lower DC link threshold. • Switch out (disable) the DC link voltage monitoring.
F7404: Upper DC link voltage threshold reached Reaction: OFF2 Acknowledgement: IMMEDIATELY	The DC link voltage monitoring is active and the upper DC link voltage threshold was reached in the "Operation" state.	• Check the line supply voltage. • Check the infeed module or the brake module. • Increase the upper DC link voltage threshold. • Switch out (disable) the DC link voltage monitoring.
F7410: Current controller output limited Reaction: OFF2 Acknowledgement: IMMEDIATELY	The condition "I_act = 0 and Uq_set_1 longer than 16 ms at its limit" is present and can be caused by the following: • Motor not connected or motor contactor open. • No DC link voltage present. • Motor Module defective.	• Connect the motor or check the motor contactor. • Check the DC link voltage. • Check the Motor Module.
F7411: Drive: Flux controller output limited Reaction: OFF2 Acknowledgement: IMMEDIATELY	The specified flux setpoint cannot be reached although 90% of the maximum current has been specified. • Incorrect motor data. • Motor data and motor configuration do not match. • The current limit has been set too low for the motor. • Induction motor (encoderless, open-loop controlled) in I^2t limiting.	• Correct the motor data. • Check the motor configuration. • Reduce the induction motor load.

Fault	Cause	Remedy
F7412: Commutation angle incorrect (motor model) Reaction: ENCODER Acknowledgement: IMMEDIATELY	An incorrect commutation angle was detected that can result in a positive coupling in the speed controller. Possible causes: • The motor encoder is incorrectly adjusted with respect to the magnet position. • The motor encoder is damaged. • Data to calculate the motor model has been incorrectly set. • Pole position identification might have calculated an incorrect value when activated. • The motor encoder speed signal is faulted. • The control loop is instable due to incorrect parameterization.	• If the encoder mounting was changed, re-adjust the encoder. • Replace the defective motor encoder. • Correctly set the motor stator resistance, cable resistance and motor-stator leakage inductance. Calculate the cable resistance from the cross-section and length, check the inductance and stator resistance using the motor data sheet, measure the stator resistance, e.g. using a multimeter - and if required, again identify the values using the stationary motor data identification. • With pole position identification activated, check the procedure for pole position identification and force a new pole position identification procedure by means of deselection followed by selection.
F7414: Encoder serial number changed Reaction: ENCODER Acknowledgement: IMMEDIATELY	• The encoder was replaced. • A third-party, build-in or linear motor was re-commissioned. • The motor with integrated and adjusted encoder was replaced. • The firmware was updated to a version that checks the encoder serial number.	For the first two causes: Carry out an automatic adjustment using the pole position identification routine. Acknowledge the fault. Initiate the pole position identification routine. Then check that the pole position identification routine is correctly executed. SERVO: If a pole position identification technique is selected, and if p0301 does not contain a motor type with an encoder adjusted in the factory, then p1990 is automatically activated. Mechanically adjust the encoder. Accept the new serial number. For the last two causes: Accept the new serial number with p0440 = 1.
F7420: Drive: Current setpoint filter natural frequency > Shannon frequency Reaction: NONE Acknowledgement: IMMEDIATELY	One of the filter natural frequencies is greater than the Shannon frequency (2KHz). Filter 1 (p1658, p1660) Filter 2 (p1663, p1665) Filter 3 (p1668, p1670) Filter 4 (p1673, p1675)	• Reduce the numerator or denominator natural frequency of the current setpoint filter involved at the control system side. • Switch out the filter involved (p1656).
F7450: Standstill monitoring has responded Reaction: OFF1 Acknowledgement: IMMEDIATELY	After the standstill monitoring time expired, the drive left the standstill window. • Position loop gain too low. • Position loop gain too high (instability/oscillation). • Mechanical overload. • Connecting cable, motor/drive converter incorrect (phase missing, interchange).	Check the causes and resolve.

