ABB DRIVES FOR WATER

ACQ80 standard program control

Firmware manual

Related documents are listed on page 13.

ACQ80 standard control program

Firmware manual

3AXD50000170654 Rev C
EN
EFFECTIVE: 2023-03-27

Table of contents

1. Introduction to the manual

2. Startup, control with I/O and ID run

3. Using the control panel

4. Program features

5. Control macros

6. Parameters

7. Additional parameter data

8. Fault tracing

9. Fieldbus control through the embedded fieldbus interface (EFB)

10. Fieldbus control through a fieldbus adapter

11. Parameterization with Drive Composer

12. Parameterization with Automation builder drive manager

Further information

1

Introduction to the manual

Contents of this chapter

The chapter describes applicability, target audience and purpose of this manual. It also describes the contents of this manual and refers to a list of related manuals for more information.

Applicability

The manual applies to the ACQ80 standard control program (version 2.18.205.2).

To check the firmware version of the control program in use, see system information parameter 07.05 Firmware version (see page 99) on the control panel.

Compatibility

This manual is compatible with the ACS-AP-x assistant control panel, the hardware version C or later and panel software version 5.02 or later. The images and instructions are based on the use of the assistant control panel with the ACQ80 drive equipped with the standard control program.

Safety instructions

Follow all safety instructions.

- Read the **complete safety instructions** in the hardware manual of the drive before you install, commission, or use the drive.
- Read the **firmware function-specific warnings and notes** before changing parameter values. These warnings and notes are included in the parameter descriptions presented in chapter Parameters on page 79.

Target audience

The reader is expected to know the fundamentals of electricity, wiring, electrical components, electrical schematic symbols, and basic working principles of solar PV and pump.

The manual is written for readers worldwide. Both SI and imperial units are shown.

Purpose of the manual

This manual provides information needed for designing, commissioning, or operating the solar pump drive system.

Contents of this manual

The manual consists of the following chapters:

- Introduction to the manual (this chapter, page 11) describes applicability, target audience, purpose and contents of this manual. At the end, it lists terms and abbreviations.
- Startup, control with I/O and ID run (page 17) describes how to start up the drive as well as how to start, stop, change the direction of the motor rotation and adjust the motor speed through the I/O interface.
- Using the control panel (page 33) contains instructions for removing and reinstalling the assistant control panel and briefly describes its display, keys and key shortcuts.
- Program features (page 35) describes program features with lists of related user settings, actual signals, and fault and warning messages.
- Control macros (page 75) contains a short description of each macro together with a connection diagram. Macros are pre-defined applications which will save the user time when configuring the drive.
- Parameters (page 79) describes the parameters used to program the drive.
- Additional parameter data (page 273) contains further information on the parameters.
- Fault tracing (page 303) lists the warning and fault messages with possible causes and remedies.
- Fieldbus control through the embedded fieldbus interface (EFB) (page 341) describes the communication to and from a fieldbus network using the embedded fieldbus interface of the drive.

- Fieldbus control through a fieldbus adapter (page 369) describes the communication to and from a fieldbus network using an optional fieldbus adapter module
- Parameterization with Drive Composer (page 381) describes about managing the drive parameters with drive composer application.
- Parameterization with Automation builder drive manager (page 385) describes about managing the drive parameters with automation builder drive manager application.
- Further information (inside of the back cover, page 389) describes how to make product and service inquiries, get information on product training, provide feedback on ABB Drives manuals and find documents on the Internet.

Related documents

Drive manuals and guides	**Code (English)**
ACQ80-04 drives (0.75 to 0.22kW) hardware manual for frames R0-R3	3AXD50000170661
ACQ80-01 drives (30 kW to 55 kW) hardware manual for frames R4-R5	3AXD50001017101
ACQ80-04 drives quick installation and startup guide	3AXD50000701247
ACQ80-01 drives (30 kW to 55 kW) quick installation and startup guide	3AXD50001017217
ACQ80 standard control program firmware manual	3AXD50000170654
ACS-BP-S basic control panel user manual	3AXD50000032527
ACX-AP-x assistant control panels user’s manual	3AUA0000085685

Option manuals and guides	**Code (English)**
DPMP-01 mounting platform for ACS-AP control panel	3AUA0000100140
DPMP-04 and DPMP-05 mounting platforms for control panels installation guide	3AXD50000308484
FECA-01 EtherCAT adapter module user's manual	3AUA0000068940
FCAN-01 CANopen Adapter Module User's Manual	3AFE68615500
FPBA-01 PROFIBUS DP adapter module user's manual	3AFE68573271
FEIP-21 EtherNet/IP fieldbus adapter module User's manual	3AXD50000158621
FMBT-21 Modbus/TCP Adapter Module User’s Manual	3AXD50000158607
FSCA-01 RS-485 adapter module user's manual	3AUA0000109533

Adaptive programming application guide	3AXD50000028574

Tool and maintenance manuals and guides	Code (English)
Drive Composer PC tool user's manual	3AUA0000094606
Converter module capacitor reforming instructions	3BFE64059629

You can find manuals and other product documents in PDF format on the Internet. See section Document library on the Internet on the inside of the back cover. For manuals not available in the Document library, contact your local ABB representative.

The codes below open online listings of the manuals applicable to the products:

ACQ80-04 manuals

ACQ80-01 manuals

Terms and abbreviations

Term/ abbreviation	Explanation
ACS-BP-S	Basic control panel, basic operator keypad for communication with the drive.
ACS-AP-x	Assistant control panel, advanced operator keypad for communication with the drive. The ACQ80 drive supports types ACS-AP-I, ACS-AP-S and ACS-AP-W.
AI	Analog input; interface for analog input signals
AO	Analog output; interface for analog output signals
Control board	Circuit board in which the control program runs.
DC link	DC circuit between rectifier and inverter
DC link capacitors	Energy storage which stabilizes the intermediate circuit DC voltage
DI	Digital input; interface for digital input signals
DPMP-01	Mounting platform for ACS-AP control panel (flange mounting)
DPMP-04/05	Mounting platform for ACS-AP control panel (surface mounting outdoors)

Term/ abbreviation	**Explanation**
Drive	Frequency converter for controlling AC induction motors and permanent magnetic motors for water pump applications.
EFB	Embedded fieldbus
FBA	Fieldbus adapter
FPBA-01	Optional PROFIBUS DP adapter module
FMBT-21	Optional Modbus/TCP adapter module
FSCA-01	Optional RS-485 adapter module
FEIP-21	Optional EtherNet/IP adapter module
FCAN-01	Optional CANopen adapter module
FECA-01	Optional EtherCAT adapter module
FPNO-21	Optional two port PROFINET adapter module
Frame (size)	Refers to drive physical size, for example R0 and R1. The type designation label attached to the drive shows the frame of the drive, see chapter *Operation principle and hardware description,* section *Type designation label* in the hardware manual of the drive.
IGBT	Insulated gate bipolar transistor: used for high efficiency and fast switching
Intermediate circuit	See DC link.
Inverter	Converts direct current and voltage to alternating current and voltage.
I/O	Input/Output
LSW	Least significant word
Macro	Pre-defined default values of parameters in drive control program. Each macro is intended for a specific application. See chapter Control macros on page 75.
MPPT	Maximum power point tracking
NETA-21	Remote monitoring tool
Network control	With fieldbus protocols based on the Common Industrial Protocol (CIP^{TM}), such as Ethernet/IP, denotes the control of the drive using the Net Ctrl and Net Ref objects of the ODVA AC/DC Drive Profile. For more information, see www.odva.org, and the following manual: *FENA-01/-11/-21 Ethernet adapter module user's manual* (3AUA0000093568 [English]).
Parameter	User-adjustable operation instruction to the drive, or signal measured or calculated by the drive
PID/Loop controller	Proportional–integral–derivative controller. Drive speed control is based on PID algorithm.
PLC	Programmable logic controller

Term/ abbreviation	**Explanation**
PROFIBUS, PROFIBUS DP, PROFINET IO	Registered trademarks of PI - PROFIBUS & PROFINET International
R0, R1,...	Frame (size)
RO	Relay output; interface for a digital output signal. Implemented with a relay.
Rectifier	Converts alternating current and voltage to direct current and voltage.
STO	Safe torque off. See chapter *The Safe torque off function* in the hardware manual of the drive.

Categorization by frame (size)

The ACQ80 is manufactured in several frames (frame sizes), which are denoted as RN, where N is an integer. Some information which only concern certain frames are marked with the symbol of the frame (RN).

The frame is marked on the type designation label attached to the drive, see section Type designation label in the hardware manual of the drive.

Cybersecurity disclaimer

This product is designed to be connected to and to communicate information and data via a network interface. It is Customer's sole responsibility to provide and continuously ensure a secure connection between the product and Customer network or any other network (as the case may be). Customer shall establish and maintain any appropriate measures (such as but not limited to the installation of firewalls, application of authentication measures, encryption of data, installation of anti-virus programs, etc) to protect the product, the network, its system and the interface against any kind of security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information. ABB and its affiliates are not liable for damages and/or losses related to such security breaches, any unauthorized access, interference, intrusion, leakage and/or theft of data or information.

2

Startup, control with I/O and ID run

Contents of this chapter

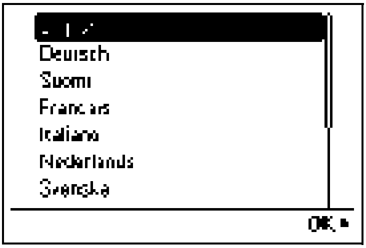
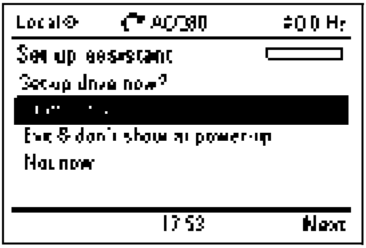
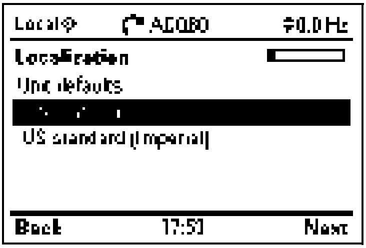
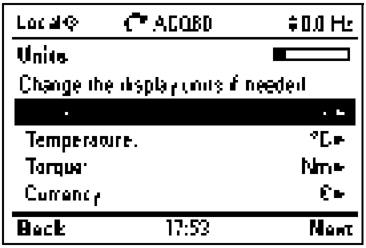
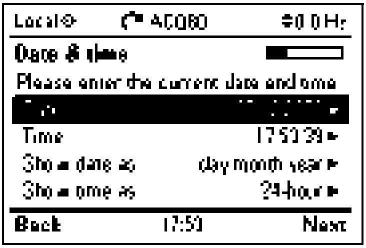
The chapter describes how to:

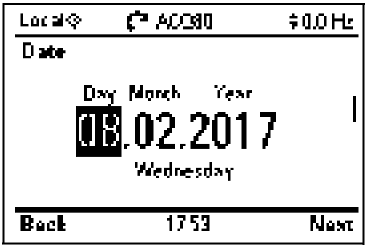
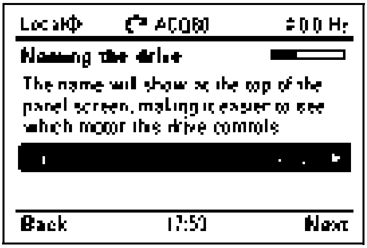
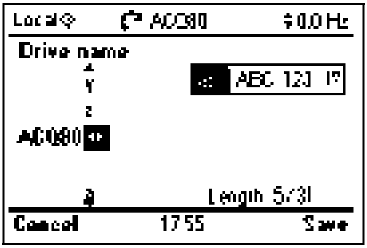
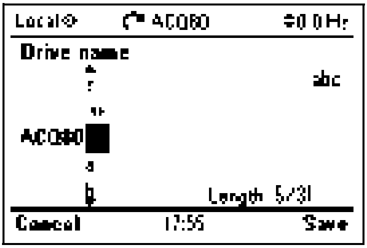
- perform the startup
- start, stop, change the direction of the motor rotation and adjust the speed of the motor through the I/O interface
- perform an Identification run (ID run) for the drive.

How to start up the drive

How to start up the drive using the First start assistant on the assistant control panel

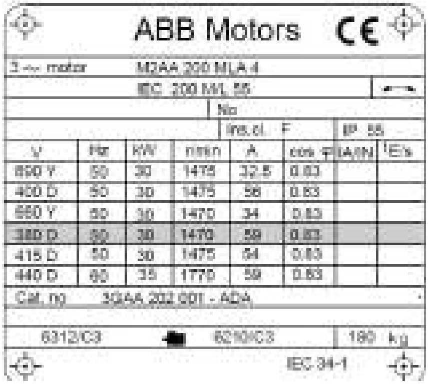
<table>
<tr><th colspan="3">Safety</th></tr>
<tr><td colspan="3">⚠ Do not startup the drive unless you are a qualified electrician.
Read and obey the instructions in chapter Safety instructions at the beginning of the <i>Hardware manual</i> of the drive. Ignoring the instructions can cause physical injury or death, or damage to the equipment</td></tr>
<tr><td>☐</td><td colspan="2">Check the installation. See chapter <i>Installation checklist</i> in the <i>Hardware manual</i> of the drive.</td></tr>
<tr><td>☐</td><td colspan="2">⚠ Make sure there is no active start on (DI1 in factory settings, that is, ABB standard macro). The drive will start up automatically at power-up if the external run command is on and the drive is in the remote control mode.
Check that the starting of the motor does not cause any danger.
Decouple the driven machine if
• there is a risk of damage in case of an incorrect direction of rotation, or
• a Normal ID run is required during the drive startup, when the load torque is higher than 20% or the machinery is not able to withstand the nominal torque transient during the ID run.</td></tr>
<tr><th colspan="3">Hints on using the assistant control panel</th></tr>
<tr><td></td><td>The two commands at the bottom of the display (Options and Menu in the figure on the right), show the functions of the two softkeys ▭ and ▭ located below the display. The commands assigned to the softkeys vary depending on the context.
Use keys ◄, ►, ▲ and ▼ to move the cursor and/or change values depending on the active view.
Key ? shows a context-sensitive help page.
For more information, see <i>ACS-AP-x assistant control panels user’s manual</i> (3AUA0000085685 [English]).</td><td></td></tr>
<tr><th colspan="3">1 – First start assistant guided settings:
Language, date and time, and motor nominal values</th></tr>
<tr><td>☐</td><td>Have the motor name plate data at hand.
Power up the drive.</td><td></td></tr>
</table>

☐	The First start assistant guides you through the first startup. The assistant begins automatically. Wait until the control panel enters the view shown on the right. Select the language you want to use by highlighting it (if not already highlighted) and pressing ▭ (**OK**). **Note:** After you have selected the language, it takes a few minutes to download the language file to the control panel.	 Deutsch Suomi Français Italiano Nederlands Svenska OK ▸
☐	Select **Start set-up** and press ▭ (**Next**).	 Local ACQ80 0.0 Hz Set up assistant Setup drive now? Yes & don't show at power-up Not now 17:53 Next
☐	Select the localization you want to use and press ▭ (**Next**).	 Local ACQ80 0.0 Hz Localization Unit defaults US standard (Imperial) Back 17:53 Next
☐	Change the units shown on the control panel if needed. • Go to the edit view of a selected row by pressing ▶. • Scroll the view with ▲ and ▼. Go to the next view by pressing ▭ (**Next**).	 Local ACQ80 0.0 Hz Units Change the display units if needed Temperature: °C ▸ Torque: Nm ▸ Currency: € ▸ Back 17:53 Next
☐	Set the date and time as well as date and time display formats. • Go to the edit view of a selected row by pressing ▶. • Scroll the view with ▲ and ▼. Go to the next view by pressing ▭ (**Next**).	 Local ACQ80 0.0 Hz Date & time Please enter the current date and time Time 17:53:39 ▸ Show date as day.month.year ▸ Show time as 24-hour ▸ Back 17:53 Next

☐	In an edit view: - Use ◄ and ► to move the cursor left and right. - Use ▲ and ▼ to change the value. - Press (**Save**) to accept the new setting, or press (**Cancel**) to go back to the previous view without making changes.	
☐	To give the drive a name that will be shown at the top, press ►. If you do not want to change the default name (ACQ80), continue straight to the set-up of the motor nominal values by pressing (**Next**).	 The name will show at the top of the panel screen, making it easier to see which motor this drive controls
☐	Enter the name: - To select the character mode (lower case / upper case / numbers / special characters), press ▲ until symbol ◄► is highlighted and then select the mode with ◄ and ►. Now you can start adding characters. The mode remains selected until you select another one. - To add a character, highlight it with ▲ and ▼, and press ►. - To remove a letter, press ◄. - Press (**Save**) to accept the new setting, or press (**Cancel**) to go back to the previous view without making changes.	 

Refer to the motor nameplate for the following nominal value settings of the motor. Enter the values exactly as shown on the motor nameplate.

Example of a nameplate of an induction (asynchronous) motor:

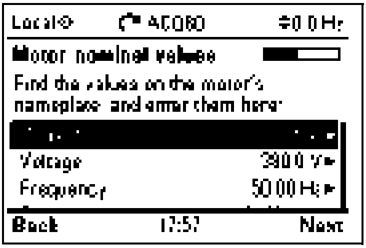


☐ Select the motor type.

Check that the motor data is correct. Values are predefined on the basis of the drive size but you should verify that they correspond to the motor.

Start with the motor nominal current.

If you have to change the value, go to the edit view of the selected row by pressing ▶ (when this symbol is shown at the end of the row).



Local ACQ80 0.0 Hz

Motor nominal values

Find the values on the motor's nameplate and enter them here:

Voltage 380.0 V ▶

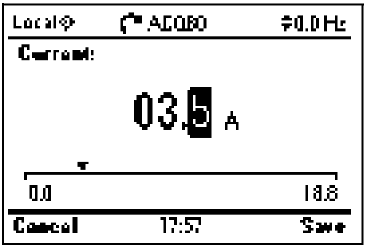
Frequency 50.00 Hz ▶

Back 17:57 Next

☐ Set the correct value:

- Use ◀ and ▶ to move the cursor left and right.
- Use ▲ and ▼ to change the value.

Press ⊂⊃ (**Save**) to accept the new setting, or press ⊂⊃ (**Cancel**) to go back to the previous view without making changes.



Local ACQ80 0.0 Hz

Current:

03.5 A

0.0 18.8

Cancel 17:57 Save

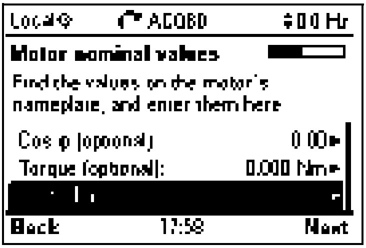
☐ Continue to check/edit the nominal values and select scalar or vector control mode.

Motor nominal cos Φ and nominal torque are optional.

Roll down with ▼ to see the last row in the view.

After editing the last row, the control panel goes to the next view.

To go directly to the next view, press ⊂⊃ (**Next**).