Fault	Cause	Remedy
F7452: Following error too high Reaction: OFF1 Acknowledgement: IMMEDIATELY	The difference between the position set-point position actual value (following error dynamic model) is greater than the tolerance. • The drive torque or accelerating capacity exceeded. • Position measuring system fault. • Position control sense incorrect. • Mechanical system locked. • Excessively high traversing velocity or excessively high position reference value (setpoint) differences.	Check the causes and resolve.
F7801: Motor overcurrent Reaction: OFF2 Acknowledgement: IMMEDIATELY	The permissible motor limit current was exceeded. • Effective current limit set too low. • Current controller not correctly set. • Motor was braked with an excessively high stall torque correction factor. • Up ramp was set too short or the load is too high. • Short-circuit in the motor cable or ground fault. • Motor current does not match the current of Motor Module.	• Reduce the stall torque correction factor. • Increase the up ramp or reduce the load. • Check the motor and motor cables for short-circuit and ground fault. • Check the Motor Module and motor combination.
F7802: Infeed or power unit not ready Reaction: OFF2 Acknowledgement: IMMEDIATELY	After an internal power-on command, the infeed or drive does not signal ready because of one of the following reasons: • Monitoring time is too short. • DC link voltage is not present. • Associated infeed or drive of the signaling component is defective.	• Ensure that there is a DC link voltage. Check the DC link busbar. Enable the infeed. • Replace the associated infeed or drive of the signaling component.
F7815: Power unit has been changed Reaction: NONE Acknowledgement: IMMEDIATELY	The code number of the actual power unit does not match the saved number.	Connect the original power unit and power up the Control Unit again (POWER ON).
F7860: External fault 1 Reaction: OFF2 Acknowledgement: IMMEDIATELY (POWER ON)	The signal "external fault 1" was triggered.	• Restart the drive. • Restore the drive to its factory default settings.
F7900: Motor blocked/speed controller at its limit Reaction: OFF2 Acknowledgement: IMMEDIATELY	The servo motor has been operating at the torque limit longer than 1s and below the speed threshold of 120 rpm. This signal can also be initiated if the speed actual value is oscillating and the speed controller output repeatedly goes to its limit.	• Check whether the servo motor can rotate freely or not. • Check the torque limit. • Check the inversion of the actual value. • Check the motor encoder connection. • Check the encoder pulse number.
F7901: Motor overspeed Reaction: OFF2 Acknowledgement: IMMEDIATELY	The maximum permissible speed has been exceeded.	Check and correct the maximum speed (p1082).

Fault	Cause	Remedy
F7995: Pole position identification not successful Reaction: OFF2 Acknowledgement: IMMEDIATELY	The pole position identification routine was unsuccessful.	Contact the Hotline.
F30001: Power unit: Overcurrent Reaction: OFF2 Acknowledgement: IMMEDIATELY	The power unit has detected an overcurrent condition. • Closed-loop control is incorrectly parameterized. • Motor has a short-circuit or fault to ground (frame). • Power cables are not correctly connected. • Power cables exceed the maximum permissible length. • Power unit defective. • Line phase interrupted.	• Check the motor data - if required, carry out commissioning. • Check the motor circuit configuration (star-delta) • Check the power cable connections. • Check the power cables for short-circuit or ground fault. • Check the length of the power cables. • Replace power unit. • Check the line supply phases. • Check the external braking resistor connection.
F30002: DC link voltage, overvoltage Reaction: OFF2 Acknowledgement: IMMEDIATELY	The power unit has detected overvoltage in the DC link. • Motor regenerates too much energy. • Device connection voltage too high. • Line phase interrupted.	• Increase the ramp-down time. • Activate the DC link voltage controller. • Use a braking resistor. • Increase the current limit of the infeed or use a larger module. • Check the device supply voltage. • Check the line supply phases.
F30003: DC link voltage, undervoltage Reaction: OFF2 Acknowledgement: IMMEDIATELY	The power unit has detected an undervoltage condition in the DC link. • Line supply failure • Line supply voltage below the permissible value. • Line supply infeed failed or interrupted. • Line phase interrupted.	• Check the line supply voltage. • Check the line supply infeed and observe the fault messages relating to it (if there are any). • Check the line supply phases. • Check the line supply voltage setting.
F30004: Drive heat sink overtemperature Reaction: OFF2 Acknowledgement: IMMEDIATELY	The temperature of the power unit heat sink has exceeded the permissible limit value. • Insufficient cooling, fan failure. • Overload. • Surrounding air temperature too high. • Pulse frequency too high.	• Check whether the fan is running. • Check the fan elements. • Check whether the surrounding air temperature is in the permissible range. • Check the motor load. • Reduce the pulse frequency if this is higher than the rated pulse frequency.
F30005: Power unit: Overload I^2t Reaction: OFF2 Acknowledgement: IMMEDIATELY	The power unit was overloaded. • The permissible rated power unit current was exceeded for an inadmissibly long time. • The permissible load duty cycle was not maintained.	• Reduce the continuous load. • Adapt the load duty cycle. • Check the motor and power unit rated currents.
F30011: Line phase failure in main circuit Reaction: OFF2 Acknowledgement: IMMEDIATELY	At the power unit, the DC link voltage ripple has exceeded the permissible limit value. Possible causes: • A line phase has failed. • The 3 line phases are inadmissibly unsymmetrical. • The fuse of a phase of a main circuit has ruptured. • A motor phase has failed.	• Check the main circuit fuses. • Check whether a single-phase load is distorting the line voltages. • Check the motor feeder cables.

Fault	Cause	Remedy
F30015: Phase failure motor cable Reaction: OFF2 Acknowledgement: IMMEDIATELY	A phase failure in the motor feeder cable was detected. The signal can also be output in the following case: The motor is correctly connected, however the closed-speed control is instable and therefore an oscillating torque is generated.	• Check the motor feeder cables. • Check the speed controller settings.
F30021: Ground fault Reaction: OFF2 Acknowledgement: IMMEDIATELY	Power unit has detected a ground fault. • Ground fault in the power cables. • Winding fault or ground fault at the motor.	• Check the power cable connections. • Check the motor.
F30027: Precharging DC link time monitoring Reaction: OFF2 Acknowledgement: IMMEDIATELY	• The power unit DC link was not able to be pre-charged within the expected time. There is no line supply voltage connected. • The line contactor/line side switch has not been closed. • The line supply voltage is too low. • The pre-charging resistors are overheated as there were too many pre-charging operations per time unit • The pre-charging resistors are overheated as the DC link capacitance is too high. • The pre-charging resistors are overheated. • The pre-charging resistors are overheated as the line contactor was closed during the DC link fast discharge through the Braking Module. • The DC link has either a ground fault or a short-circuit. • The pre-charging circuit is possibly defective.	Check the line supply voltage at the input terminals.
F30036: Internal overtemperature Reaction: OFF2 Acknowledgement: IMMEDIATELY	The temperature inside the drive has exceeded the permissible temperature limit. • Insufficient cooling, fan failure. • Overload. • Surrounding air temperature too high.	• Check whether the fan is running. • Check the fan elements. • Check whether the surrounding air temperature is in the permissible range. Notice: This fault can only be acknowledged once the permissible temperature limit minus 5 K has been fallen below.
F30050: 24 V supply overvoltage Reaction: OFF2 Acknowledgement: POWER ON	The voltage monitor signals an overvoltage fault on the module.	• Check the 24 V power supply. • Replace the module if necessary.
F30071: No new actual values received from the power unit module Reaction: OFF2 Acknowledgement: IMMEDIATELY	The number of actual value telegrams from the power unit module that have failed has exceeded the permissible number.	Replace the module if necessary.

Fault	Cause	Remedy
F30074: Communication error between the Control Unit and Power Module Reaction: NONE Acknowledgement: IMMEDIATELY	Communications between the Control Unit (CU) and Power Unit (PU) via the interface no longer possible. The CU may have been withdrawn or is incorrectly inserted. Fault value (r0949, interpret hexadecimal): 0 hex: • a Control Unit with external 24 V supply was withdrawn from the Power Unit during operation. • with the Power Unit switched off, the external 24 V supply for the Control unit was interrupted for some time. 1 hex: The Control Unit was withdrawn from the Power Unit during operation, although the encoderless safe motion monitoring functions are enabled. This is not supported. After reinserting the Control Unit in operation, communications to the Power Unit no longer possible. 20A hex: The Control Unit was inserted on a Power Unit, which has another code number. 20B hex: The Control Unit was inserted on a Power Unit, which although it has the same code number, has a different serial number. 601 hex: The Control Unit was inserted on a Power Unit, whose power/performance class (chassis unit) is not supported.	Reinsert the Control Unit (CU) or the Control Unit adapter (CUAxx) onto the original Power Unit (PU) and continue operation. If required, carry out a POWER ON for the CU and/or the CUA.
F31100: Zero mark distance error Reaction: ENCODER Acknowledgement: PULSE INHIBIT	The measured zero mark distance does not correspond to the parameterized zero mark distance. For distance-coded encoders, the zero mark distance is determined from zero marks detected pairs. This means that if a zero mark is missing, depending on the pair generation, this cannot result in a fault and also has no effect in the system.	• Check that the encoder cables are routed in compliance with EMC. • Check the plug connections. • Check the encoder type (encoder with equidistant zero marks). • Replace the encoder or encoder cable.
F31110: Serial communications error Reaction: ENCODER Acknowledgement: PULSE INHIBIT	Serial communication protocol transfer error between the encoder and evaluation module.	• Check the encoder cable and shielding connection. • Replace the motor.
F31111: Encoder 1: Absolute encoder internal error Reaction: ENCODER Acknowledgement: PULSE INHIBIT	The absolute encoder fault word supplies fault bits that have been set.	• Check the encoder cable connection, and make sure the encoder cables are routed in compliance with EMC. • Check the motor temperature. • Replace the encoder/motor.