Local ACQ80 0.0 Hz

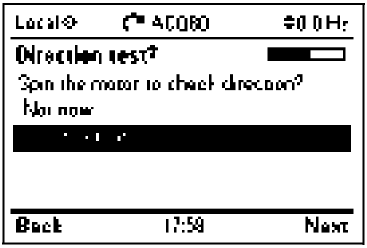
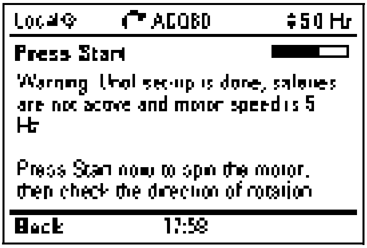
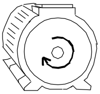
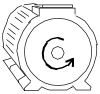
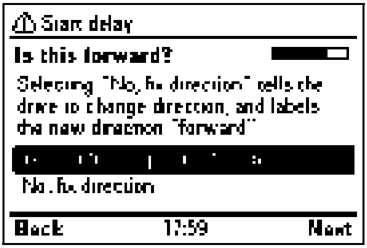
Motor nominal values

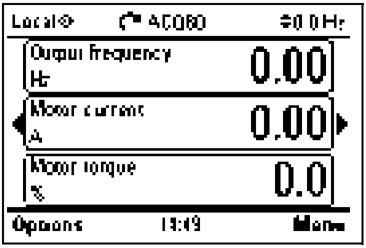
Find the values on the motor's nameplate, and enter them here

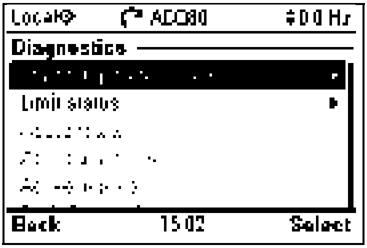
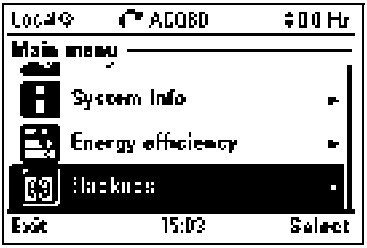
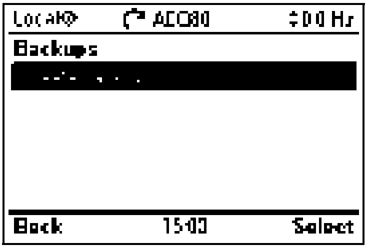
Cos φ (optional) 0.00 ▶

Torque (optional): 0.000 Nm ▶

Back 17:58 Next

☐	Direction test is optional, and requires rotating the motor. Do not do this if it could cause any risk, or if the mechanical set-up does not allow it. To do the direction test, select **Spin the motor** and press (**Next**). **Note**: During testing, make sure that the pump motor is outside the well or tank and pump is decoupled from the motor.	 Local ACQ80 ⇕0.0 Hz **Direction test?** Spin the motor to check direction? Not now [illegible] **Back** 17:59 **Next**
☐	Press the Start key on the control panel to start the drive.	 Local ACQ80 ⇕5.0 Hz **Press Start** Warning: Until set-up is done, safeties are not active and motor speed is 5 Hz Press Start now to spin the motor, then check the direction of rotation **Back** 17:58
☐	Check the direction of the motor. If it is forward, select **Yes, motor is spinning forward** and press (**Next**) to continue. If the direction is not forward, select **No, fix direction** and press (**Next**) to continue.  Forward direction  Reverse direction	 ⚠ Start delay **Is this forward?** Selecting "No, fix direction" tells the drive to change direction, and labels the new direction "forward" [illegible] No, fix direction **Back** 17:59 **Next**
☐	If you want to make a backup of the settings made so far, select **Backup** and press (**Next**). If you do not want to make a backup, select **Not now** and press (**Next**).	 Local ACQ80 ⇕0.0 Hz **Make backup?** Copies all settings into a backup file stored in the control panel. To restore a backup, go to Menu > Backups. [illegible] Backup **Back** 17:59 **Next**

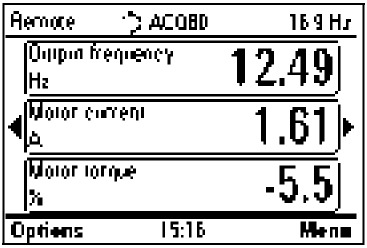
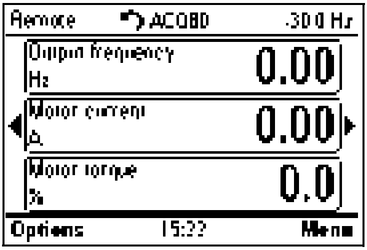
<table>
<tr><td>☐</td><td>The first start is now complete and the drive is ready for use.
Press (Done) to enter the Home view.</td><td>
Local ACQ80 0.0 Hz
First start complete
Drive is ready for use.
Reference Custom
Back 19:00 Done</td></tr>
<tr><td>☐</td><td>The Home view monitoring the values of the selected signals is shown on the control panel.</td><td>
Local ACQ80 0.0 Hz
Output frequency Hz 0.00
Motor current A 0.00
Motor torque % 0.0
Options 13:49 Menu</td></tr>
<tr><th colspan="3">2 – Parameters</th></tr>
<tr><td>☐</td><td colspan="2">For a basic startup, configure the below parameters:
99.03 Motor type = Asynchronous motor/Permanent magnet motor
99.04 Motor control mode = Scalar for Asynchronous motor and Vector for permanent magnet motor
99.06...99.10 = As per motor name plate
Note: For permanent magnet motors, enter motor back EMF value instead of motor nominal voltage.
79.1 Solar status word1
79.11 Manual input source 1
79.41 Start DC voltage
79.42 PV cell min voltage/79.43 PV cell max voltage
79.51 Pump minimum speed
79.52 Pump maximum speed
79.01 Solar status word1 = Manual In 1 Start; stop
79.11 Manual input source 1 = DI1
79.41 Start DC voltage = ABB recommends to keep this value higher than the value in parameter 79.42.
79.42 PV cell min voltage/79.43 PV cell max voltage = As per PV array rating
79.51 Pump minimum speed = ABB recommends to keep this value 20% of motor nominal rpm or more.
79.52 Pump maximum speed = Pump maximum speed in RPM</td></tr>
</table>

<table>
<tr><th colspan="3">3 – Diagnostics menu</th></tr>
<tr><td>☐</td><td>After making the additional adjustments and checking the I/O connections, use the Diagnostics menu to make sure that the setup is functioning correctly.
In the Main menu, select Diagnostics and press ▭ (Select) (or ▶).</td><td> </td></tr>
<tr><td>☐</td><td>Select the diagnostics item you want to view and press ▭ (Select).
Return to the Diagnostics menu by pressing ▭ (Back).</td><td> </td></tr>
<tr><th colspan="3">4 – Back up</th></tr>
<tr><td>☐</td><td>After you have finished startup ABB recommends that you make a backup.
In the Main menu, select Backups and press ▭ (Select) (or ▶).</td><td> </td></tr>
<tr><td>☐</td><td>Press ▭ (Select) to start backup.</td><td> </td></tr>
</table>

How to control the drive through the I/O interface

The table below describes how to operate the drive through the digital and analog inputs when:

- the motor startup is performed, and
- the default parameter settings of the ABB standard macro are in use.

Preliminary settings	
If you need to change the direction of rotation, check that limits allow reverse direction: Go to **Menu - Primary settings - Limits** and make sure that the minimum limit has a negative value and the maximum limit has a positive value.	
Make sure that the control connections are wired according to the connection diagram given for the ABB standard macro. **Note:** Most of the macros uses I/O that exist only when I/O module is installed. If you do not use it, choose ABB limited macro or change the default use of the I/O by parameters.	See section Default control connections for the ABB standard macro on page 76.
Make sure that the drive is in remote control. Press key Loc/Rem to switch between remote and local control.	In remote control, the control panel display shows text **Remote** at the top left.
Starting and controlling the speed of the motor	
Start by switching digital input DI1 on. The arrow starts rotating. It is dotted until the setpoint is reached. Regulate the drive output frequency (motor speed) by adjusting voltage of analog input AI1.	 Remote ACO8D 16.9 Hz Output frequency Hz 12.49 Motor current A 1.61 Motor torque % -5.5 Options 15:16 Menu
Stopping the motor	
Switch digital input DI1 off. The arrow stops rotating.	 Remote ACO8D -30.0 Hz Output frequency Hz 0.00 Motor current A 0.00 Motor torque % 0.0 Options 15:22 Menu

How to perform the ID run

⚠ Make sure that you remove pump and pump motor from the well or tank and decouple the motor from pump before performing the ID run. Ignoring this warning result in motor bearing damage.

The drive automatically estimates motor characteristics using Standstill ID run when the drive is started for the first time in vector control and after any motor parameter (group 99 Motor data) is changed. This is valid when

- parameter 99.13 ID run requested selection is Standstill and
- parameter 99.04 Motor control mode selection is Vector.

In most applications there is no need to perform a separate ID run. The ID run should be selected manually if:

- vector control mode is used (parameter 99.04 Motor control mode is set to Vector), and
- permanent magnet motor (PM) is used (parameter 99.03 Motor type is set to Permanent magnet motor), or
- permanent magnet assisted synchronous reluctance motor (PMaSynRM) is used (parameter 99.03 Motor type is set to PMaSynRM), or
- drive operates near zero speed references, or
- operation at torque range above the motor nominal torque, over a wide speed range is needed.

Do the ID run with the ID run assistant by selecting **Menu - Primary settings - Motor - ID run** (see page 27) or with parameter 99.13 ID run requested (see page 29).

Note: If motor parameters (group 99 Motor data) are changed after the ID run, it must be repeated.

Note: If you have already parameterized your application using the scalar motor control mode (99.04 Motor control mode is set to Scalar) and you need to change motor control mode to Vector,

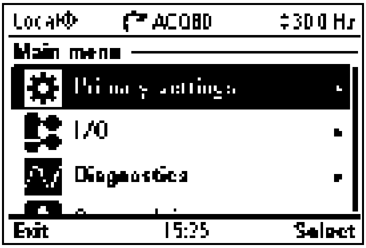
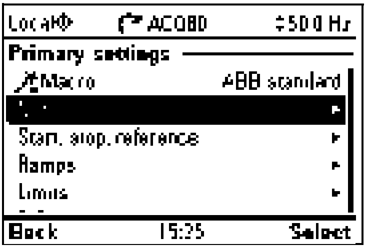
- change the control mode to vector with the **Control mode** assistant (go to **Menu - Primary settings - Motor - Control mode)** and follow the instructions. The ID run assistant then guides you through the ID run.

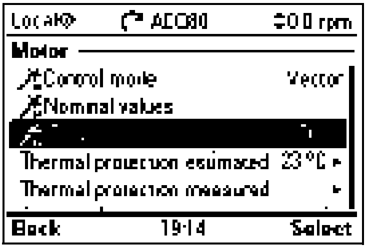
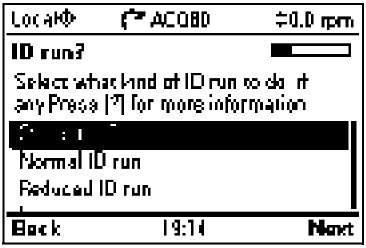
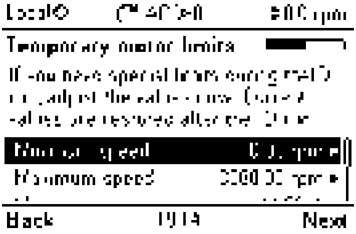
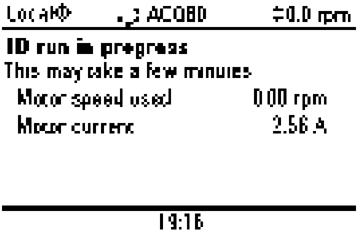
or

- set parameter 99.04 Motor control mode to Vector, and
  - for I/O controlled drive, check parameters in groups 23 Speed reference ramp, 12 Standard AI, 30 Limits and 46 Monitoring/scaling settings.

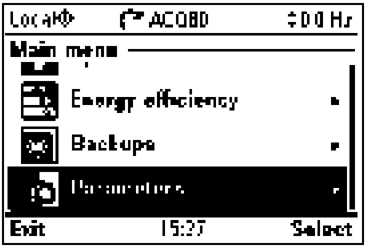
ID run procedure

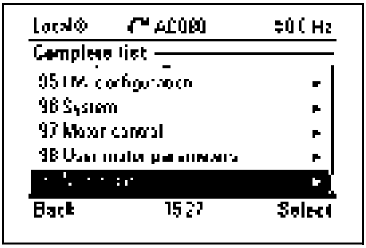
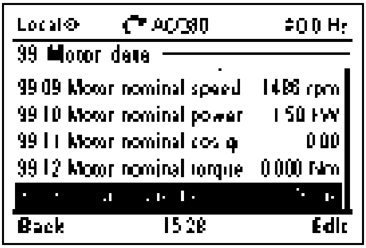
With the ID run assistant

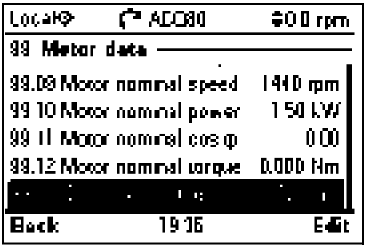
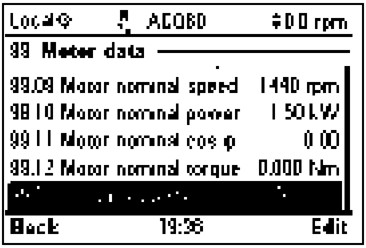
<table>
<tr><th colspan="3">Pre-check</th></tr>
<tr><td colspan="3">⚠ ⚠ WARNING! The motor will run at up to approximately 50…80% of the nominal speed during the ID run. The motor will rotate in the forward direction. Make sure that it is safe to run the motor before performing the ID run.
Do not do ID run on a rotating motor. Make sure that the motor is stopped before starting the ID run.</td></tr>
<tr><td>☐</td><td colspan="2">Decouple the motor from the driven equipment</td></tr>
<tr><td>☐</td><td colspan="2">Check that the values of the motor data parameters are equivalent to those on the motor nameplate.</td></tr>
<tr><td>☐</td><td colspan="2">Check that the STO circuit is closed.</td></tr>
<tr><td></td><td colspan="2">The assistant will ask if you want to use temporary motor limits. They must meet the following conditions:</td></tr>
<tr><td>☐</td><td colspan="2">Minimum speed ≤ 0 rpm</td></tr>
<tr><td>☐</td><td colspan="2">Maximum speed = motor rated speed (Normal ID run procedure needs the motor to be run at 100% speed.)</td></tr>
<tr><td>☐</td><td colspan="2">Maximum current > 0.5 x motor nominal current</td></tr>
<tr><td>☐</td><td colspan="2">Maximum torque > 50%</td></tr>
<tr><td>☐</td><td colspan="2">Make sure that the control panel is in local control (text Local shown at the top left). Press key Loc/Rem to switch between local and remote control.</td></tr>
<tr><th colspan="3">ID run</th></tr>
<tr><td>☐</td><td>Go to the Main menu by pressing (Menu) in the Home view.
Select Primary settings and press (Select) (or ▶).</td><td>
</td></tr>
<tr><td>☐</td><td>Select Motor and press (Select) (or ▶).</td><td>
</td></tr>
</table>

☐	Select **ID run** (shown only when the drive is in vector control mode) and press ⌴ (**Select**) (or ▶).	 Local ACO80 0.0 rpm Motor Control mode Vector Nominal values Thermal protection estimated 23 °C ▸ Thermal protection measured ▸ Back 19:14 Select
☐	Select the type of ID run you want to do and press ⌴ (**Select**) (or ▶).	 Local ACO80 0.0 rpm ID run? Select what kind of ID run to do, if any. Press [?] for more information. Normal ID run Reduced ID run Back 19:14 Next
☐	Warning message **Identification run** is shown at the top for a few seconds. Control panel LED starts blinking green to indicate an active warning. Check the motor limits shown on the control panel. If you need other limits during the ID run you can enter them here. The originals limits will be restored after the ID run. Press ⌴ (**Next**).	 Temporary motor limits Maximum speed Back 19:14 Next
☐	Press the start key (◇) to start the ID run. In general, ABB recommends not to press any control panel keys during the ID run. However, you can stop the ID run at any time by pressing the stop key (⊙). During the ID run a progress view is shown. After the ID run is completed, text **ID run done** is shown. The LED stops blinking. If the ID run fails, fault FF61 ID run is shown. See chapter Fault tracing on page 303 for more information.	 Local ACO80 0.0 rpm Press Start for ID run When you press Start, the motor is injected with DC current for about 1 minute, and may rotate up to half a revolution. After the ID run the drive stops. Back 19:16  Local ACO80 0.0 rpm ID run in progress This may take a few minutes Motor speed used 0.00 rpm Motor current 2.56 A 19:16

With parameter 99.13 ID run requested

	Pre-check	
	WARNING! The motor will run at up to approximately 50…80% of the nominal speed during the ID run. The motor will rotate in the forward direction. **Make sure that it is safe to run the motor before performing the ID run.** **Do not do ID run on a rotating motor. Make sure that the motor is stopped before starting the ID run.**	
☐	De-couple the motor from the driven equipment	
☐	Check that the values of the motor data parameters are equivalent to those on the motor nameplate.	
☐	Check that the STO circuit is closed.	
	If parameter values (from group 10 Standard DI, RO to group 99 Motor data) are changed before the ID run, check that the new settings meet the following conditions:	
☐	30.11 Minimum speed ≤ 0 rpm	
☐	30.12 Maximum speed = motor rated speed (Normal ID run procedure needs the motor to be run at 100% speed.)	
☐	30.17 Maximum current > 0.5 x motor nominal current	
☐	30.20 Maximum torque 1 > 50%	
☐	Make sure that the control panel is in local control (text Local shown at the top left). Press key Loc/Rem to switch between local and remote control.	
	ID run	
☐	Go to the **Main** menu by pressing (**Menu**) in the Home view. Press ▲.	
☐	Select **Parameters** and press (**Select**) (or ▶).	

☐	Select **Complete list** and press (**Select**) (or ▶).	
☐	Scroll the page with ▲ and ▼, and select parameter group **99 Motor data** and press (**Select**) (or ▶).	
☐	Scroll the page with ▲ and ▼, and select parameter **99.13 ID run requested** (99.13 ID run requested) and press (**Select**) (or ▶).	
☐	Select the ID run type and press (**Save**) (or ▶).	