Fault	Cause	Remedy
F31112: Encoder 1: Error bit set in the serial protocol Reaction: ENCODER Acknowledgement: PULSE INHIBIT	The encoder sends a set error bit via the serial protocol.	• Check the encoder cable and shielding connection. • Replace the encoder/motor.
F31130: Zero mark and position error from the coarse synchronization Reaction: ENCODER Acknowledgement: PULSE INHIBIT	After initializing the pole position using track C/D, Hall signals or pole position identification routine, the zero mark was detected outside the permissible range. For distance-coded encoders, the test is carried out after passing 2 zero marks. Fine synchronization was not carried out.	• Check that the encoder cables are routed in compliance with EMC. • Check the plug connections. • If the Hall sensor is used as an equivalent for track C/D, check the connection. • Check the connection of track C or D. • Replace the encoder or encoder cable.
F31150: Encoder 1: Initialization error Reaction: ENCODER Acknowledgement: PULSE INHIBIT	The encoder functionality is not operating correctly.	• Check the encoder type used (incremental or absolute) and encoder cable. • If relevant, note additional fault messages that describe the fault in detail.
F52920: Encoder wire broken Reaction: OFF2 Acknowledgement: POWER ON	For a square-wave signal encoder (TTL, bipolar, double ended), the A*, B*, and R* signals are not inverted with respect to signals A, B, and R.	• Check whether the encoder is connected at the encoder port. • Check the encoder or cable for whether the encoder supplies TTL signals and the associated inverted signals.
F52980: Absolute encoder motor changed Reaction: OFF1 Acknowledgement: IMMEDIATELY	The servo motor with an absolute encoder is changed. Actual motor ID is different from commissioned motor ID.	The servo motor will be automatically configured after the acknowledgement of this fault.
F52981: Absolute encoder motor mismatched Reaction: OFF1 Acknowledgement: IMMEDIATELY	The motor connected with an absolute encoder cannot be operated. The servo drive in use does not support the Motor ID.	Use a suitable motor.
F52983: No encoder detected Reaction: OFF1 Acknowledgement: IMMEDIATELY	The servo drive in use does not support encoderless operation.	• Check the encoder cable connection between the servo drive and the servo motor. • Use a servo motor with encoder.
F52984: Incremental encoder motor not configured Reaction: OFF1 Acknowledgement: IMMEDIATELY	• Commissioning of the servo motor has failed. • An incremental encoder motor is connected but not commissioned. • Drive commissioning parameter filter (p10) is not set to 0.	• Configure the motor ID by setting the parameter p29000. • If p10 is unequal to 0, change p10 to 0 in the drive expert list, save parameters, and repower on the drive.
F52985: Absolute encoder motor wrong Reaction: OFF1 Acknowledgement: IMMEDIATELY	• Motor ID is downloaded wrong during manufacture. • The software of the servo drive does not support the Motor ID.	• Update the software. • Use a suitable motor.

Fault	Cause	Remedy
F52987: Absolute encoder replaced Reaction: OFF1 Acknowledgement: IMMEDIATELY	Incorrect data of the absolute encoder.	Contact the Hotline.

Alarm list

Alarm	Cause	Remedy
A1009: Control module over-temperature	The temperature of the control module (Control Unit) has exceeded the specified limit value.	• Check the air intake for the Control Unit. • Check the Control Unit fan. Note: The alarm automatically disappears after the limit value has been undershot.
A1019: Writing to the removable data medium unsuccessful	The write access to the removable data medium was unsuccessful.	Remove and check the removable data medium. Then run the data backup again.
A1032: All parameters must be saved	The parameters of an individual drive object were saved, although there is still no backup of all drive system parameters. The saved object-specific parameters are not loaded the next time that the system powers up. For the system to successfully power up, all of the parameters must have been completely backed up.	Save all parameters.
A1045: Configuring data invalid	An error was detected when evaluating the parameter files saved in the non-volatile memory. Because of this, under certain circumstances, several of the saved parameter values were not able to be accepted.	Save the parameterization using the "SAVE" function on the BOP. This overwrites the incorrect parameter files in the non-volatile memory – and the alarm is withdrawn.
A1774: Test stop for fail-safe digital outputs required	The preset time for the forced checking procedure (test stop) for the fail-safe digital outputs (F-DO) has been exceeded. A new forced checking procedure is required. **Note:** • This message does not result in a safety stop response. • The test must be performed within a defined maximum time interval (maximum of 8760 hours) in order to comply with the requirements as laid down in the standards for timely fault detection and the conditions to calculate the failure rates of safety functions (PFH value). Operation beyond this maximum time period is permissible if it can be ensured that the forced checking procedure is performed before persons enter the hazardous area and who are depending on the safety functions correctly functioning.	Carry out the forced checking procedure for the digital outputs. For more information, refer to Section "Safe Torque Off (STO)" in the SINUMERIK 808D ADVANCED Function Manual.

Alarm	Cause	Remedy
A1920: Drive Bus: Receive setpoints after To	Output data of Drive Bus master (setpoints) received at the incorrect instant in time within the Drive Bus clock cycle.	• Check bus configuration. • Check parameters for clock cycle synchronization (ensure To > Tdx). Note: • To: Time of setpoint acceptance • Tdx: Data exchange time
A1932: Drive Bus clock cycle synchronization missing for DSC	There is no clock synchronization or clock synchronous sign of life and DSC is selected. Note: DSC: Dynamic Servo Control	Set clock synchronization across the bus configuration and transfer clock synchronous sign-of-life.
A5000: Drive heat sink overtemperature	The alarm threshold for overtemperature at the inverter heat sink has been reached. If the temperature of the heat sink increases by an additional 5 K, then fault F30004 is initiated.	Check the following: • Is the surrounding air temperature within the defined limit values? • Have the load conditions and the load duty cycle been appropriately dimensioned? • Has the cooling failed?
A6310: DC link voltage exceeding the tolerance range	For AC/AC drive units, the measured DC voltage lies outside the tolerance range after pre-charging has been completed. The following applies for the tolerance range: 1.16 * 400 V < actual DC link voltage < 1.6 * 400 V. The alarm can only be eliminated when the drive is powered down.	Check the line supply voltage.
A7012: Motor temperature model 1/3 overtemperature	The motor temperature model 1/3 identified that the alarm threshold was exceeded.	• Check the motor load and reduce it if required. • Check the motor surrounding air temperature.
A7565: Encoder error in encoder interface	An encoder error was signaled for encoder via the encoder interface (G1_ZSW.15).	Acknowledge the encoder error using the encoder control word (G1_STW.15 = 1).
A7576: Encoderless operation due to a fault active	Encoderless operation is active due to a fault.	• Remove the cause of a possible encoder fault. • Carry out a POWER ON (power off/on) for all components.
A7965: Save required	The angular commutation offset was redefined and has still not been saved. In order to permanently accept the new value, it must be saved in a non-volatile fashion.	This alarm automatically disappears after the data has been saved.
A7971: Angular commutation offset determination activated	The automatic determination of the angular commutation offset (encoder adjustment) is activated. The automatic determination is carried out at the next power-on command.	The alarm automatically disappears after determination.
A7991: Motor data identification activated	The motor data identification routine is activated. The motor data identification routine is carried out at the next power-on command.	The alarm automatically disappears after the motor data identification routine has been successfully completed. If a POWER ON or a warm restart is performed with motor data identification selected, the motor data identification request will be lost. If motor data identification is required, it will need to be selected again manually following ramp-up.

Alarm	Cause	Remedy
A30016: Load supply switched off	The DC link voltage is too low.	• Switch on the load supply. • Check the line supply if necessary.
A30031: Hardware current limiting in phase U	Hardware current limit for phase U responded. The pulsing in this phase is inhibited for one pulse period. • Closed-loop control is incorrectly parameterized. • Fault in the motor or in the power cables. • The power cables exceed the maximum permissible length. • Motor load too high. • Power unit defective. Note: Alarm A30031 is always output if, for a Power Module, the hardware current limiting of phase U, V or W responds.	Check the motor data. As an alternative, run a motor data identification. • Check the motor circuit configuration (star-delta). • Check the motor load. • Check the power cable connections. • Check the power cables for short-circuit or ground fault. • Check the length of the power cables.
A31117: Inversion error signals A/B/R Reaction: ENCODER Acknowledgement: PULSE INHIBIT	For a square-wave encoder (bipolar, double ended) signals A*, B* and R* are not inverted with respect to signals A, B and R.	• Check the encoder/cable. • Does the encoder supply signals and the associated inverted signals?
A31411: Encoder 1: Absolute encoder signals internal alarms	The absolute encoder fault word includes alarm bits that have been set.	• Check the encoder cable connection, and make sure the encoder cables are routed in compliance with EMC. • Check the motor temperature. • Replace the encoder/motor.
A31412: Encoder 1: Error bit set in the serial protocol	The encoder sends a set error bit via the serial protocol.	• Carry out a POWER ON (power off/on) for all components. • Check that the encoder cables are routed in compliance with EMC. • Check the plug connections. • Replace the encoder.
A52900: Failure during data copying	• Copying is halted. • The SD card was plugged out. • The drive is not in the stop state.	• Re-plug in the SD card. • Make sure the drive is in the stop state.

A.9 AMM communication tool

With the communication tool Access MyMachine (AMM), you can establish an Ethernet connection and realize data transfer between the control system and a computer. This tool is available in the Toolbox and is supported by Windows Vista/Win 7.