☐	The control panel returns to the previous view and warning message **Identification run** is shown at the top for a few seconds. Control panel LED starts blinking green to indicate an active warning (AFF6). The AFF6 warning view is shown when no key has been pressed for one minute. Pressing ▭ (**How to fix**) shows text informing that the ID run will be done at the next start. You can hide the warning view by pressing ▭ (**Hide**). Press the start key (◇) to start the ID run. In general, ABB recommends not to press any control panel keys during the ID run. However, you can stop the ID run at any time by pressing the stop key (▽).	 Local ACQ80 ‡0.0 rpm **99 Motor data** 99.09 Motor nominal speed 1440 rpm 99.10 Motor nominal power 1.50 kW 99.11 Motor nominal cos φ 0.00 99.12 Motor nominal torque 0.000 Nm **Back** 19:16 **Edit**  Local ACQ80 ‡0.0 rpm Warning AFF6 Aux. code: 0000 0000 **Identification run** 19:35:15 Motor identification run about to be performed **Hide** 19:35 **How to fix**
☐	During the ID run the arrow is rotating at the top. After the ID run is completed, text **ID run done** is shown. The LED stops blinking. If the ID run fails, fault FF61 ID run is shown. See chapter Fault tracing on page 303 for more information.	 Local ACQ80 ‡0.0 rpm **99 Motor data** 99.09 Motor nominal speed 1440 rpm 99.10 Motor nominal power 1.50 kW 99.11 Motor nominal cos φ 0.00 99.12 Motor nominal torque 0.000 Nm **Back** 19:36 **Edit**

3

Using the control panel

The ACQ80 drive supports both basic and assistant control panels. For more information, see:

- *ACX-AP-x assistant control panel’s user’s manual* (3AUA0000085685 [English])

and

- *ACS-BP-S basic control panel’s user’s manual* (3AXD50000032527 [English]).

4

Program features

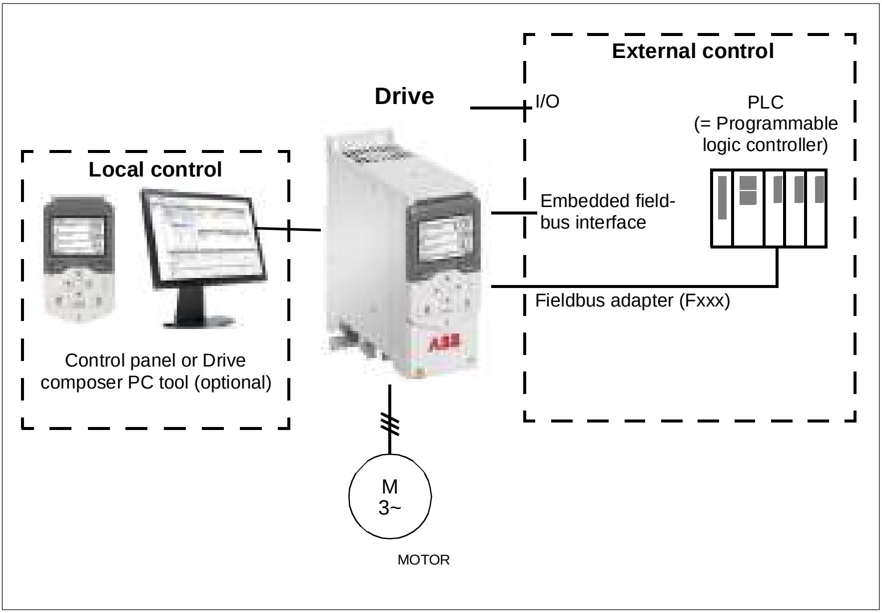
What this chapter contains

This chapter describes some of the important functions within the control program, how to use them and how to program them to operate. It also explains the control locations and operating modes.

Local control vs. external control

The ACQ80 drive has two main control locations, external and local. The control locations are selected with the **Loc/Rem** key on the control panel or in the PC tool.

- Local control allows you to control the drive through control panel or drive composer.
- In external control, speed of the pump motor is managed by internal MPPT logic. With external control, only start/stop or speed limiting via PID can be done. For more information, see section MPPT control program on page 42.



Local control

The control commands are given from the control panel keypad or from a PC equipped with Drive composer when the drive is in local control. Speed control mode is available in vector motor control mode and frequency mode is available when scalar motor control mode is used.

Local control is mainly used during commissioning and maintenance. The control panel always overrides the external control signal sources when used in local control.

External control

External (remote) control mode is the default selection. In external control mode, by default, the speed references are provided by MPPT functionality. For more information, see section MPPT control program on page 42.

Operating modes of the drive

The drive can be operated in scalar and vector control mode. The mode is selectable for both Local and External control. See parameter 99.04 Motor control mode.

■ Speed control mode

Speed control mode is available in both local and external control. It is supported in vector motor control only.

■ Frequency control mode

Frequency control mode is available in both local and external control. It is supported in scalar motor control.

■ Special control modes

In addition to the above-mentioned control modes, you can also use special control mode, Process PID control. For more information, see section Process PID control (page 53).

Drive configuration and programming

■ Configuring using parameters

Parameter configurations for the standard drive operations and can be set through

- the control panel, as described in chapter Using the control panel
- the Drive composer PC tool, see chapter Parameterization with Drive Composer
- the automation builder drive manager, see Parameterization with Automation builder drive manager or
- the fieldbus interface, as described in chapters Fieldbus control through the embedded fieldbus interface (EFB) and Fieldbus control through a fieldbus adapter.

All parameter settings are stored automatically to the permanent memory of the drive. However, if an external +24 V DC power supply is used for the drive control unit, it is highly recommended to force a save by using parameter 96.07 Parameter save manually before powering down the control unit after any parameter changes have been made.

If necessary, the default parameter values can be restored by parameter 96.06 Parameter restore.

Adaptive programming

Conventionally, the user can control the operation of the drive by parameters. However, the standard parameters have a fixed set of choices or a setting range. To further customize the operation of the drive, an adaptive program can be constructed out of a set of function blocks.

The Drive Composer PC tool V2.7 and above (available separately) has an Adaptive programming feature with a graphical user interface for building the custom program. The function blocks include the usual arithmetic and logical functions, as well as, for example, selection, comparison and timer blocks.

The physical inputs, drive status information, actual values, constants and parameters can be used as the input for the program. The output of the program can be used, for example, as a start signal, external event or reference, or connected to the drive outputs. See the table below for a listing of the available inputs and outputs.

If you connect the output of the adaptive program to a selection parameter that is a pointer parameter, the selection parameter will be write-protected.

Example:

If parameter 31.01 External event 1 source is connected to an adaptive programming block output, the parameter value is shown as Adaptive program on a control panel or PC tool. The parameter is write-protected (= the selection cannot be changed).

The status of the adaptive program is shown by parameter 07.30 Adaptive program status. The adaptive program can be disabled by 96.70 Disable adaptive program.

For more information, see the *Adaptive programming application guide* (3AXD50000028574 [English].

Inputs available to the adaptive program	
Input	Source
I/O	
DI1	10.02 DI delayed status, bit 0
DI2	10.02 DI delayed status, bit 1
DI3	10.02 DI delayed status, bit 2
DI4	10.02 DI delayed status, bit 3
DI5	10.02 DI delayed status, bit 4
DI6	10.02 DI delayed status, bit 5
AI1	12.11 AI1 actual value
AI2	12.21 AI2 actual value
Actual signals	
Motor speed	01.01 Motor speed used
Output frequency	01.06 Output frequency
Motor current	01.07 Motor current

Inputs available to the adaptive program	
Input	Source
Motor torque	01.10 Motor torque
Motor shaft power	01.17 Motor shaft power
Status	
Enabled	06.16 Drive status word 1, bit 0
Inhibited	06.16 Drive status word 1, bit 1
Ready to start	06.16 Drive status word 1, bit 3
Tripped	06.11 Main status word, bit 3
At setpoint	06.11 Main status word, bit 8
Limiting	06.16 Drive status word 1, bit 7
Ext1 active	06.16 Drive status word 1, bit 10
Ext2 active	06.16 Drive status word 1, bit 11

Outputs available to the adaptive program	
Output	*Target*
I/O	
RO1	10.24 RO1 source
RO2	10.27 RO2 source
RO3	10.30 RO3 source
AO1	13.12 AO1 source
AO2	13.22 AO2 source
Start control	
Fault reset	31.11 Fault reset selection
Speed control	
Speed proportional gain	25.02 Speed proportional gain
Speed integration time	25.03 Speed integration time
Acceleration time 1	23.12 Acceleration time 1
Deceleration time 1	23.13 Deceleration time 1
Events	
External event 1	31.01 External event 1 source
External event 2	31.03 External event 2 source
External event 3	31.05 External event 3 source
External event 4	31.07 External event 4 source
External event 5	31.09 External event 5 source
Process PID	
Set 1 setpoint 1	40.16 Set 1 setpoint 1 source
Set 1 feedback 1	40.08 Set 1 feedback 1 source
Set 1 gain	40.32 Set 1 gain
Set 1 integration time	40.33 Set 1 integration time
Set 1 tracking mode	40.49 Set 1 tracking mode
Set 1 track reference	40.50 Set 1 tracking ref selection

Adaptive program fault and aux code formats

The format of the aux code:

Bits 24-31: State number	Bits 16-23: block number	Bits 0-15: error code

If the state number is zero but the block number has a value, the fault is related to a function block in the base program. If both state number and block number are zero, the fault is a generic fault that is not related to a specific block.

See fault 64A6 Adaptive program on page 330.

Sequence program

An adaptive program can contain base program and sequence program parts. Base program is run continuously when adaptive program is in running mode. The functionality of the base program is programmed using function blocks and system inputs and outputs.

Sequence program is a state machine. This means that only one state of the sequence program is run at a time. You can create a sequence program by adding states and programming the state programs using the same program elements as in the base program. You can program state transitions by adding state transition outputs to the state programs. The state transition rules are programmed using function blocks.

The number of the active state of the sequence program is shown by parameter 07.31 AP sequence state.

Control interfaces

Programmable analog inputs

The control unit has two programmable analog inputs. Analog inputs can be used for PID purpose or to read external sensor values. With analog inputs, speed of the motor cannot be changed as motor speed control is always by internal MPPT logic of ACQ80. For more information, see section MPPT control program on page 42.

Settings

Parameter group 12 Standard AI (page 108).

Programmable analog outputs

The control unit has two current (0…20 mA) analog outputs. Analog output 1 can be set as a voltage (0/2…10 V) or current (0/4…20 mA) output with parameters. Analog output 2 always uses current. Each output can be filtered, inverted and scaled.

Settings

Parameter group 13 Standard AO (page 115).

Programmable digital inputs and outputs

The control unit has six digital inputs.

Digital input DI5 can be used as high frequency pulse input. The panel shows the appropriate selection only.

Settings

Parameter groups 10 Standard DI, RO (page 100).

Programmable frequency input and output

Digital input DI5 can be configured as high frequency input. The panel shows the appropriate selection only.

Settings

Parameter groups 10 Standard DI, RO (page 100) and 11 Standard DIO, FI, FO (page 106).

Programmable relay outputs

The control unit has three relay outputs. The signal to be indicated by the outputs can be selected by parameters.

Settings

Parameter group 10 Standard DI, RO (page 100).

Fieldbus control

The drive can be connected to several different automation systems through its fieldbus interfaces. See chapters Fieldbus control through the embedded fieldbus interface (EFB) (page 341) and Fieldbus control through a fieldbus adapter (page 369).

Settings

Parameter groups 50 Fieldbus adapter (FBA) (page 209), 51 FBA A settings (page 213), 52 FBA A data in (page 215), and 53 FBA A data out (page 216) and 58 Embedded fieldbus (page 216).

Pump control features

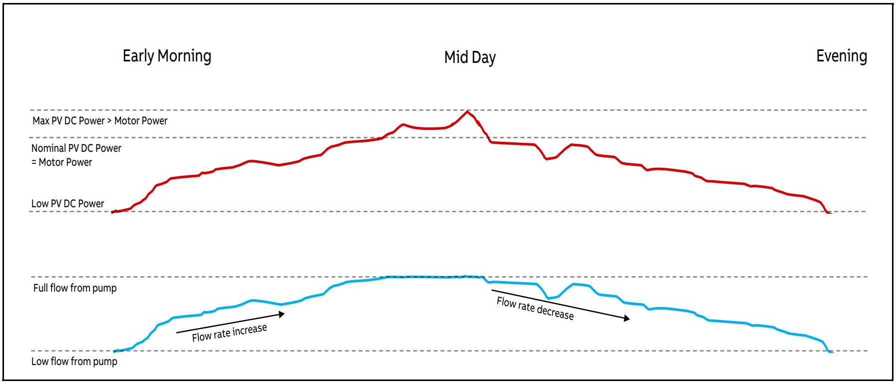
MPPT control program

The Maximum Power Point Tracking (MPPT) control program is a built-in logic in the ACQ80 drives. This enables the drive to monitor the available DC power from the PV array and regulate the motor speed accordingly.

Some of the other features of MPPT program are:

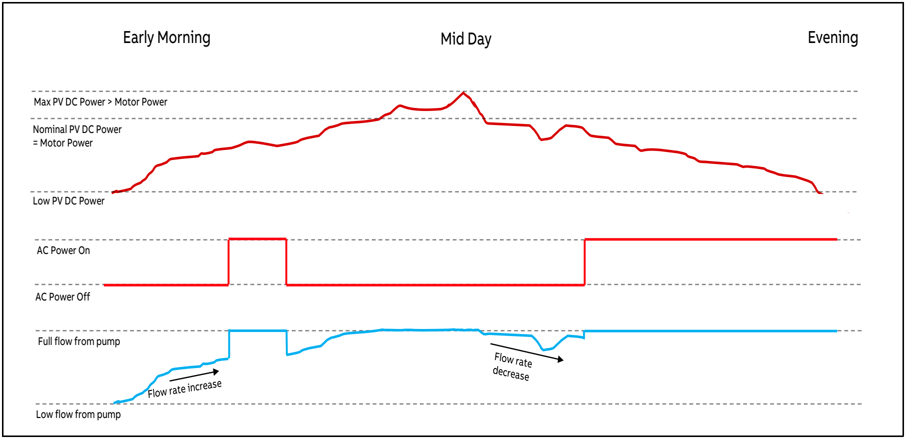
- Monitors the DC power continuously.
- Make sure that the pump works smoothly with controlled acceleration and declaration of pump motors even when there are sudden changes in DC voltage due to cloud passing. This helps to avoid motor and pump damage.
- Monitors available DC power and avoids multiple restarts of pump motor during early morning and late evening time when PV array is the only source of power to the drive. This function also helps to increase service life of motor, pump and pipeline.

MPPT operation with Solar power only



Note: Based on the application requirement, pump ON-OFF can be controlled by parameter 79.10 Operating mode. During an ON command to the drive, the flow rate depends on the power availability as explained in the above graph.

MPPT operation with both Solar and AC grid or generator power

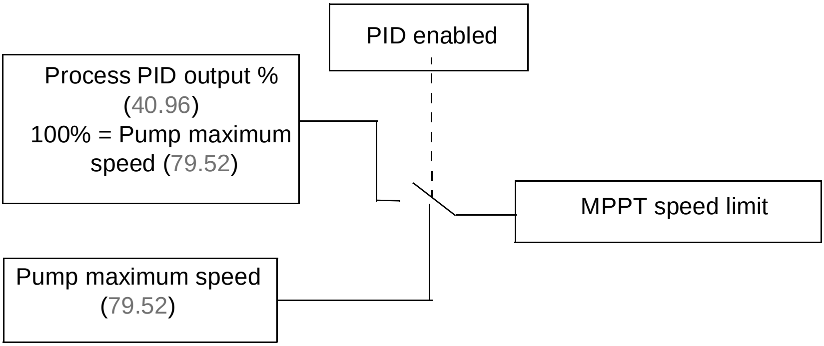


Note: Based on the application requirement, pump ON-OFF can be controlled by parameter 79.10 Operating mode. During an ON command to the drive, the flow rate depends on the power availability as explained in the above graph.

Use of PID output as MTTP speed limit

In normal MPPT operation, the maximum pump speed defined in the parameter 79.52 Pump maximum speed is used as the maximum speed limit for MPPT operation. When PID is enabled, the PID output generated by the PID set 1

(40.96) is used as the speed limit instead of the defined maximum pump speed (79.52).



Settings

Parameter group 79 Solar pump control (page 226) and 40 Process PID set 1 (page 190).

Solar pump control

The solar pump control feature can be used to select one of five operation modes of the solar pump drive-in parameter.

The drive

- starts when the actual DC bus voltage is equal to or greater than PV cell minimum voltage (79.42)
- stops when the actual DC bus voltage is less than PV cell minimum voltage (79.42).

The maximum voltage at which the drive trips (D4B1 PV max volt) can be defined with parameter 79.43 PV cell max voltage. The voltage at which the water motor pump starts or stops is defined with parameter 79.41 Start DC voltage.

The pump

- starts when the actual DC bus voltage is equal to or greater than the voltage defined in the Start DC voltage (79.41)
- stops when the actual DC bus voltage is less than Start DC voltage (79.41).

To make sure that drive is ready and has sufficient DC voltage to start running the pump motor, the value of parameter 79.41 Start DC voltage value should be equal or higher than 79.42 PV cell min voltage.

Note: The drive must be kept in external mode for the below modes. MPPT control program functions only in external mode.

The ACQ80 drive has the below five pump control modes:

1. Auto

   The auto mode can be used to start and stop the pump automatically based on the values set in parameter 79.41 Start DC voltage, 79.42 PV cell min voltage, and 79.43 PV cell max voltage.

2. Manual In1 Start; Stop

   In Manual In1 Start; Stop mode, the drive starts and stops by the DI selected in parameter 79.11 Manual input source 1. This mode can be used to start and stop the pump with an external selector switch.

3. Manual In1P Start; In2 stop

   In the Manual In1P Start; In2 stop mode, the drive starts with the pulse command from the DI selected in the parameter 79.11 Manual input source 1 and stops with the DI selected in the parameter 79.12 Manual input source 2. This mode can be used to start and stop the pump with two separate push buttons.

4. Fieldbus A

   With the Fieldbus A mode, the drive can be started and stopped with the fieldbus device. You can define the embedded fieldbus parameters in the parameter group 50 Fieldbus adapter (FBA) and the start/stop command can be provided from the control bit of the fieldbus device which is connected to the drive.

   The speed references are provided by MPPT. For more information, see section Flow calculation on page 45.

5. Embedded fieldbus

   With the Embedded fieldbus mode, the drive can be started and stopped with the embedded fieldbus. You can define the fieldbus adapter parameters in the parameter group 58 Embedded fieldbus and the start/stop command can be provided from the control bit of the fieldbus device which is connected to the drive.

Flow calculation

The flow calculation function provides calculation of flow without the installation of separate flow meter.

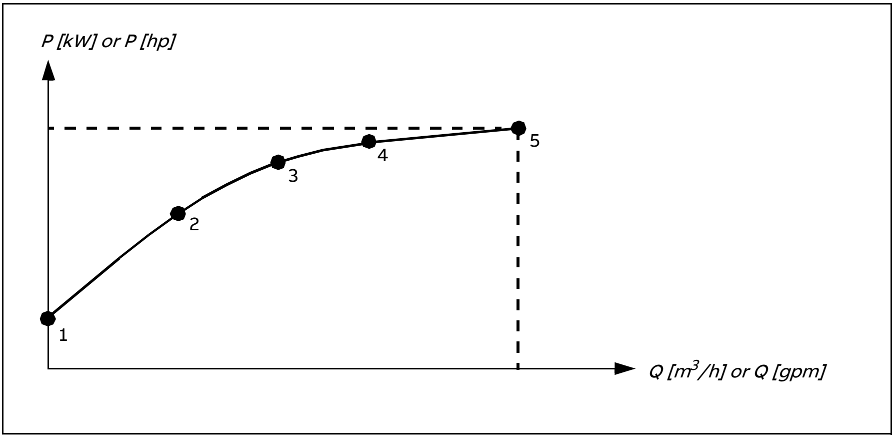
There are three types of flow calculation:

1. DI based flow calculation

The DI based flow calculation is used when the pump has sensors that provides pulse count for each flow of one liter water. The drive performs the flow calculation based on the inputs from the sensors.