Ethernet connections

The following Ethernet connections are possible between the control system and the AMM tool on the computer:

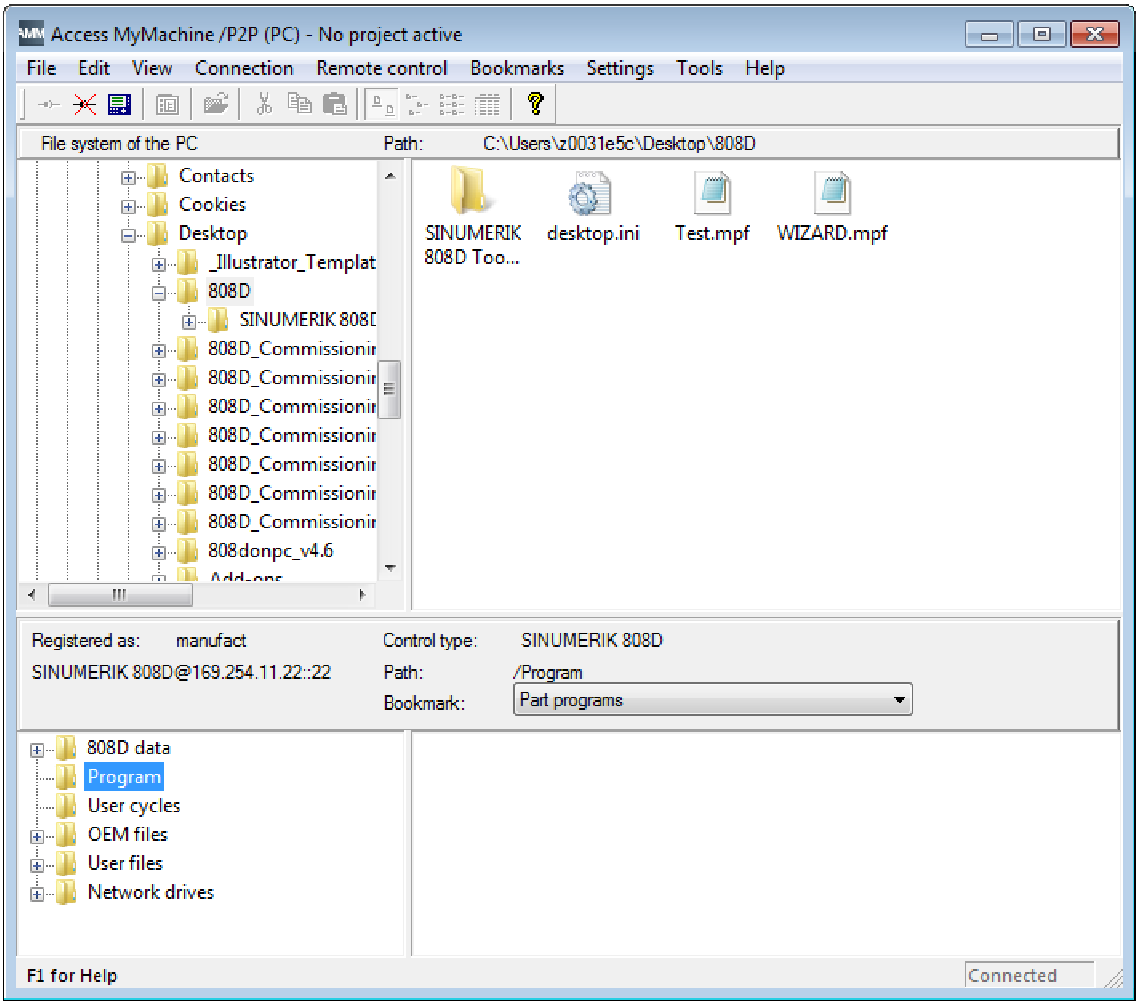
- Direct connection: connecting the control system directly to a computer
- Network connection: integrating the control system into an existing Ethernet network

For more information about connecting the AMM tool, see Section "Connecting with AMM (Page 46)".

After an active Ethernet connection is established, the AMM tool provides the possibility of data exchange between the control system and a computer, as well as remote control of the HMI from the computer. For more information about the tool functionality, see the Online Help of the tool.

A.9.1 File management and transfer

After an active Ethernet connection is established, you can have a remote access to the control system's NC file system from your computer. In this case, you can easily manage the NC files with the AMM tool and transfer files between the control system and your computer.