2. PQ (power/flow) curve based flow calculation

In the PQ curve based flow calculation, the user can define a PQ (power/flow) performance curve that is used as the basis for the calculation or a differential pressure based flow feedback. The figure below shows the PQ performance curve of the pump for the flow calculation function.



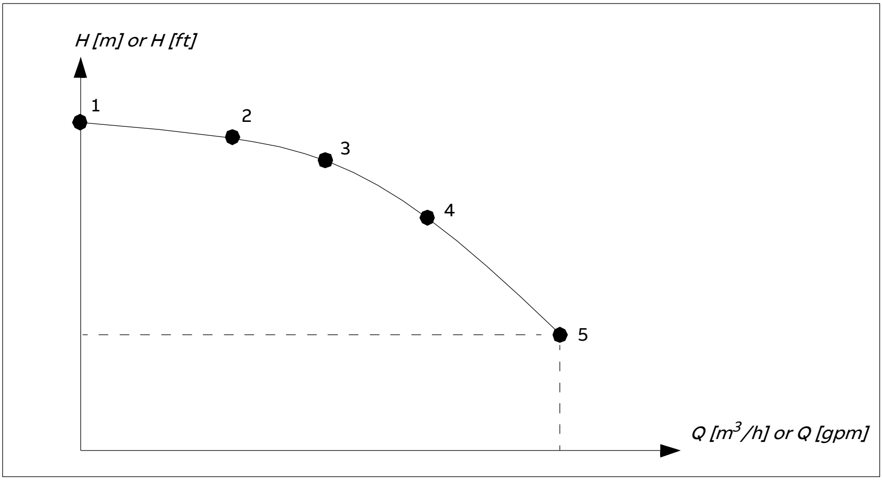
Notes:

- The flow calculation function cannot be used for invoicing purposes.
- The flow calculation function cannot be used outside the normal operating range of the pump.
- Power points in PQ curve are expected to be in ascending order (P1 < P2 < P3 < P4 < P5).
- Flow points in PQ curve are expected to be in ascending order (Q1 < Q2 < Q3 < Q4 < Q5).

3. HQ (head/flow) curve based flow calculation

In the HQ curve based flow calculation, the user can define a HQ (head/flow) performance curve that is used as the basis for the calculation or a differential pressure based flow feedback.

The figure below shows the HQ performance curve of the pump for the flow calculation function.



Settings

Parameter group 80 Flow calculation (page 231) and 81 Sensor settings (page 237)

Pump cleaning

The pump cleaning function is mainly used to clean pumps whenever a blockage occurs in the pump. This function consists of a programmable sequence of forward rotation of the pump and helps to remove any residue or rags on the impeller or piping.

Note: Pump cleaning function works only in external mode.

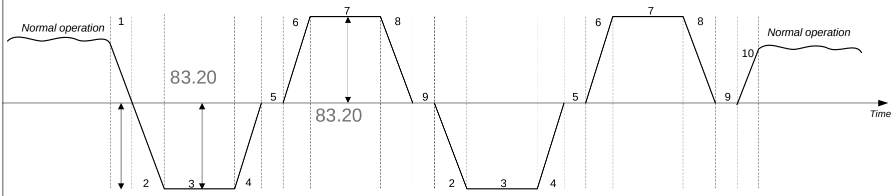
The main features of pump cleaning function are:

- prevents blockages and decreases the need of manual cleaning
- increases the lifetime of the pump, pipes and impellers, and
- improves energy efficiency of the system.

Pump cleaning sequence

The drive starts cleaning with a pulse in the opposite direction of the running direction. The speed step size is same for both positive and negative directions.

The pump cleaning sequence can have several positive direction speed steps in one cleaning sequence.



Sequence	Parameter	Sequence	Parameter
1	83.26 Time to zero-speed	6	83.25 Time to cleaning speed
2	83.25 Time to cleaning speed	7	83.27 Cleaning on time
3	83.27 Cleaning on time	8	83.26 Time to zero-speed
4	83.26 Time to zero-speed	9	83.28 Cleaning off time
5	83.28 Cleaning off time	10	83.25 Time to cleaning speed

When the negative speed is not allowed, the drive ignores phases 1…4.

Note: Cleaning in a negative direction requires negative minimum speed/frequency in parameter 30.11 Minimum speed / 30.13 Minimum frequency.

Cleaning sequence steps

1. The pump system meets the triggering conditions as per the operating mode (83.12) selected. At this condition, normal operation stops and the drive uses the target time defined in parameter 83.26 Time to zero-speed to reach zero speed.
2. Cleaning speed is defined by parameter 83.20 Cleaning speed step.
3. Initially, the pump runs in negative direction. The pump runs at cleaning speed for the time defined by parameter 83.27 Cleaning on time.
4. The pump decelerates to zero-speed. Time to zero speed is defined by parameter 83.26 Time to zero-speed.
5. The pump is stopped until parameter 83.28 Cleaning off time is elapsed.
6. The pump accelerates the pump speed to positive direction. See parameter 83.25 Time to cleaning speed.
7. The pump runs at the positive cleaning speed. See parameter 83.27 Cleaning on time.
8. The pump decreases the pump speed back to zero defined by parameter 83.26 Time to zero-speed.

9. The drive waits until the parameter 83.28 Cleaning off time is elapsed. A new cleaning sequence starts or normal operation starts.
10. The pump starts following speed/frequency reference of the active control location. During acceleration to speed/frequency, the drive follows pump cleaning acceleration time 83.25 Time to cleaning speed.

The operation of cleaning sequence is based on the selected triggering conditions. See diagram on page 47.

You can start the pump cleaning sequence as follows:

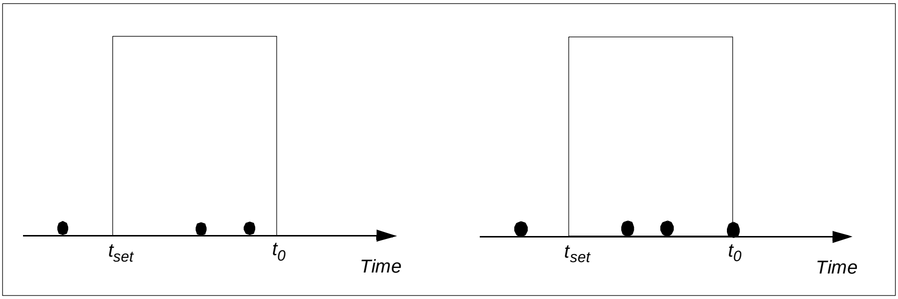
- On every start and stop.
- With DI4, DI5 or DI6.
- Based on the pump condition. For example, Supervision 1...3. See parameter group 32 Supervision.
- Based on time interval defined by parameter 83.15 Fixed time interval. For example, at every 10 hours.
  Note: Pump cleaning is executed only once for every start after time is elapsed.
- Based on real time clock (for example, at 01h:00min:00s) defined by parameter 34.100 Timed function 1 and based on timer configurations defined by parameters 34.10 Timed functions enable to 34.90 Exception day 16.
- By selecting Start cleaning now in parameter 83.12 Start pump cleaning.
  Notes:
  - The start command is released automatically by firmware and is independent of drive start command.
  - Pump cleaning can be interrupted by removing the configured trigger.
  - After pump cleaning cycles, normal pump operation is not automatically resumed even when start command is active. You need to remove the trigger manually and an acknowledgment of pump cleaning must be given each time.
  - If parameter 83.12 Start pump cleaning is set to Start cleaning now, then after the pump cleaning cycle is completed, the drive resumes normal operation.
  - If pump cleaning is triggered using parameter 83.12 Start pump cleaning and parameter 83.11 Pump cleaning triggers is activated at the same time, then priority is given to parameter 83.12 Start pump cleaning.
  - In local mode, no warnings are generated when trigger from parameter 83.12 Start pump cleaning is active. However, when the drive is switched to external mode and the trigger is active, then the pump cleaning is automatically started.

- The following triggers are used for parameter 83.12 Start pump cleaning:
  - Manually (With DI4, DI5 or DI6 defined by parameter 83.12 Start pump cleaning)
  - Through fieldbus or from control panel, with parameter 83.12 Start pump cleaning. To start a cleaning cycle, set the parameter to a value of 1 or select Start cleaning now from the fieldbus.

Cleaning count monitoring

The cleaning count monitoring function calculates the number of cleaning cycles inside a user-defined monitoring window. Too frequent cleaning attempts may indicate a pump problem (such as blockage) that the pump cleaning function cannot solve alone but it requires manual inspection and cleaning. The following figures describes the operation of cleaning count monitoring.

For example, set the cleaning count time to one hour. The pump cleaning function trips on a fault if it detects too frequent cleaning cycles. The drive completes three pump cleaning cycles. The drive continuous its operation as long as the time interval between three cleanings are over the user defined value (one hour).



The third pump cleaning cycle starts within the preset count time (one hour) and the pump cleaning function trips on a fault and the pump is stopped without performing the third cleaning cycle. After reseting fault, the drive starts with the third pump cleaning cycle.

If the parameter 83.35 Cleaning count fault is set to No action, supervision is not executed. If you change the parameter 83.35 Cleaning count fault to Warning or Fault, the pump cleaning count starts from zero.

When the pump cleaning function is active and maximum number of cycles per time unit is reached, the drive displays a warning which appears in the event log.

Time scheduled pump cleaning

Time scheduled pump cleaning allows you to clean the pump at the desired time. When the time scheduled pump cleaning is enabled and the present time is equal to the user mentioned time, the normal operation stops and the pump cleaning starts automatically.

You can enter a maximum of five different times of a day in the parameters 83.41 Pump cleaning time 1....83.45 Pump cleaning time 5 and schedule the pump cleaning. Setting the time in ascending order or descending order is not mandatory and you can set any time as per your need. Cleaning is activated only if the drive start command is already active i.e. drive is in running state.

If drive is not running at the defined time, the drive skips the cleaning schedule of that particular time. If a pump cleaning operation is ongoing and any of the remaining defined time matches the present time, the cleaning operation does not stop and ignores the pump cleaning trigger. After the pump cleaning, the normal pump operation starts.

Notes:

- A warning A6A7 System time not set is generated, if the system time is not set properly and time scheduled pump is activated.
- If 83.10 Pump cleaning action = Warning only and the time scheduled pump cleaning is running based on the set time, the drive does not generate the warning D507 Pump cleaning needed.

Settings

Parameter group 83 Pump cleaning (page 242).

Dry run protection

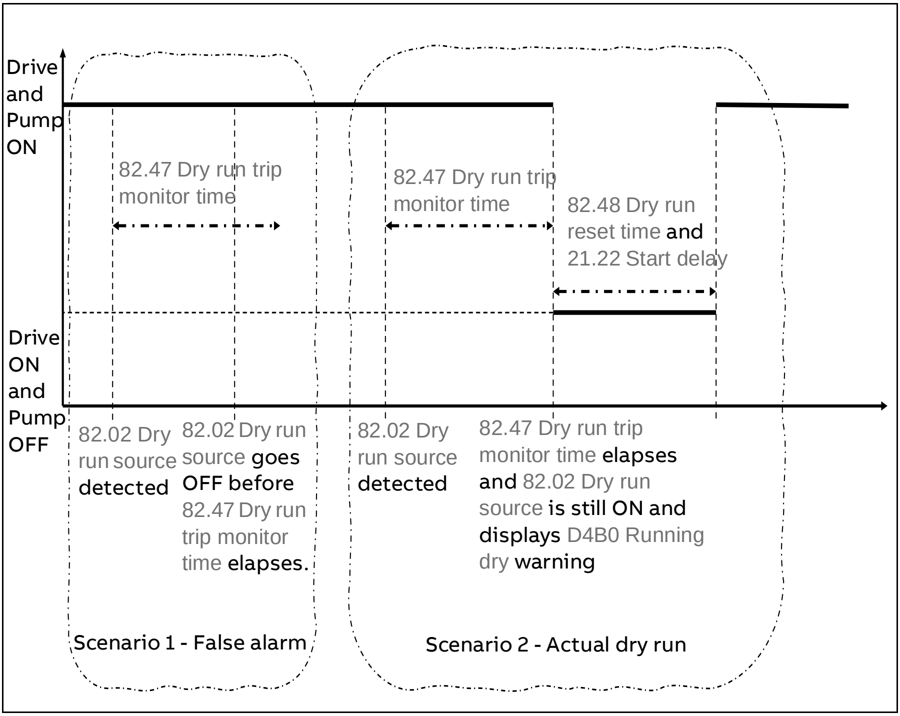
The dry run protection function automatically detects and avoids running of a pump with no flow of water in the pump. The dry run protection can be activated through one of the following methods:

- Using DI
- Using minimum load current

Dry run protection using DI

The dry run protection using DI (82.02 Dry run source = any DI), detects the dry run condition of the pump based on the digital signals received from the sensors. The drive trips on fault D4B0 Running dry whenever the sensor detects the dry run condition and sends the digital input value true to the drive.

Note: Fault D4B0 cannot be reset until selected DI in parameter 82.02 Dry run source is low.



Dry run protection through minimum load current

The dry run protection through minimum load current (82.02 Dry run source = Min load current) detects the dry run condition of the pump based on the minimum load current value defined in the parameter 82.46 Dry run current limit.

The drive trips on the fault D4B0 Running dry whenever the

- actual current of the motor is less than the dry run current limit set in parameter 82.46 Dry run current limit,
- actual speed of the motor is greater than the minimum speed set in parameter 79.51 Pump minimum speed, and
- both the conditions exists for the time set in parameter 82.47 Dry run trip monitor time.

You can define the fault reset time with parameter 82.48 Dry run reset time.

Settings

Parameter group 82 Pump protections (page 239).

Pump inlet and outlet protection

The Pump inlet and outlet protection function monitors pump inlet and outlet pressure and takes the user defined actions in case the pressure is outside the normal range.

The inlet and outlet minimum pressure protection function can first generate a warning when the pump pressure is below minimum pressure warning level for pressure check delay time. If the pressure continues to fall below the minimum pressure fault level, a fault is generated.

The outlet maximum pressure protection function can first generate a warning when the pump outlet pressure is above maximum pressure warning level for pressure check delay time. If the pressure continues to rise above the maximum pressure fault level, a fault is generated.

Settings

Parameter group 81 Sensor settings (page 237) and 82 Pump protections (page 239).

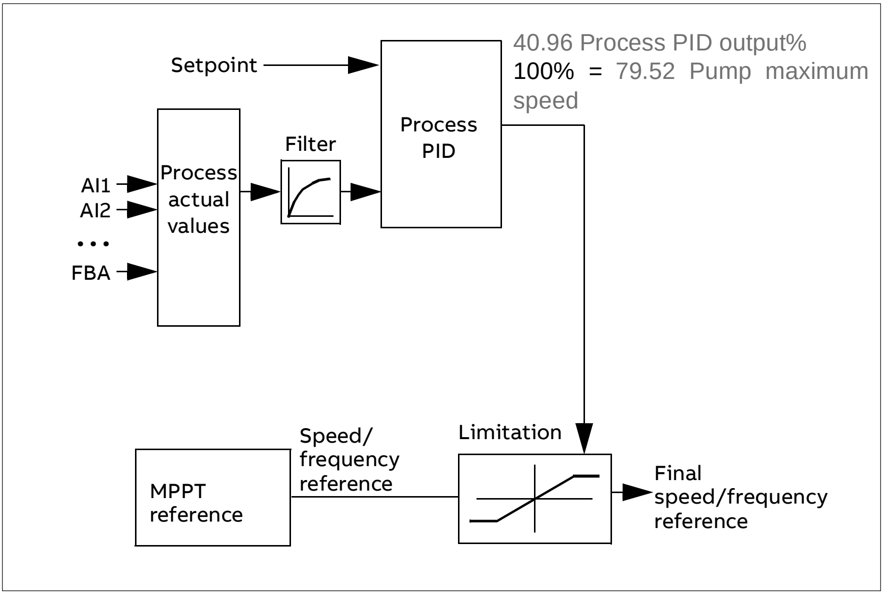
Process PID control

The drive has a built-in process PID controller that controls process variables such as pressure or pipe flow or fluid level in a container.

The process PID control has the following features:

- Uses the process reference/setpoint (water pressure or flow) as an alternative to the speed reference.
- The actual value or the process feedback is the actual measured value fed back to the drive.
- The PID control adjusts the drive speed to maintain the measured process quantity (actual value) at the setpoint.
- Enables the drive to adjust its operation according to the process feedback. Thus the user need not set the speed/frequency reference.

The simplified block diagram below illustrates the process PID control.



Note: When PID is enabled, the PID output generated by the PID set 1 (40.96) is used as a reference limiter for speed/frequency reference generated from MPPT algorithm.

Tracking

In tracking mode, the PID block output is set directly to the value of parameter 40.50 Set 1 tracking ref selection. The internal I term of the PID controller is set so that no transient is allowed to pass on to the output, so when the tracking mode is left, normal process control operation can be resumed without a significant bump.

Settings

- **Menu - Primary settings - PID - PID output**
- Parameter groups 40 Process PID set 1 (page 190).

Motor control

Motor types

The drive supports asynchronous AC induction and permanent magnet (PM) motors.

Motor identification

The performance of vector control is based on an accurate motor model determined during the motor start-up.

A motor identification magnetization is automatically performed for the first time when the start command is given. During this first startup, the motor is magnetized at zero speed for several seconds and the motor and motor cable resistance are measured to allow the motor model to be created. This identification method is suitable for most applications.

In some applications a separate identification run (ID run) can be performed.

Settings

99.13 ID run requested (page 268).

Scalar motor control

Scalar motor control is the default motor control method. In scalar control mode, the drive is controlled with a frequency reference.

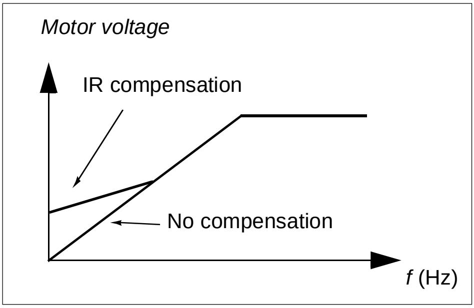
ABB recommends to activate the scalar motor control mode in the following situations:

- If the exact nominal motor values are not available or the drive needs to run different motors after commissioning.
- If a short commissioning time is needed.
- If the application does not require the best possible motor control performance.
- If the nominal current of the motor is less than 1/6th of the nominal output current of the drive.
- If the drive is used without a motor connected (for example, for test purposes).
- If the drive runs a medium-voltage motor through a step-up transformer.
- If the drive is equipped with a sine filter.

Note: Performance of the vector control is not achieved in scalar control.

See also section Operating modes of the drive (page 37).

IR compensation for scalar motor control



IR compensation (also known as voltage boost) is available only when the motor control mode is scalar. When IR compensation is activated, the drive gives an extra voltage boost (based on the available DC Voltage) to the motor at low speeds. IR compensation is useful in applications, such as positive displacement pumps, that require a high break-away torque.

Note: IR compensation is not possible or required in vector control. The compensation is applied automatically.

Settings

- **Menu - Primary settings - Motor - Control mode**
- Parameters 99.04 Motor control mode (page 264) and 99.13 ID run requested (page 268), and 97.13 IR compensation (page 260).
- Parameter group 28 Frequency reference chain (page 137).

Vector control

Vector control is the motor control mode that is intended for applications where high control accuracy is needed. It offers better control over whole speed range, in particular in applications where slow speed with high torque is needed. It requires an identification run at start-up. Vector control cannot be used in all applications, for example, when sine filters are being used or there are multiple motors connected to single drive.

The switching of the output semiconductors is controlled to achieve the required stator flux and motor torque. The reference value for the torque controller comes from the speed controller.

Stator flux is calculated by integrating the motor voltage in vector space. Rotor flux can be calculated from stator flux and the motor model. Motor torque is produced by controlling current 90 degrees from the rotor flux. By utilizing the identified motor model, the rotor flux estimate is improved. Actual motor shaft speed is not needed for the motor control.

Note: Permanent motors must use vector control and back EMF. This value should be entered in the parameter 99.07 Motor nominal voltage.

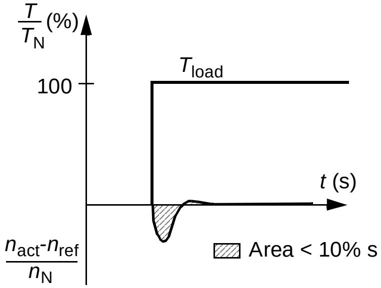
Settings

- **Menu - Primary settings - Motor - Control mode**
- Parameter 99.04 Motor control mode (page 264) and 99.13 ID run requested (page 268).

Speed control performance

The figure below shows the typical speed control performance.

Speed control	Performance
Static accuracy	20% of motor nominal slip
Dynamic accuracy	< 10% s with 100% torque step (with default speed controller tuning)
Tuned speed controller	< 2% s with 100% torque step



T_N = rated motor torque
n_N = rated motor speed
n_{act} = actual speed
n_{ref} = speed reference

Switching frequency

The drive has two switching frequency settings: reference switching frequency and minimum switching frequency. The drive tries to keep the highest allowed switching frequency (= reference switching frequency) if thermally possible, and then adjusts dynamically between the reference and minimum switching frequencies depending on the drive temperature. When the drive reaches the minimum switching frequency (= lowest allowed switching frequency), it starts to limit output current if the heating up continues.

For derating, see chapter *Technical data*, section Switching frequency derating in the *Hardware manual* of the drive.

Example 1: If you need to fix the switching frequency to a certain value with some external filters as required, set both the reference and the minimum switching frequency to this value and the drive will retain this switching frequency.

Example 2: If the reference switching frequency is set to 12 kHz and the minimum switching frequency is set to the smallest available value, the drive maintains the highest possible switching frequency to reduce motor noise and only when the drive heats up it will decrease the switching frequency. This is useful, for example, in applications where low noise is necessary but higher noise can be tolerated when the full output current is needed.

Settings

Parameter 97.01 Switching frequency reference and 97.02 Minimum switching frequency (page 246).

Safety and protections

■ Fixed/standard protections

Overcurrent

If the output current exceeds the internal overcurrent limit, the IGBTs are shut down immediately to protect the drive.

Drive temperature

If the temperature rises high enough, the drive first starts to limit the switching frequency and then the current to protect itself. If it is still keeps heating up, for example because of a fan failure, an overtemperature fault is generated.

Short circuit

In case of a short circuit, the IGBTs are shut down immediately to protect the drive.

■ Motor thermal protection

The control program features two separate motor temperature monitoring functions. The temperature data sources and warning/trip limits can be set up independently for each function.

The motor temperature can be monitored using

- the motor thermal protection model (estimated temperature derived internally inside the drive), or
- sensors installed in the windings. This will result in a more accurate motor model.

Motor thermal protection model

The drive calculates the temperature of the motor on the basis of following assumptions:

1. When power is applied to the drive for the first time, the motor is assumed to be at ambient temperature (defined by parameter 35.50 Motor ambient

temperature). After this, when power is applied to the drive, the motor is assumed to be at the estimated temperature.

2. Motor temperature is calculated using the user-adjustable motor thermal time and motor load curve. The load curve should be adjusted in case the ambient temperature exceeds 30°C.
3. The motor thermal model can be used only when one motor is connected to the drive.

Insulation

⚠ **WARNING!** IEC 60664 requires double or reinforced insulation between live parts and the surface of accessible parts of electrical equipment which are either non-conductive or conductive but not connected to the protective earth.

To fulfil this requirement, connect a thermistor to the drive’s control terminals using any of these alternatives:

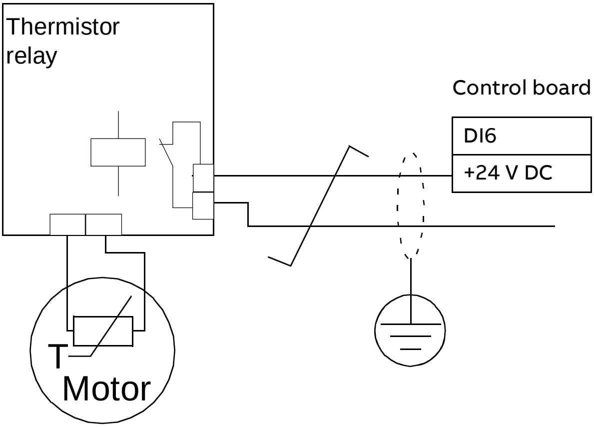
- Separate the thermistor from live parts of the motor with double reinforced insulation.
- Protect all circuits connected to the drive’s digital and analog inputs. Protect against contact, and insulate from other low voltage circuits with basic insulation (rated for the same voltage level as the drive’s main circuit).

Use an external thermistor relay. The relay insulation must be rated for the same voltage level as the drive’s main circuit

Temperature monitoring using thermistor relays

A normally closed or a normally open thermistor relay can be connected to digital input DI6.

See section Insulation on page 59.



Settings

Parameter group 35 Motor thermal protection (page 177).

Programmable protection functions

External events (parameters 31.01...31.10)

Five different event signals from the process can be connected to selectable inputs to generate trips and warnings for the driven equipment. When the signal is lost, an external event (fault, warning, or a mere log entry) is generated.

Motor phase loss detection (parameter 31.19)

The parameter selects how the drive reacts whenever a motor phase loss is detected.

Earth (Ground) fault detection (parameter 31.20)

Note that

- an earth fault in the supply cable does not activate the protection
- in a grounded supply, the protection activates within 2 milliseconds
- in an ungrounded supply, the supply capacitance must be 1 microfarad or more
- the capacitive currents caused by shielded motor cables up to 300 meters will not activate the protection
- the protection is deactivated when the drive is stopped.

Safe torque off detection (parameter 31.22)

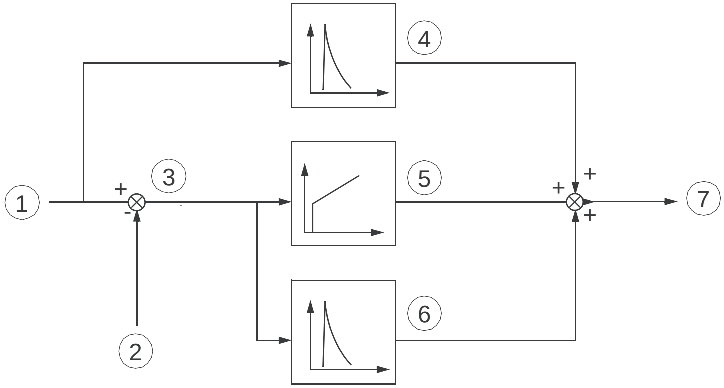
The drive monitors the status of the Safe torque off input, and this parameter selects which indications are given when the signals are lost. (The parameter doe … nore info … Safe torq

Swa

The … tally (for … rive). The

Cur

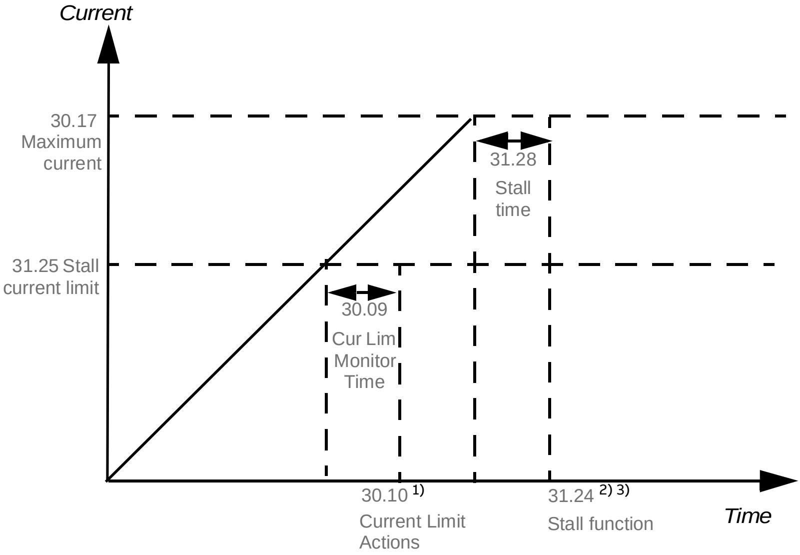
The … s, and help … , mor … be set in the parameters 30.17 Maximum current, 30.09 Cur Lim Monitor Time, and 30.10 Current Limit Actions respectively.



By default, when the drive reaches the maximum current limit and exceeds the monitor time, a warning message (A8B6) is displayed.

Stall function (parameters 31.24…31.28)

The drive monitors the stall current limit and its related parameters, and helps to prevent stalling of the motor. You can adjust the supervision limits (current, frequency and time) and choose how the drive reacts to a stall condition.



Notes

1) By default, displays a warning message when the drive reaches maximum current limit (30.17) and exceeds the current limit monitor time (30.09). You can configure the actions as required.

2) The stall condition occurs when the output frequency is below the level set by parameter 31.27 Stall frequency limit or the motor speed is below the level set by parameter 31.26 Stall speed limit.

3) If enabled, displays a warning message when the drive reaches stall current limit (30.17) and exceeds the stall time (31.28). You can configure the actions as required. By default, stall protection is enabled.

Overspeed protection (parameter 31.30)

The user can set overspeed limits by specifying a margin that is added to the present maximum and minimum speed limits.

Local control loss detection (parameter 49.05)

The parameter selects how the drive reacts to a control panel or PC tool communication break.

AI supervision (parameters 12.03…12.05)

The parameters select how the drive reacts when an analog input signal moves out of the minimum and/or maximum limits specified for the input. This can be due to broken I/O wiring or sensor.

Fan control (95.200)

Fan control prevents overheating and dust accumulation in the drive. The user can set the fan to run continuously in maximum speed (Always On [1]) or can set to run the fan in a controlled mode (Auto[0]), as per the load speed.

Automatic fault resets

The default fault reset time can be set in parameter 79.61 Fault reset time. When the drive trips due to

- undervoltage fault,
- PV cell maximum voltage fault, or
- when actual speed decreases below the minimum motor speed defined in the parameter 79.51 Pump minimum speed,

the drive waits for the defined time and then resets the fault automatically.

⚠ **WARNING!** Before you activate the function, make sure that no dangerous situations can occur.

The function resets the drive automatically and continues operation after a fault.

Settings

Parameters 79.51 Pump minimum speed, 79.61 Fault reset time (page 231).

Emergency stop

The emergency stop signal is connected to the input selected with parameter 21.05 Emergency stop source. An emergency stop can also be generated through fieldbus (parameter 06.01 Main control word, bits 0…2).

The emergency stop mode is selected by parameter 21.04 Emergency stop mode. The following modes are available:

- Off1: Stop along the standard deceleration ramp defined for the particular reference type in use
- Off2: Stop by coasting
- Off3: Stop by the emergency sto0p ramp defined by parameter 23.23 Emergency stop time.

Notes:

- The installer of the equipment is responsible for installing the emergency stop devices and all additional devices needed for the emergency stop function to fulfill the required emergency stop categories. For more information, contact your local ABB representative.
- After an emergency stop signal gets detected, the emergency stop function is activated and is not canceled even if the signal gets canceled.
- If the minimum (or maximum) torque limit is set to 0%, the emergency stop function may not be able to stop the drive.

Settings

Parameters 21.04 Emergency stop mode (page 125), 21.05 Emergency stop source (page 126) and 23.23 Emergency stop time (page 131)

Diagnostics

Signal supervision

Six signals can be selected to be supervised by this function. Whenever a supervised signal exceeds or falls below predefined limits, a bit in 32.01 Supervision status is activated, and a warning or fault generated.

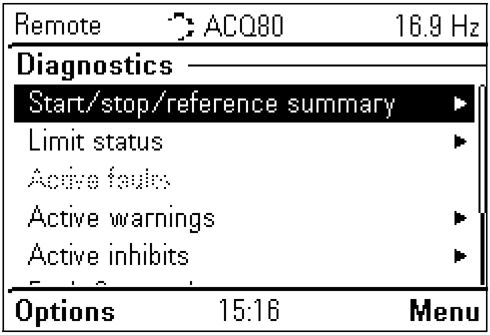
For example, if user wants to monitor DC voltage and generate a warning/fault message if it exceeds certain limit, he/she can select DC Voltage [7] in the parameter 32.07 Supervision 1 signal, set low/high limit in the parameter 32.09/32.10 and set the action in the parameter 32.06 Supervision 1 action.

The supervised signal is low-pass filtered.

Settings

Parameter group 32 Supervision (page 152).

Diagnostics menu



The **Diagnostics** menu provides quick information on active faults and warnings, and helps you to resolve potential problems. To go the **Diagnostics** menu from the Home view, select **Menu - Diagnostics**.

The table below provides detailed information about the contents of the different views available in the **Diagnostics** menu.

Menu item	Description
Start, stop, reference summary	This view shows where the drive is currently taking its start and stop commands and reference. The view is updated in real time. If the drive is not starting or stopping as expected, or runs at an undesired speed, use this view to find out where the control comes from.

Menu item	Description
Limit status	This view describes any limits currently affecting operation. If the drive is running at undesired speed, use this view to find out if any limitations are active.
Active faults	This view shows the currently active faults and provides instructions on how to fix and reset them.
Active warnings	This view shows the currently active warnings and provides instructions on how to fix them.
Active inhibits	This view shows up to five simultaneous active start inhibits and how to fix them.
Fault & event log	This view lists the faults, warnings and other events that have occurred in the drive. Press **Details** to see, for each stored fault, the fault code, time and values of parameters (actual signals and status words) 05.80…05.88 stored at the time of the fault.
Fieldbus	This view provides status information and sent and received data from fieldbus for troubleshooting.
Load profile	This view provides status information regarding load distribution (that is, how much of the drive's running time was spent on each load level) and peak load levels.

Load analyzer

Peak value logger

The user can select a signal to be monitored by a peak value logger. The logger records the peak value of the signal along with the time the peak occurred, as well as motor current, DC voltage and motor speed at the time of the peak. The peak value is sampled at 2 ms intervals.

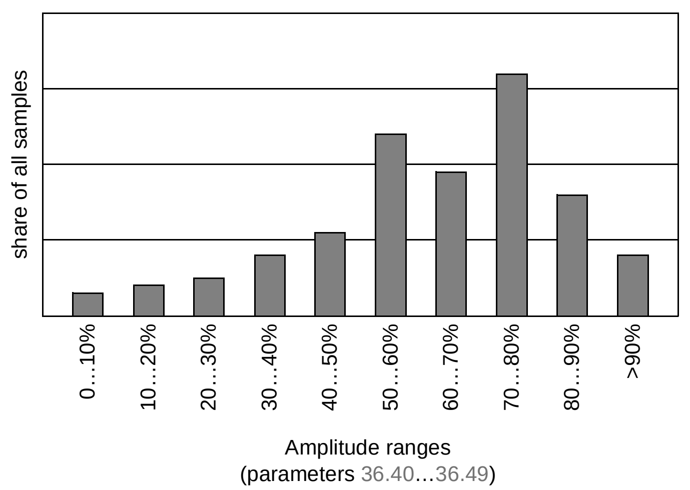
Amplitude loggers

The control program has two amplitude loggers.

For amplitude logger 2, the user can select a signal to be sampled at 200 ms intervals, and specify a value that corresponds to 100%. The collected samples are sorted into 10 read-only parameters according to their amplitude.

- Parameter 1 shows the share of samples that have fallen in range 0… 10% of the reference value during the time that the logging has been active.
- Parameter 2 shows that share of samples that have fallen in range 10…20% of the reference value during the time that the logging has been active
- etc.

You can view this graphically with the assistant panel or the Drive composer PC tool.



Amplitude logger 1 is fixed to monitor motor current, and cannot be reset. With amplitude logger 1, 100% corresponds to the maximum output current of the drive (I_{max}). The maximum output current values are listed in the section *Ratings* in the *Hardware manual* of the drive. The measured current is logged continuously. The distribution of samples is shown by parameters 36.20…36.29.

Settings

Parameter group 36 Load analyzer (page 186).

Miscellaneous

Backup and restore

You can make backups of the settings manually to the assistant control panel. The assistant control panel also keeps one automatic backup. You can restore a backup to another drive, or a new drive replacing a faulty one. You can make backups and restore on the control panel or with the Drive composer PC tool.

Backup

Manual backup

Make a backup when necessary, for example, after you have started up the drive or when you want to copy the settings to another drive.

Parameter changes from fieldbus interfaces are ignored unless you have forced parameter saving with parameter 96.07 Parameter save manually.

Automatic backup

The control panel has a dedicated space for one automatic backup. An automatic backup is created two hours after the last parameter change. After completing the backup, the panel waits for 24 hours before checking for additional parameter changes. If any changes exist, it creates a new backup overwriting the previous one when two hours have passed after the latest change.

Notes:

- You cannot adjust the delay time or disable the automatic backup function.
- Parameter changes from fieldbus interfaces are ignored unless you have forced parameter saving with parameter 96.07 Parameter save manually.

Restore

The backups are shown on the panel.

- Automatic backup is marked with icon 🄰 and
- Manual backup is marked with icon 🗋.

To restore a backup, select it and press ▶. In the following display you can view backup contents and restore all parameters or select a subset to be restored.

Note: To restore a backup, the drive must be in Local control.

Settings

Menu - Backups

Parameter 96.07 Parameter save manually (page 250).

User parameter sets

The drive supports four user parameter sets that can be saved to the permanent memory and recalled using drive parameters. It is also possible to use digital inputs to switch between user parameter sets. To change a user parameter set, make sure the drive is not modulating.

A user parameter set contains all editable values in parameter groups 10…99 except the following:

- forced I/O values such as parameters 10.03 DI force selection and 10.04 DI forced data
- I/O extension module settings (group 15)
- fieldbus communication settings (groups 50…53 and 58)
- parameter 95.01 Supply voltage.

As the motor settings are included in the user parameter sets, make sure the settings correspond to the motor used in the application before recalling a user set. In an application where different motors are used with the drive, perform the motor ID run with each motor and the save the results in different user sets. The appropriate set can then be recalled when the motor is switched on.