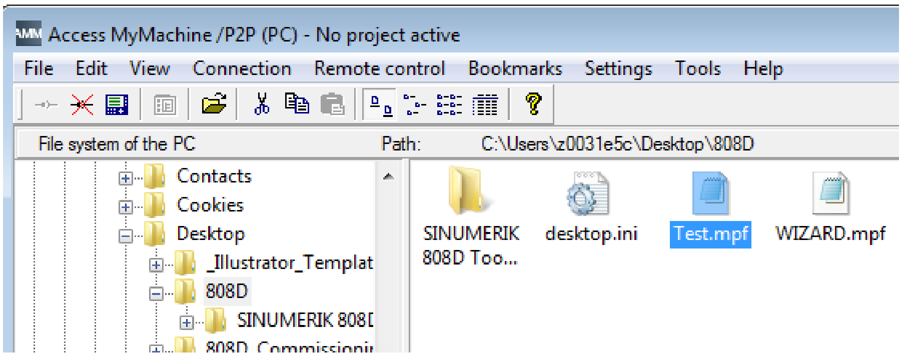
You can edit, rename, copy, or delete part programs, workpiece programs, cycles, and so on directly in the NC file system of the AMM tool.

Transferring a file to the control system

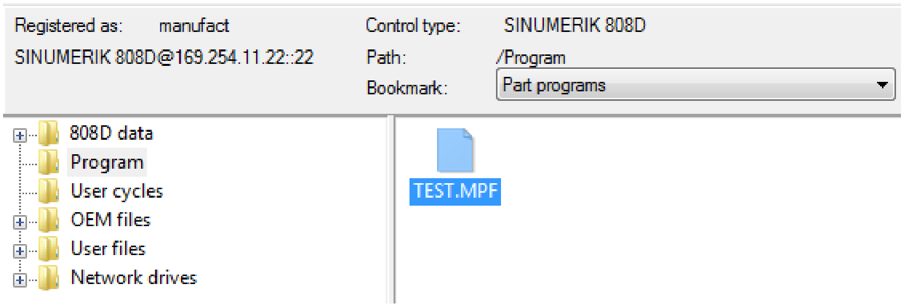
The file transfer between the control system and a computer is possible by means of simple copy and paste/drag and drop operations.

Proceed as follows to transfer a program file from a computer to the control system:

1. Open the main screen of the AMM tool on your computer.
2. Select a desired program file to be transferred (for example, Test.mpf) from the PC file system.



3. Copy the program file with the toolbar button, keyboard shortcuts (Ctrl + C), or from the shortcut menu.
4. Select the program directory in the NC file system.
5. Paste the copied file into the current directory with the toolbar button, keyboard shortcuts (Ctrl + V), or from the shortcut menu.



Alternatively, you can transfer the file by simply dragging and dropping it from the PC file system to the NC file system.

After the file is successfully pasted, you can find it in the corresponding directory on the control system.

A.9.2 Remote control

A.9.2.1 Configuring the remote control

With the remote control function you can perform the following operations:

- Operating the HMI remotely from a computer
- Generating screenshots of the HMI and saving them onto a computer

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Note

To use the remote control function of AMM, make sure you enable the communication ports 22 and 5900 on the HMI. For more information about enabling the communication ports, see Section "Configuring the firewall (Page 41)".

Configuring the remote access rights

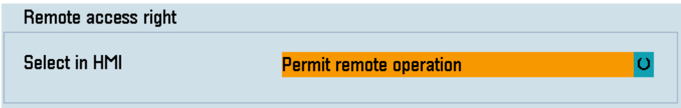
Proceed through the following steps to configure the remote access rights on the HMI:

1. Select the alarm operating area on the PPU.

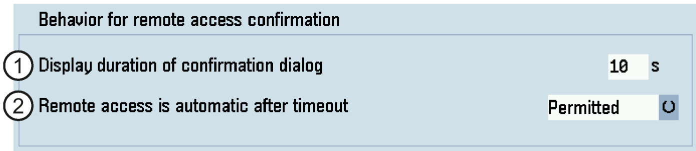
2. Press this softkey to change the settings, if desired.

3. Press this softkey to make the settings changeable. Note that this softkey is visible only with a system password.

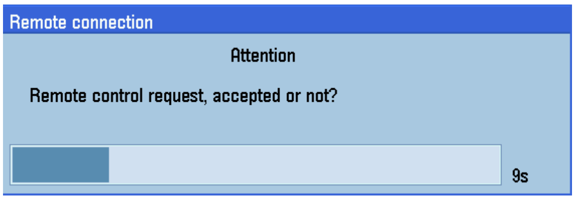
4. Use this key to select the desired right for remote access. You can choose to allow the remote operation/monitoring of the HMI, or forbid the remote access to the HMI.



5. Set the behavior of the control system when it receives a remote access request.

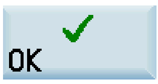


① Specify the duration of the following dialog box displaying on the HMI:



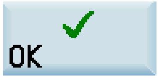
The following operations on the HMI are possible when this dialog box appears:

Press this softkey to reject the request.



Press this softkey to permit the request.

② Use the following key to select the automatic response for the control system after the above dialog box disappears with no softkey operations.