Settings and diagnostics

Parameters: 10.03 DI force selection…10.04 DI forced data (page 101), 95.01 Supply voltage (page 246) and 96.10 User set status…96.13 User set I/O mode in1 (page 254)

Event: 64B2 User set fault (page 331).

User lock

For better cyber security, it is highly recommended that you set a master pass code to prevent changing of parameter values and/or the loading of firmware and other files.

WARNING! ABB will not be liable for damages or losses caused by the failure to activate the user lock using a new pass code. See The frame is marked on the type designation label attached to the drive, see section Type designation label in the hardware manual of the drive.

To activate the user lock for the first time:

- Enter the default pass code, 10000000, into 96.02 Pass code. This will make parameters 96.100…96.102 visible.
- Enter a new pass code into 96.100 Change user pass code. Always use eight digits, if using Drive composer PC tool. Finish with Enter.
- Confirm the new pass code in 96.101 Confirm user pass code.

⚠ **WARNING!** Store the pass code in a safe place – even ABB cannot open the user lock if the pass code is lost.

- In 96.102 User lock functionality, define the actions that you want to prevent (ABB recommends to select all the actions unless otherwise required by the application).
- Enter an invalid pass code into 96.02 Pass code.
- Activate 96.08 Control board boot, or cycle the power to the drive.
- Make sure that the parameters 96.100…96.102 are hidden. If they are not, enter another random pass code into 96.02 Pass code.

To reopen the lock, enter your pass code into 96.02 Pass code. This will again make parameters 96.102…96.102 visible.

Settings

Parameters 96.02 (page 249) and 96.100…96.102 (page 257).

Sine filter support

With a sine filter connected to the output of the drive, the drive must use scalar motor control mode, and limit the switching and output frequencies to

- prevent the drive from operating at filter resonance frequencies, and
- protect the filter from overheating.

When using ABB sine filters (available separately), this is done automatically when you switch bit 1 of 95.15 Special HW settings on.

Contact your local ABB representative before connecting a sine filter from another manufacturer.

Settings

Parameter 95.15 Special HW settings (page 247).

Dead-band function

With the Dead-band function, you can freeze the AI reference for a defined area (that is, dead-band) or ignore a low AI reference caused by possible electromagnetic interference issues.

In voltage mode:

AI dead band value = 10V* AI dead band (12.110) * 0.01

In current mode:

AI dead band value = 20mA* AI dead band (12.110) * 0.01

In addition, 10% of the dead-band value is added as dead-band hysteresis positive and negative. This value is internally set in the firmware and cannot be changed.

$$\text{AI Hysteresis} = \text{AI dead-band value} \times 10\%$$

Notes: AI dead-band (12.110) is applicable for both AI1 and AI2.**Example of using dead-band in AI1 (voltage mode)**

If,

12.15 AI1 unit selection = V

12.110 AI dead band = 50

12.18 AI1 max = 0 - 10 V

then,

AI dead-band value = 10 * 50 * 0.01 = 5 V

AI Hysteresis value = 5 * 0.1 = 0.5 V

Hysteresis positive value = 5 + 0.5 = 5.5 V

Hysteresis negative value = 5 - 0.5 = 4.5 V

When AI1 input voltage increases, up to 5.5 V, the AI1 actual value (12.11) displays zero. After AI1 input voltage reaches 5.5 V, the AI1 actual value displays 5.5 V and continues to display the detected value up to the maximum AI1 value10 V (12.18).

When AI1 input voltage decreases, the AI1 actual value displays the detected value up to 4.5 V. From 4.5 V to zero, the AI1 actual value displays Zero till it reaches 0V.

Example of using dead-band in AI1 (current mode)

If,

12.15 AI1 unit selection = mA

12.110 AI dead band = 50

12.18 AI1 max = 0 - 20 mA

then,

AI dead-band value = 20 * 50 * 0.01 = 10 mA

AI Hysteresis value = 10 * 0.1 = 1.0 mA

Hysteresis positive value = 10 + 1.0 = 11.0 mA

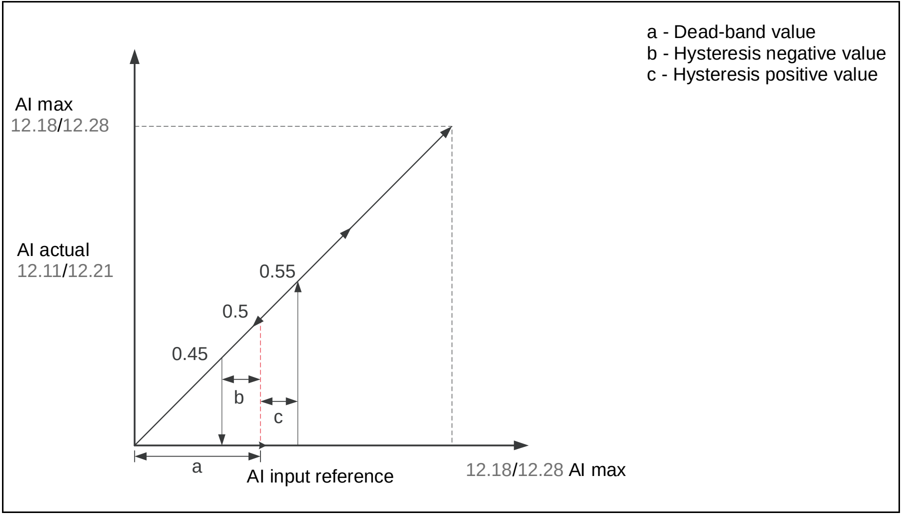
Hysteresis negative value = 10 - 1.0 = 9.0 mA

When AI1 input voltage increases, up to 11 mA, the AI1 actual value (12.11) displays zero. After AI1 input voltage reaches 11 mA, the AI1 actual value displays 11 mA and continues to display the detected value up to the maximum AI1 value 20 mA (12.18).

When AI1 input voltage decreases, the AI1 actual value displays the detected value up to 9.0 mA. From 9.0 mA to zero, the AI1 actual value displays Zero till it reaches 0V.

See the timing diagram below:

Dead-band function timing diagram



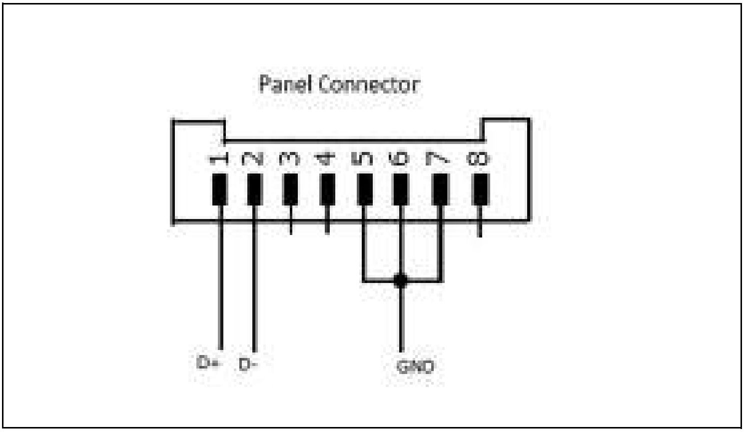
Settings

Parameter 12.110 AI dead band (page 114)

Change panel port to EFB port

You can use panel port as EFB port. To change panel port to EFB port, set parameter 58.01 Protocol enable to Modbus RTU and restart the drive. If the changeover of the panel part to EFB port is success, the drive does not detect control panel within 20 seconds. If the drive detects the control panel, remove the control panel and reboot the drive again.

Cable connection diagram



Notes:

- When an external IO module (RIIO, BIO-01 etc) is connected to drive, this changeover does not happen and only external IO is used for communication.
- This feature is applicable only for R0-R2 frames.

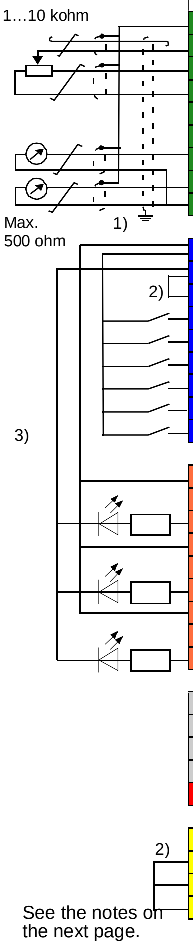
5

Control macros

Contents of this chapter

This chapter describes the default control connections in ACQ80 drives.

Default control connections for the ABB standard macro



X1	Reference voltage and analog inputs and outputs		I/O available in base unit
1	SCR	Signal cable shield (screen)	
2	AI1	Not configured	
3	AGND	Analog input circuit common	
4	+10V	Reference voltage 10 V DC	
5	AI2	Not configured	
6	AGND	Analog input circuit common	
7	AO1	Output frequency: 0...20 mA	
8	AO2	Motor current	
9	AGND	Analog output circuit common	
X2 and X3	**Aux. voltage output and programmable DIs**		
10	+24V	Aux. voltage output +24 V DC, max. 250 mA	x
11	DGND	Aux. voltage output common for DIs	x
12	DCOM	Digital input common for all	x
13	DI1	Not configured	x
14	DI2	Not configured	x
15	DI3	Not configured	
16	DI4	Not configured	
17	DI5	Not configured	
18	DI6	Not configured	
X6, X7, X8	**Relay output**		
19	RO1C	**Ready run** 250 V AC / 30 V DC 2 A	x
20	RO1A		x
21	RO1B		x
22	RO2C	**Running** 250 V AC / 30 V DC 2 A	
23	RO2A		
24	RO2B		
25	RO3C	**Fault (-1)** 250 V AC / 30 V DC 2 A	
26	RO3B		
27	RO3A		
X5	**EIA-485 Modbus RTU**		
29	B+	Embedded Modbus RTU (EIA-485). See chapter Fieldbus control through the embedded fieldbus interface (EFB) on page 341.	
30	A-		
31	DGND		
S100	TERM	Serial data link termination switch	
	Safe torque off		
34	SGND	Safe torque off. Factory connection. Both circuits must be closed for the drive to start. See chapter Delete safe torque in drive hardware manual.	x
35	OUT		x
36	IN1		x
37	IN2		x

Terminal size: 0.14…1.5 mm^2

Tightening torque: 0.5 N·m (0.4 lbf·ft)

[1] Ground the outer shield of the cable 360 degrees under the grounding clamp on the grounding shelf for the control cables.

[2] Connected with jumpers at the factory.

[3] Use shielded twisted-pair cables for digital signals.

Output signals

- Analog output AO1: Output frequency
- Analog output AO2: Motor current
- Relay output 1: Ready run
- Relay output 2: Running
- Relay output 3: Fault (-1)

6

Parameters

What this chapter contains

The chapter describes the parameters, including actual signals, of the control program. At the end of the chapter, on page 272, there is a separate list of the parameters whose default values are different between 50 Hz and 60 Hz supply frequency settings.

Terms and abbreviations

Term	Definition
Def	(In the following table, shown on the same row as the parameter name) The default value of a *parameter* when used in the ABB standard macro. For information on other macro-specific parameter values, see chapter Control macros (page 75).
FbEq16	(In the following table, shown on the same row as the parameter range, or for each selection) 16-bit fieldbus equivalent: The scaling between the value shown on the panel and the integer used in communication when a 16-bit value is selected for transmission to an external system. A dash (-) indicates that the parameter is not accessible in 16-bit format. The corresponding 32-bit scalings are listed in chapter Additional parameter data (page 273).
Other	The value is taken from another parameter. Choosing “Other” displays a parameter list in which the user can specify the source parameter.
Other [bit]	The value is taken from a specific bit in another parameter. Choosing “Other” displays a parameter list in which the user can specify the source parameter and bit.
Parameter	Either a user-adjustable operating instruction for the drive, or an Actual signal.
p.u.	Per unit
[parameter number]	Value of the parameter

Summary of parameter groups

Group	**Contents**	**Page**
01 Actual values	Basic signals for monitoring the drive.	83
03 Input references	Values of references received from various sources.	88
04 Warnings and faults	Information on warnings and faults that occurred last.	89
05 Diagnostics	Various run-time-type counters and measurements related to drive maintenance.	90
06 Control and status words	Drive control and status words.	94
07 System info	Drive hardware and firmware information.	99
10 Standard DI, RO	Configuration of digital inputs and relay outputs.	100
11 Standard DIO, FI, FO	Configuration of the frequency input.	106
12 Standard AI	Configuration of standard analog inputs.	108
13 Standard AO	Configuration of standard analog outputs.	115
21 Start/stop mode	Start and stop modes.	123
23 Speed reference ramp	Speed reference ramp settings (programming of the acceleration and deceleration rates for the drive).	129
24 Speed reference conditioning	Speed error calculation; speed error window control configuration; speed error step.	131
25 Speed control	Speed controller settings.	132
28 Frequency reference chain	Settings for the frequency reference chain.	137
30 Limits	Drive operation limits.	138
31 Fault functions	Configuration of external events; selection of behavior of the drive upon fault situations.	143
32 Supervision	Configuration of signal supervision functions 1…6.	152
34 Timed functions	Configuration of the timed functions.	166
35 Motor thermal protection	Motor thermal protection settings such as temperature measurement configuration, load curve definition and motor fan control configuration.	177
36 Load analyzer	Peak value and amplitude logger settings.	186
40 Process PID set 1	Parameter values for process PID control.	190
46 Monitoring/scaling settings	Speed supervision settings; actual signal filtering; general scaling settings.	205
49 Panel port communication	Communication settings for the control panel port on the drive.	208
50 Fieldbus adapter (FBA)	Fieldbus communication configuration.	209
51 FBA A settings	Fieldbus adapter A configuration.	213
52 FBA A data in	Selection of data to be transferred from drive to fieldbus controller through fieldbus adapter A.	215

Group	Contents	Page
53 FBA A data out	Selection of data to be transferred from fieldbus controller to drive through fieldbus adapter A.	216
58 Embedded fieldbus	Configuration of the embedded fieldbus (EFB) interface.	216
79 Solar pump control	Start/stop enable signal source selection; positive/negative reference enable signal source selection. See also chapter Solar pump control (page 44).	226
80 Flow calculation	Actual flow calculation. See section Flow calculation (page 45)..	231
81 Sensor settings	Sensor settings for inlet and outlet pressure protection function.	237
82 Pump protections	Settings for dry run protection.	239
83 Pump cleaning	Settings for the pump cleaning sequence.	242
95 HW configuration	Various hardware-related settings.	246
96 System	Language selection; access levels; macro selection; parameter save and restore; control unit reboot; user parameter sets; unit selection.	248
97 Motor control	Switching frequency; slip gain; voltage reserve; flux braking; anti-cogging (signal injection); IR compensation.	259
98 User motor parameters	Motor values supplied by the user that are used in the motor model.	262
99 Motor data	Motor configuration settings.	264

Parameter listing

No.	Name/Value	Description	Def/ FbEq16
01 Actual values		Basic signals for monitoring the drive. All parameters in this group are read-only unless otherwise noted. **Note:** Values of these actual signals are filtered with the filter time defined in group 46 Monitoring/scaling settings. The selection lists for parameters in other groups mean the raw value of the actual signal instead. For example, if a selection is “Output frequency” it does not point to the value of parameter 01.06 Output frequency but to the raw value.	
01.01	Motor speed used	Shows estimated motor speed. A filter time constant for this signal can be defined by parameter 46.11 Filter time motor speed.	-
	-30000.00… 30000.00 rpm	Estimated motor speed.	1 = 1 rpm
01.02	Motor speed estimated	Shows estimated motor speed in rpm. A filter time constant for this signal can be defined by parameter 46.11 Filter time motor speed.	-
	-30000.00… 30000.00 rpm	Estimated motor speed.	1 = 1 rpm
01.03	Motor speed %	Shows motor speed in percent of the synchronous motor speed.	-
	-1000.00… 1000.00%	Motor speed.	10 = 1%
01.06	Output frequency	Shows estimated drive output frequency in Hz. A filter time constant for this signal can be defined by parameter 46.12 Filter time output frequency.	-
	-500.00… 500.00 Hz	Estimated output frequency.	10 = 1 Hz
01.07	Motor current	Shows measured (absolute) motor current in A.	-
	0.00… 30000.00 A	Motor current.	1 = 1 A
01.08	Motor current % of motor nom	Shows motor current (drive output current) in percent of the nominal motor current.	-
	0.0…1000.0%	Motor current.	1 = 1%

No.	Name/Value	Description	Def/ FbEq16
01.09	Motor current % of drive nom	Shows motor current (drive output current) in percent of the nominal drive current.	-
	0.0…1000.0%	Motor current.	1 = 1%
01.10	Motor torque	Shows motor torque in percent of the nominal motor torque. See also parameter 01.30 Nominal torque scale. A filter time constant for this signal can be defined by parameter 46.13 Filter time motor torque.	-
	-1600.0… 1600.0%	Motor torque.	10 = 1%
01.11	DC voltage	Shows measured DC link voltage.	-
	0.00… 2000.00 V	DC link voltage.	10 = 1 V
01.13	Output voltage	Shows calculated motor voltage in V AC.	-
	0…2000 V	Motor voltage.	1 = 1 V
01.14	Output power	Shows drive output power. A filter time constant for this signal can be defined by parameter 46.14 Filter time power.	-
	-32768.00… 32767.00 kW	Output power.	1 = 1 unit
01.15	Output power % of motor nom	Shows output power in percent of the nominal motor power.	-
	-300.00… 300.00%	Output power.	1 = 1%
01.17	Motor shaft power	Shows estimated mechanical power at motor shaft. The unit is selected by parameter 96.16 Unit selection.	-
	-32768.00… 32767.00 kW or hp	Motor shaft power.	1 = 1 unit
01.18	Inverter GWh counter	Shows amount of energy that has passed through the drive (in either direction) in full gigawatt-hours. The minimum value is zero.	-
	0…65535 GWh	Energy in GWh.	1 = 1 GWh
01.19	Inverter MWh counter	Shows amount of energy that has passed through the drive (in either direction) in full megawatt-hours. Whenever the counter rolls over, 01.18 Inverter GWh counter is incremented. The minimum value is zero.	-
	0…1000 MWh	Energy in MWh.	1 = 1 MWh

No.	Name/Value	Description	Def/ FbEq16
01.20	Inverter kWh counter	Shows amount of energy that has passed through the drive (in either direction) in full kilowatt-hours. Whenever the counter rolls over, 01.19 Inverter MWh counter is incremented. The minimum value is zero.	-
	0…1000 kWh	Energy in kWh.	10 = 1 kWh
01.24	Flux actual %	Shows used flux reference in percent of nominal flux of motor.	-
	0…200%	Flux reference.	1 = 1%
01.30	Nominal torque scale	Shows torque that corresponds to 100% of nominal motor torque. The unit is selected by parameter 96.16 Unit selection. **Note:** This value is copied from parameter 99.12 Motor nominal torque if entered. Otherwise the value is calculated from other motor data.	-
	0.000… 4000000 N·m or lb·ft	Nominal torque.	1 = 100 unit
01.50	Current hour kWh	Shows current hour energy consumption. This is the energy of the last 60 minutes (not necessarily continuous) the drive has been running, not the energy of a calendar hour. The value is set to the value before the power cycle when the drive is again up and running.	-
	0.00… 1000000.00 kWh	Energy.	1 = 1 kWh
01.51	Previous hour kWh	Shows previous hour energy consumption. The value 01.50 Current hour kWh is stored here when its values has been cumulated for 60 minutes. The value is set to the value before the power cycle when the drive is again up and running.	-
	0.00… 1000000.00 kWh	Energy.	1 = 1 kWh

No.	Name/Value	Description	Def/ FbEq16
01.52	Current day kWh	Shows current day energy consumption. This is the energy of the last 24 hours (not necessarily continuous) the drive has been running, not the energy of a calendar day. The value is set to the value before the power cycle when the drive is again up and running.	-
	0.00…1000000.00 kWh	Energy.	1 = 1 kWh
01.53	Previous day kWh	Shows previous day energy consumption. The value 01.52 Current day kWh is stored here when its value has been cumulated for 24 hours. The value is set to the value before the power cycle when the drive is again up and running.	-
	0.00…1000000.00 kWh	Energy.	1 = 1 kWh
01.54	Cumulative inverter energy	Amount of energy that has passed through the drive (in either direction) in full kilowatt-hours. The minimum value is zero.	-
	-200000000.0…200000000.0 kWh	Energy in kWh.	10 = 1 kWh
01.55	Inverter GWh counter (resettable)	Amount of energy that has passed through the drive (in either direction) in full gigawatt-hours. The minimum value is zero. You can reset the value by setting it to zero. Resetting any of parameters 01.55…01.58 resets all of them.	-
	0…65535 GWh	Energy in GWh.	1 = 1 GWh
01.56	Inverter MWh counter (resettable)	Amount of energy that has passed through the drive (in either direction) in full megawatt-hours. Whenever the counter rolls over, 01.55 Inverter MWh counter (resettable) is incremented. The minimum value is zero. You can reset the value by setting it to zero. Resetting any of parameters 01.55…01.58 resets all of them.	-
	0…1000 MWh	Energy in MWh.	1 = 1 MWh

No.	Name/Value	Description	Def/ FbEq16
01.57	Inverter kWh counter (resettable)	Amount of energy that has passed through the drive (in either direction) in full kilowatt-hours. Whenever the counter rolls over, 01.56 Inverter kWh counter (resettable) is incremented. The minimum value is zero. You can reset the value by setting it to zero. Resetting any of parameters 01.55…01.58 resets all of them.	-
	0…1000 kWh	Energy in kWh.	10 = 1 kWh
01.58	Cumulative inverter energy (resettable)	Amount of energy that has passed through the drive (in either direction) in full kilowatt-hours. The minimum value is zero. You can reset the value by setting it to zero. Resetting any of parameters 01.55…01.58 resets all of them.	-
	-200000000.0 … 200000000.0 kWh	Energy in kWh.	10 = 1 kWh
01.61	Abs motor speed used	Shows absolute value of parameter 01.01 Motor speed used.	-
	0.00… 30000.00 rpm	Absolute motor speed in rpm.	1 = 1 rpm
01.62	Abs motor speed %	Shows absolute value of parameter 01.03 Motor speed %.	-
	0.00… 1000.00%	Absolute motor speed in %.	10 = 1%
01.63	Abs output frequency	Shows absolute value of parameter 01.06 Output frequency.	-
	0.00… 500.00 Hz	Absolute output frequency.	10 = 1 Hz
01.64	Abs motor torque	Shows absolute value of parameter 01.10 Motor torque.	-
	0.0…1600.0%	Motor torque.	10 = 1%
01.65	Abs output power	Shows absolute value of parameter 01.14 Output power.	-
	0.00… 32767.00 kW	Output power.	1 = 1 kW
01.66	Abs output power % motor nom	Shows absolute value of parameter 01.15 Output power % of motor nom.	-
	0.00… 300.00%	Output power.	1 = 1%

No.	Name/Value	Description	Def/ FbEq16
01.68	Abs motor shaft power	Shows absolute value of parameter 01.17 Motor shaft power.	-
	0.00… 32767.00 kW or hp	Motor shaft power.	1 = 1 kW

03 Input references		Values of references received from various sources. All parameters in this group are read-only unless otherwise noted.	
03.01	Panel reference	Shows reference 1 given from the control panel or PC tool.	-
	-100000.00… 100000.00	Control panel or PC tool reference.	1 = 10
03.02	Panel reference remote	Shows reference 2 given from the control panel or PC tool.	-
	-100000.00… 100000.00	Control panel or PC tool reference.	1 = 10
03.05	FB A reference 1	Shows reference 1 received through fieldbus adapter A. See also chapter Fieldbus control through a fieldbus adapter (page 369).	-
	-100000.00… 100000.00	Reference 1 from fieldbus adapter A.	1 = 10
03.06	FB A reference 2	Shows reference 2 received through fieldbus adapter A.	-
	-100000.00… 100000.00	Reference 2 from fieldbus adapter A.	1 = 10
03.09	EFB reference 1	Shows scaled reference 1 received through the embedded fieldbus interface.	1 = 10
	-30000.00… 30000.00	Scaled reference 1 received through the embedded fieldbus interface.	1 = 10
03.10	EFB reference 2	Shows scaled reference 2 received through the embedded fieldbus interface.	1 = 10
	-30000.00… 30000.00	Scaled reference 2 received through the embedded fieldbus interface.	1 = 10

No.	Name/Value	Description	Def/ FbEq16
04 Warnings and faults		Information on warnings and faults that occurred last. For explanations of individual warning and fault codes, see chapter Fault tracing. All parameters in this group are read-only unless otherwise noted.	
04.01	Tripping fault	Shows code of the 1st active fault (the fault that caused the current trip).	0x0000
	0x0000...0xffff	1st active fault.	1 = 1
04.02	Active fault 2	Shows code of the 2nd active fault.	0x0000
	0x0000...0xffff	2nd active fault.	1 = 1
04.03	Active fault 3	Shows code of the 3rd active fault.	0x0000
	0x0000...0xffff	3rd active fault.	1 = 1
04.06	Active warning 1	Shows code of the 1st active warning.	0x0000
	0x0000...0xffff	1st active warning.	1 = 1
04.07	Active warning 2	Shows code of the 2nd active warning.	0x0000
	0x0000...0xffff	2nd active warning.	1 = 1
04.08	Active warning 3	Shows code of the 3rd active warning.	0x0000
	0x0000...0xffff	3rd active warning.	1 = 1
04.11	Latest fault	Shows code of the 1st stored (non-active) fault.	0x0000
	0x0000...0xffff	1st stored fault.	1 = 1
04.12	2nd latest fault	Shows code of the 2nd stored (non-active) fault.	0x0000
	0x0000...0xffff	2nd stored fault.	1 = 1
04.13	3rd latest fault	Shows code of the 3rd stored (non-active) fault.	0x0000
	0x0000...0xffff	3rd stored fault.	1 = 1
04.16	Latest warning	Shows code of the 1st stored (non-active) warning.	0x0000
	0x0000...0xffff	1st stored warning.	1 = 1
04.17	2nd latest warning	Shows code of the 2nd stored (non-active) warning.	0x0000
	0x0000...0xffff	2nd stored warning.	1 = 1
04.18	3rd latest warning	Shows code of the 3rd stored (non-active) warning.	0x0000
	0x0000...0xffff	3rd stored warning.	1 = 1

No.	Name/Value	Description	Def/ FbEq16
04.40	Event word 1	Shows the user-defined event word. This word collects the status of the events (warnings, faults or pure events) selected by parameters 04.41…04.71. This parameter is read-only.	-

Bit	Name	Description
0	User bit 0	1 = Event selected by parameter 04.41 is active
1	User bit 1	1 = Event selected by parameter 04.43 is active
…	…	…
15	User bit 15	1 = Event selected by parameter 04.71 is active

No.	Name/Value	Description	Def/ FbEq16
	0000h…FFFFh	User-defined event word.	1 = 1
04.41	Event word 1 bit 0 code	Selects the hexadecimal code of an event (warning, fault or pure event) whose status is shown as bit 0 of 04.40 Event word 1. The event codes are listed in chapter Fault tracing (page 303).	0x2310h
	0000h…FFFFh	Code of event.	1 = 1
04.43	Event word 1 bit 1 code	Selects the hexadecimal code of an event (warning, fault or pure event) whose status is shown as bit 0 of 04.40 Event word 1. The event codes are listed in chapter Fault tracing (page 303).	0x3210h
	0000h…FFFFh	Code of event.	1 = 1
04.45, 04.47, 04.49, …	…	…	…
04.71	Event word 1 bit 15 code	Selects the hexadecimal code of an event (warning, fault or pure event) whose status is shown as bit 0 of 04.40 Event word 1. The event codes are listed in chapter Fault tracing (page 303).	0x2330h
	0000h…FFFFh	Code of event.	1 = 1

05 Diagnostics		Various run-time-type counters and measurements related to drive maintenance. All parameters in this group are read-only unless otherwise noted.	
05.01	On-time counter	On-time counter. The counter runs when the drive is powered	0
	0…65535 d	On-time counter.	1 = 1 d

No.	Name/Value	Description	Def/ FbEq16
05.02	Run-time counter	Motor run-time counter. The counter runs when the inverter modulates.	0
	0…65535 d	Motor run-time counter.	1 = 1 d
05.03	Pump run hours	Shows the pump running time in hours. The pump run hours is based on the value in parameter 05.02 Run-time counter and is calculated as, 24 * 05.02 value + fractional part of a day.	-
	0.0… 429496729.5 h	Hours.	1 = 1 h
05.04	Fan on-time counter	Shows running time of the drive cooling fan. Can be reset from the control panel by keeping Reset down for over 3 seconds.	0
	0…65535 d	Cooling fan run-time counter.	1 = 1 d
05.10	Control board temperature	Shows measured temperature of the control board	0
	-100… 300 °C	Control board temperature in degrees Celsius or Fahrenheit.	1 = unit
05.11	Inverter temperature	Shows estimated drive temperature in percent of fault limit. The fault limit varies according to the type of the drive. 0.0% = 0 °C (32 °F) 100.0% = Fault limit	0
	-40.0…160.0%	Drive temperature in percent.	1 = 1%
05.20	Diagnostic word 1	Diagnostic word 1. For possible causes and remedies, see chapter Fault tracing.	0b0000

Bit	Name	Value
0	Any warning or fault	Yes = Drive has generated a warning or tripped on a fault.
1	Any warning	Yes = Drive has generated a warning.
2	Any fault	Yes = Drive has tripped on a fault.
3	Reserved	
4	Overcurrent flt	Yes = Drive has tripped on fault 2310 Overcurrent.
5	Reserved	
6	DC overvoltage	Yes = Drive has tripped on fault 3210 DC link overvoltage.
7	DC undervoltage	Yes = Drive has tripped on fault 3220 DC link undervoltage.
8	Reserved	
9	Device overtemp flt	Yes = Drive has tripped on fault 4310 Excess temperature.
10...15	Reserved	

No.	Name/Value	Description	Def/ FbEq16
	0b0000...0b1111	Diagnostic word 1.	1 = 1

No.	Name/Value	Description	Def/ FbEq16
05.21	Diagnostic word 2	Diagnostic word 2. For possible causes and remedies, see chapter Fault tracing.	0b0000

Bit	Name	Value
0...9	Reserved	
10	Motor overtemperature fault	Yes = Drive has tripped on fault 4981 External temperature 1 or4982 External temperature 2
11...15	Reserved	

	0b0000...0b1111	Diagnostic word 2.	1 = 1
05.22	Diagnostic word 3	Diagnostic word 3. For more information, see chapter Fault tracing.	0b0000

Bit	Name	Value
0...8	Reserved	
9	kWh pulse	Yes = kWh pulse is active.
10	Reserved.	
11	Fan command.	On = Drive fan is rotating above idle speed.
12...15	Reserved	

	0b0000...0b1111	Diagnostic word 3.	1 = 1
05.80	Motor speed at fault	Displays 24.02 Used speed feedback at which fault occurred. This is applicable in both scalar and speed control mode.	-
	-30000.00… 30000.00 rpm	Motor speed at fault.	See par. 46.01
05.81	Output frequency at fault	Displays the output frequency (01.06) at which fault occurred.	-
	-500.00… 500.00 Hz	Output frequency at fault.	See par. 46.02
05.82	DC voltage at fault	Displays the DC link volt age (01.11) at which fault occurred.	-
	0.00… 2000.00 V	DC voltage at fault.	10 = 1 V
05.83	Motor current at fault	Displays the motor current (01.07) at which fault occurred.	-
05.84	Motor torque at fault	Displays the motor torque (01.10) at which fault occurred	-
	-1600.0… 1600.0%	Motor torque at fault.	See par. 46.03

<table>
<tr><th>No.</th><th>Name/Value</th><th>Description</th><th>Def/ FbEq16</th></tr>
<tr><td>05.85</td><td>Main status word at fault</td><td>Displays the main status word (06.11) at which fault occurred. For the bit list, see parameter 06.11 Main status word.</td><td>0x0000</td></tr>
<tr><td colspan="4">
<table>
<tr><th>Bit</th><th>Name</th></tr>
<tr><td>0</td><td>Ready to switch ON</td></tr>
<tr><td>1</td><td>Ready run</td></tr>
<tr><td>2</td><td>Ready ref</td></tr>
<tr><td>3</td><td>Tripped</td></tr>
<tr><td>4</td><td>Off 2 inactive</td></tr>
<tr><td>5</td><td>Off 3 inactive</td></tr>
<tr><td>6</td><td>Switch-on inhibited</td></tr>
<tr><td>7</td><td>Warning</td></tr>
<tr><td>8</td><td>At setpoint</td></tr>
<tr><td>9</td><td>Remote</td></tr>
<tr><td>10</td><td>Above limit</td></tr>
<tr><td>11</td><td>User bit 0</td></tr>
<tr><td>12</td><td>User bit 1</td></tr>
<tr><td>13</td><td>User bit 2</td></tr>
<tr><td>14</td><td>User bit 3</td></tr>
<tr><td>15</td><td>Reserved</td></tr>
</table>
</td></tr>
<tr><td></td><td>0x0000...0xffff</td><td>Main status word at fault.</td><td>1 = 1</td></tr>
<tr><td>05.86</td><td>DI delayed status at fault</td><td>Displays the DI delayed status (10.02) at which fault occurred. For the bit list, see parameter 10.02 DI delayed status.</td><td>0b0000</td></tr>
<tr><td></td><td>0b0000...0b1111</td><td>DI delayed status at fault.</td><td>1 = 1</td></tr>
<tr><td>05.87</td><td>Inverter temperature at fault</td><td>Displays the inverter temperature (05.11) at which fault occurred.</td><td>-</td></tr>
<tr><td></td><td>-40…160°C</td><td>Inverter temperature at fault.</td><td>1 = 1°C</td></tr>
<tr><td>05.88</td><td>Reference used at fault</td><td>Displays the reference used (28.01/23.01) at which fault occurred. The type of the reference depends on the selected operation mode (79.10).</td><td>-</td></tr>
<tr><td></td><td>-30000.00…
30000.00</td><td>Reference used at fault.</td><td>100 = 1</td></tr>
</table>

No.	Name/Value	Description	Def/ FbEq16
06 Control and status words		Drive control and status words.	
06.01	Main control word	The main control word of the drive. This parameter shows the control signals as received from the selected sources (such as digital inputs, the fieldbus interfaces and the application program). For the bit descriptions see page 373. The related status word and state diagram are presented on pages 375 and 376 respectively. This parameter is read-only.	0x0000

Bit	Name
0	Off1 control
1	Off2 control
2	Off3 control
3	Run
4	Ramp out zero
5	Ramp hold
6	Ramp in zero
7	Reset
8...9	Reserved
10	Remote cmd
11	Ext ctrl loc
12	User bit 0
13	User bit 1
14	User bit 2
15	User bit 3

	0x0000...0xffff	Main control word.	1 = 1

<table>
<tr><th>No.</th><th>Name/Value</th><th>Description</th><th>Def/ FbEq16</th></tr>
<tr><td>06.11</td><td>Main status word</td><td>Main status word of the drive.
For the bit descriptions see page 375. The related control word and state diagram are presented on pages 373 and 376 respectively.
This parameter is read-only.</td><td>0x0000</td></tr>
<tr><td colspan="4">
<table>
<tr><th>Bit</th><th>Name</th></tr>
<tr><td>0</td><td>Ready to switch ON</td></tr>
<tr><td>1</td><td>Ready run</td></tr>
<tr><td>2</td><td>Ready ref</td></tr>
<tr><td>3</td><td>Tripped</td></tr>
<tr><td>4</td><td>Off 2 inactive</td></tr>
<tr><td>5</td><td>Off 3 inactive</td></tr>
<tr><td>6</td><td>Switch-on inhibited</td></tr>
<tr><td>7</td><td>Warning</td></tr>
<tr><td>8</td><td>At setpoint</td></tr>
<tr><td>9</td><td>Remote</td></tr>
<tr><td>10</td><td>Above limit</td></tr>
<tr><td>11</td><td>User bit 0</td></tr>
<tr><td>12</td><td>User bit 1</td></tr>
<tr><td>13</td><td>User bit 2</td></tr>
<tr><td>14</td><td>User bit 3</td></tr>
<tr><td>15</td><td>Reserved</td></tr>
</table>
</td></tr>
<tr><td></td><td>0x0000...0xffff</td><td>Main status word.</td><td>1 = 1</td></tr>
</table>

No.	Name/Value	Description	Def/ FbEq16
06.16	Drive status word 1	Drive status word 1. This parameter is read-only.	0b0000

Bit	Name	Description
0	Enabled	Not applicable.
1	Inhibited	1 = Start inhibited. To start the drive, the inhibiting signal (see par. 06.18) must be removed and the start signal cycled.
2	DC charged	1 = DC circuit has been charged
3	Ready to start	1 = Drive is ready to receive a start command
4	Following reference	1 = Drive is ready to follow given reference
5	Started	1 = Drive has been started
6	Modulating	1 = Drive is modulating (output stage is being controlled)
7	Limiting	1 = Any operating limit (speed, torque, etc.) is active
8	Local control	1 = Drive is in local control
9	Network control	1 = Drive is in *network control* (see page 15).
10	Ext1 active	1 = Control location EXT1 active
11	Ext2 active	1 = Control location EXT2 active
12	Reserved	
13	Start request	1 = Start requested. 0 = When Enable to rotate signal is 0 (rotating of the motor is disabled).
14	Running	1 = Drive is controlling speed or frequency, in PID sleep or pre-magnetization.
15	Reserved	

	0b0000...0b1111	Drive status word 1.	1 = 1
06.17	Drive status word 2	Drive status word 2. This parameter is read-only.	0b0000

Bit	Name	Description
0	Identification run done	1 = Motor identification (ID) run has been performed
1	Magnetized	1 = The motor has been magnetized
2	Reserved	
3	Speed control	1 = Speed control mode active
4...9	Reserved	
10	Above limit	1 = Actual speed or frequency equals or exceeds limit (defined by parameters 46.31…46.32). Valid in both directions of rotation.
11...12	Reserved	
13	Start delay active	1 = Start delay (par. 21.22) active.
14…15	Reserved	

	0b0000...0b1111	Drive status word 2.	1 = 1

No.	Name/Value	Description	Def/ FbEq16
06.18	Start inhibit status word	Start inhibit status word. This word specifies the source of the inhibiting signal that is preventing the drive from starting. The conditions marked with an asterisk (*) only require that the start command is cycled. In all other instances, the inhibiting condition must be removed first. See also parameter 06.16 Drive status word 1, bit 1. This parameter is read-only.	0b0000