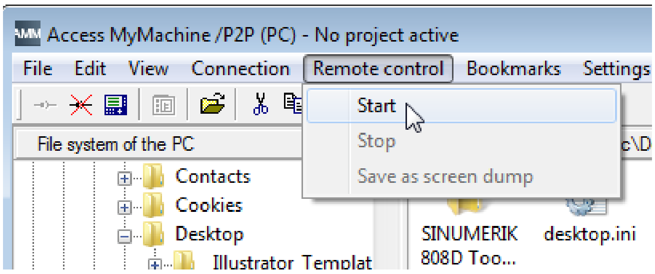


6. Press this softkey to save the settings.

Starting/stopping remote control

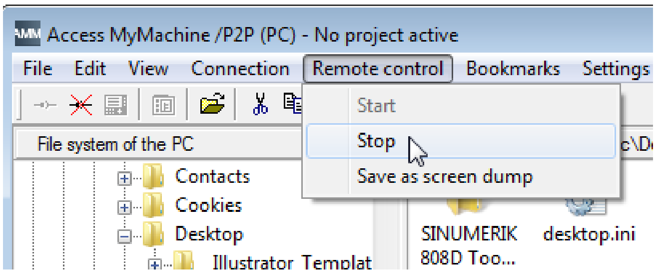
Proceed through the following steps to start/stop the remote control of the HMI:

1. Start the AMM tool and establish an Ethernet connection to the control system (see section "Connecting with AMM (Page 46)").
2. Click the  button in the toolbar or select from the main window menu as follows to start the remote control.



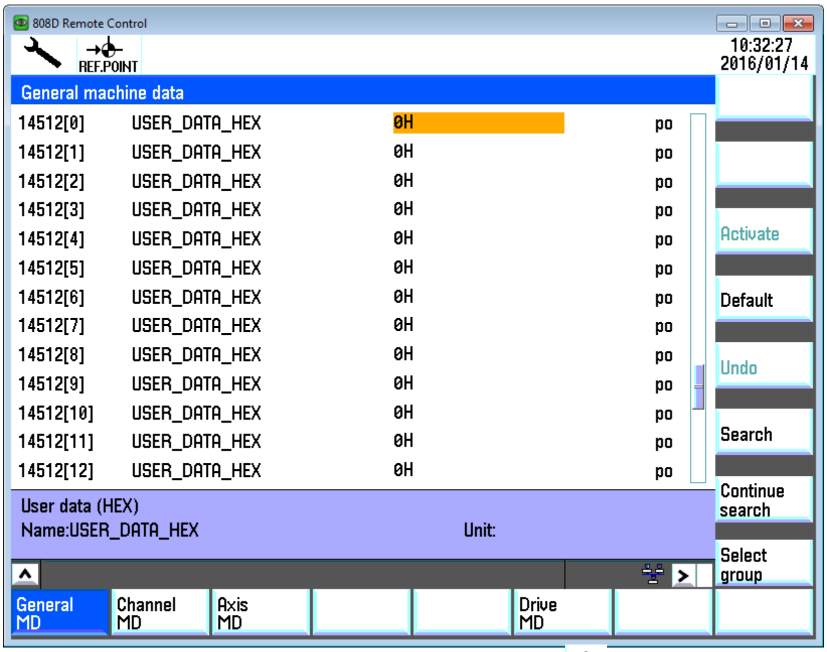
Once the remote control has been started, a monitoring window opens showing the HMI screen contents of the connected control system. You can find a  symbol in the tip area of the HMI screen.

3. Closing the monitoring window or selecting from the main window menu as follows stops the remote control.



A.9.2.2 Operating the HMI via remote control

If the remote control has been started, you can use your mouse to operate the HMI by clicking on the softkeys displayed in the monitoring window.



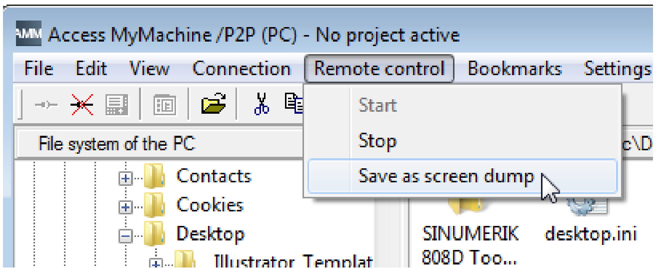
You can perform the return operation by clicking the ^ icon in the screen when possible.

You can view the extended horizontal softkeys by clicking the > icon in the screen when possible.

A.9.2.3 Saving the remote control screen as a picture

Operating sequence

1. After the remote control is started, select from the AMM main window menu as follows:



2. Select the target directory on your computer.
3. Specify the picture name and type.

4. Click this button to save the picture.

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