Bit	Name	Description
0	Not ready run	1 = DC voltage is missing or drive has not been parametrized correctly. Check the parameters in groups 95 and 99.
1	Ctrl location changed	* 1 = Control location has changed
2	SSW inhibit	1 = Control program is keeping itself in inhibited state
3	Fault reset	* 1 = A fault has been reset
4	Reserved	
5	Lost run enable	1 = Run enable signal missing
6	Reserved	
7	STO	1 = Safe torque off function active
8	Current calibration ended	* 1 = Current calibration routine has finished
9	ID run ended	* 1 = Motor identification run has finished
10	Reserved	
11	Em Off1	1 = Emergency stop signal (mode off1)
12	Em Off2	1 = Emergency stop signal (mode off2)
13	Em Off3	1 = Emergency stop signal (mode off3)
14	Auto reset inhibit	1 = The autoreset function is inhibiting operation
15	Reserved	

	0b0000...0b1111	Start inhibit status word.	1 = 1

No.	Name/Value	Description	Def/ FbEq16
06.19	Speed control status word	Speed control status word. This parameter is read-only.	0b0000

Bit	Name	Description
0	Zero speed	Drive has been running below zero speed limit (30.00 rpm).
1	Forward	1 = Drive is running in forward direction above zero speed limit.
2	Reverse	1 = Drive is running in reverse direction above zero speed limit.
3…6	Reserved	
7	Any constant speed request	Not applicable.
8…15	Reserved	

	0b0000...0b1111	Speed control status word.	1 = 1
06.29	MSW bit 10 selection	Selects a binary source whose status is transmitted as bit 10 (User bit 0) of 06.11 Main status word.	Above limit
	False	0	0
	True	1	1
	Above limit	Bit 10 of 06.17 Drive status word 2 (see page 96).	2
	Other [bit]	Source selection (see Terms and abbreviations on page 80).	
06.30	MSW bit 11 selection	Selects a binary source whose status is transmitted as bit 11 (User bit 0) of 06.11 Main status word.	Ext ctrl loc
	False	0	0
	True	1	1
	Ext ctrl loc	Bit 11 of 06.01 Main control word (see page 95).	2
	Other [bit]	Source selection (see Terms and abbreviations on page 80).	-
06.31	MSW bit 12 selection	Selects a binary source whose status is transmitted as bit 12 (User bit 1) of 06.11 Main status word.	Ext run enable
	False	0.	0
	True	1.	1
	Ext run enable	Status of the external run enable signal.	2
	Other [bit]	Source selection (see Terms and abbreviations on page 80).	-

No.	Name/Value	Description	Def/ FbEq16
06.32	MSW bit 13 selection	Selects a binary source whose status is transmitted as bit 13 (User bit 2) of 06.11 Main status word.	False
	False	0.	0
	True	1.	1
	Other [bit]	Source selection (see Terms and abbreviations on page 80).	-
06.33	MSW bit 14 selection	Selects a binary source whose status is transmitted as bit 14 (User bit 3) of 06.11 Main status word.	False
	False	0.	0
	True	1.	1
	Other [bit]	Source selection (see Terms and abbreviations on page 80).	-

07 System info		Drive hardware and firmware information. All parameters in this group are read-only.	
07.03	Drive rating id	Type of the drive. (Rating ID in brackets.)	Not selected
07.04	Firmware name	Firmware identification.	-
07.05	Firmware version	Version number of the firmware.	0.00.0.0
	0.00.0.0… 255.255.255.255	-	1=1
07.06	Loading package name	Name of the firmware loading package.	-
07.07	Loading package version	Version number of the firmware loading package.	0.00.0.0
	0.00.0.0… 255.255.255.255	-	1=1
07.11	Cpu usage	Microprocessor load in percent.	0
	0…100%	Microprocessor load.	1 = 1

No.	Name/Value	Description	Def/ FbEq16
07.30	Adaptive program status	Shows the status of the adaptive program. See section	-

Bit	Name	Description
0	Initialized	1 = Adaptive program initialized
1	Editing	1 = Adaptive program is being edited
2	Edit done	1 = Editing of adaptive program finished
3	Running	1 = Adaptive program running
4…13	Reserved	
14	State changing	1 = State change in progress in adaptive programming engine
15	Faulted	1 = Error in adaptive program

	0000h…FFFFh	Adaptive program status.	1 = 1
07.31	AP sequence state	Shows the number of the active state of the sequence program part of the adaptive program (AP). If adaptive programming is not running, or it does not contain a sequence program, the parameter is zero.	
	0…20		1 = 1

10 Standard DI, RO		Configuration of digital inputs and relay outputs.	
10.02	DI delayed status	Shows the status of digital inputs DI1…DI6. Bits 0…5 reflect the delayed status of DI1…DI6. **Example:** 0000000000010011b = DI5, DI2 and DI1 are on, DI3, DI4 and DI6 are off. This word is updated only after a 2 ms activation/deactivation delay. When the value of a digital input changes, it must remain the same in two consecutive samples, that is for 2 ms, for the new value to be accepted. This parameter is read-only.	0b0000

Bit	Name	Description
0	DI1	1 = Digital input 1 is ON.
1	DI2	1 = Digital input 2 is ON.
2	DI3	1 = Digital input 3 is ON.
3	DI4	1 = Digital input 4 is ON.
4	DI5	1 = Digital input 5 is ON.
5	DI6	1 = Digital input 6 is ON.
6…15	Reserved	

	0b0000...0b1111	Delayed status for digital inputs.	1 = 1

<table>
<tr><th>No.</th><th>Name/Value</th><th>Description</th><th>Def/
FbEq16</th></tr>
<tr><td>10.03</td><td>DI force selection</td><td>The electrical statuses of the digital inputs can be overridden for eg. testing purposes. A bit in parameter 10.04 DI forced data is provided for each digital input, and its value is applied whenever the corresponding bit in this parameter is 1.
Note: Boot and power cycle reset the force selections (parameters 10.03 and 10.04).</td><td>0b0000</td></tr>
<tr><td colspan="4"><table>
<tr><th>Bit</th><th>Value</th></tr>
<tr><td>0</td><td>1 = Force DI1 to value of bit 0 of parameter 10.04 DI forced data.
(0 = Normal mode)</td></tr>
<tr><td>1</td><td>1 = Force DI2 to value of bit 1 of parameter 10.04 DI forced data.
(0 = Normal mode)</td></tr>
<tr><td>2</td><td>1 = Force DI3 to value of bit 2 of parameter 10.04 DI forced data.
(0 = Normal mode)</td></tr>
<tr><td>3</td><td>1 = Force DI4 to value of bit 3 of parameter 10.04 DI forced data.
(0 = Normal mode)</td></tr>
<tr><td>4</td><td>1 = Force DI5 to value of bit 4 of parameter 10.04 DI forced data.
(0 = Normal mode)</td></tr>
<tr><td>5</td><td>1 = Force DI6 to value of bit 5 of parameter 10.04 DI forced data.
(0 = Normal mode)</td></tr>
<tr><td>6…15</td><td>Reserved</td></tr>
</table></td></tr>
<tr><td></td><td>0b0000...0b1111</td><td>Override selection for digital inputs.</td><td>1 = 1</td></tr>
<tr><td>10.04</td><td>DI forced data</td><td>Allows the data value of a forced digital input to be changed from 0 to 1. It is only possible to force an input that has been selected in parameter 10.03 DI force selection.
Bit 0 is the forced value for DI1; bit 5 is the forced value for the DI6.</td><td>0b0000</td></tr>
<tr><td colspan="4"><table>
<tr><th>Bit</th><th>Value</th></tr>
<tr><td>0</td><td>Force the value of this bit to D1, if so defined in parameter 10.03 DI force selection.</td></tr>
<tr><td>1</td><td>Force the value of this bit to D3, if so defined in parameter 10.03 DI force selection.</td></tr>
<tr><td>2</td><td>Force the value of this bit to D3, if so defined in parameter 10.03 DI force selection.</td></tr>
<tr><td>3</td><td>Force the value of this bit to D4, if so defined in parameter 10.03 DI force selection.</td></tr>
<tr><td>4</td><td>Force the value of this bit to D5, if so defined in parameter 10.03 DI force selection.</td></tr>
<tr><td>5</td><td>Force the value of this bit to D6, if so defined in parameter 10.03 DI force selection.</td></tr>
<tr><td>6…15</td><td>Reserved</td></tr>
</table></td></tr>
<tr><td></td><td>0b0000...0b1111</td><td>Forced values of digital inputs.</td><td>1 = 1</td></tr>
</table>

No.	Name/Value	Description	Def/ FbEq16
10.21	RO status	Status of relay outputs RO1…RO3.	0b0000

Bit	Value
0	1 = RO1 is energized.
1	1 = RO2 is energized.
2	1 = RO3 is energized.
3…15	Reserved

No.	Name/Value	Description	Def/ FbEq16
	0b0000...0b1111	Status of relay outputs.	1 = 1
10.22	RO force selection	The signals connected to the relay outputs can be overridden for eg. testing purposes. A bit in parameter 10.23 RO forced data is provided for each relay output, and its value is applied whenever the corresponding bit in this parameter is 1. **Note:** Boot and power cycle reset the force selections (parameters 10.22 and 10.23).	0b0000

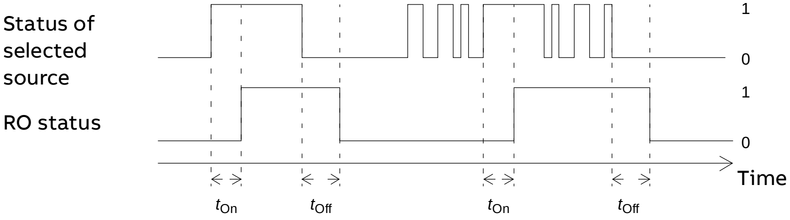
Bit	Value
0	1 = Force RO1 to value of bit 0 of parameter 10.23 RO forced data. (0 = Normal mode)
1	1 = Force RO2 to value of bit 1 of parameter 10.23 RO forced data. (0 = Normal mode)
2	1 = Force RO3 to value of bit 2 of parameter 10.23 RO forced data. (0 = Normal mode)
3…15	Reserved

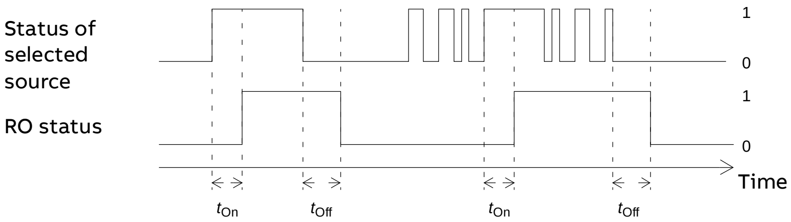
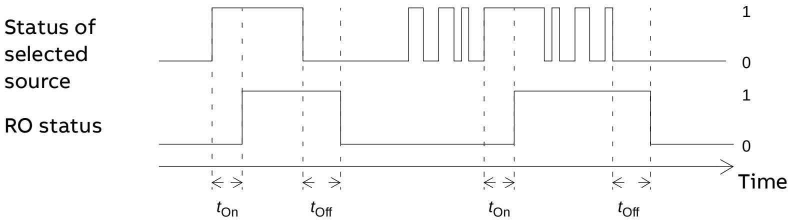
No.	Name/Value	Description	Def/ FbEq16
	0b0000...0b1111	Override selection for relay outputs.	1 = 1
10.23	RO forced data	Contains the values of relay outputs that are used instead of the connected signals if selected in parameter 10.22 RO force selection. Bit 0 is the forced value for RO1.	0b0000

Bit	Value
0	Force the value of this bit to RO1, if so defined in parameter 10.22 RO force selection.
1	Force the value of this bit to RO2, if so defined in parameter 10.22 RO force selection.
2	Force the value of this bit to RO3, if so defined in parameter 10.22 RO force selection.
3…15	Reserved

No.	Name/Value	Description	Def/ FbEq16
	0b0000...0b1111	Forced RO values.	1 = 1

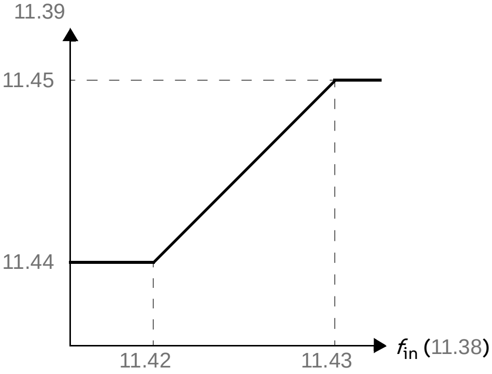
No.	Name/Value	Description	Def/ FbEq16
10.24	RO1 source	Selects a drive signal to be connected to relay output RO1.	Ready run
	Not energized	Output is not energized.	0
	Energized	Output is energized.	1
	Ready run	Bit 1 of 06.11 Main status word (see page 95).	2
	Enabled	Bit 0 of 06.16 Drive status word 1 (see page 96).	4
	Started	Bit 5 of 06.16 Drive status word 1 (see page 96).	5
	Magnetized	Bit 1 of 06.17 Drive status word 2 (see page 96).	6
	Running	Bit 6 of 06.16 Drive status word 1 (see page 96).	7
	Ready ref	Bit 2 of 06.11 Main status word (see page 95).	8
	At setpoint	Bit 8 of 06.11 Main status word (see page 95).	9
	Reverse	Bit 2 of 06.19 Speed control status word (see page 98).	10
	Zero speed	Bit 0 of 06.19 Speed control status word (see page 98).	11
	Above limit	Bit 10 of 06.17 Drive status word 2 (see page 96).	12
	Warning	Bit 7 of 06.11 Main status word (see page 95).	13
	Fault	Bit 3 of 06.11 Main status word (see page 95).	14
	Fault (-1)	Inverted bit 3 of 06.11 Main status word (see page 95).	15
	Fault/Warning	Bit 3 of 06.11 Main status word OR bit 7 of 06.11 Main status word (see page 95).	16
	Overcurrent	Fault 2310 Overcurrent has occurred.	17
	Overvoltage	Not applicable.	
	Drive temp	Fault 2381 IGBT overload or 4110 Control board temperature or 4210 IGBT overtemperature or 4290 Cooling or 42F1 IGBT temperature or 4310 Excess temperature or 4380 Excess temperature difference has occurred.	19
	Undervoltage	Fault 3220 DC link undervoltage has occurred.	20
	Motor temp	Fault 4981 External temperature 1 or 4982 External temperature 2 has occurred.	21
	Ext2 active	Bit 11 of 06.16 Drive status word 1 (see page 96).	23
	Remote control	Bit 9 of 06.11 Main status word (see page 95).	24
	Timed function 1	Bit 0 of 34.01 Timed functions status (see page 166).	27
	Timed function 2	Bit 1 of 34.01 Timed functions status (see page 166).	28
	Timed function 3	Bit 2 of 34.01 Timed functions status (see page 166).	29

No.	Name/Value	Description	Def/ FbEq16
	Reserved		30…32
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 152).	33
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 152).	34
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 152).	35
	Start delay	Bit 13 of 06.17 Drive status word 2 (see page 96).	39
	RO/DIO control word bit0	Bit 0 of 10.99 RO/DIO control word (see page 106).	40
	RO/DIO control word bit1	Bit 1 of 10.99 RO/DIO control word (see page 106).	41
	RO/DIO control word bit2	Bit 2 of 10.99 RO/DIO control word (see page 106).	42
	PFC1	Not applicable.	
	PFC2	Not applicable.	
	PFC3	Not applicable.	
	PFC4	Not applicable.	
	Event word 1	Not applicable.	
	User load curve	Not applicable.	
	RO/DIO control word	Maps to corresponding bit in parameter 10.99 RO/DIO control word. For example, Bit 0 of 10.99 RO/DIO control word controls RO1, Bit 1 of 10.99 RO/DIO control word controls RO2, and so on.	
	Other [bit]	Source selection (see Terms and abbreviations on page 80).	-
10.25	RO1 ON delay	Defines the activation delay for relay output RO1.	0.0 s
		 t_{On} = 10.25 RO1 ON delay t_{Off} = 10.26 RO1 OFF delay	
	0.0 … 3000.0 s	Activation delay for RO1.	10 = 1 s
10.26	RO1 OFF delay	Defines the deactivation delay for relay output RO1. See parameter 10.25 RO1 ON delay.	0.0 s
	0.0 … 3000.0 s	Deactivation delay for RO1.	10 = 1 s

No.	Name/Value	Description	Def/ FbEq16
10.27	RO2 source	Selects a drive signal to be connected to relay output RO2. For the available selections, see parameter 10.24 RO1 source.	Running
10.28	RO2 ON delay	Defines the activation delay for relay output RO2.	0.0 s
	 t_{On} = 10.28 RO2 ON delay t_{Off} = 10.29 RO2 OFF delay		
	0.0 … 3000.0 s	Activation delay for RO2.	10 = 1 s
10.29	RO2 OFF delay	Defines the deactivation delay for relay output RO2. See parameter 10.28 RO2 ON delay.	0.0 s
	0.0 … 3000.0 s	Deactivation delay for RO2.	10 = 1 s
10.30	RO3 source	Selects a drive signal to be connected to relay output RO3. For the available selections, see parameter 10.24 RO1 source.	Fault (-1)
10.31	RO3 ON delay	Defines the activation delay for relay output RO3.	0.0 s
	 t_{On} = 10.31 RO3 ON delay t_{Off} = 10.32 RO3 OFF delay		
	0.0 … 3000.0 s	Activation delay for RO3.	10 = 1 s
10.32	RO3 OFF delay	Defines the deactivation delay for relay output RO3. See parameter 10.31 RO3 ON delay.	0.0 s
	0.0 … 3000.0 s	Deactivation delay for RO3.	10 = 1 s

<table>
<tr><th>No.</th><th>Name/Value</th><th>Description</th><th>Def/
FbEq16</th></tr>
<tr><td>10.99</td><td>RO/DIO control word</td><td>Storage parameter for controlling the relay outputs eg. through the embedded fieldbus interface. To control the relay outputs (RO) of the drive, send a control word with the bit assignments shown below as Modbus I/O data. Set the target selection parameter of that particular data (58.101…58.114) to RO/DIO control word. In the source selection parameter of the desired output, select the appropriate bit of this word.</td><td>0b0000</td></tr>
<tr><td></td><td colspan="3">
<table>
<tr><th>Bit</th><th>Name</th><th>Description</th></tr>
<tr><td>0</td><td>RO1</td><td>Source bits for relay outputs RO1…RO3. See parameters 10.24, 10.27 and 10.30.</td></tr>
<tr><td>1</td><td>RO2</td><td></td></tr>
<tr><td>2</td><td>RO3</td><td></td></tr>
<tr><td>3…15</td><td>Reserved</td><td></td></tr>
</table>
</td></tr>
<tr><td></td><td>0b0000...0b1111</td><td>RO/DIO control word.</td><td>1 = 1</td></tr>
<tr><td>10.101</td><td>RO1 toggle counter</td><td>Shows number of times relay output RO1 has changed states.</td><td>0</td></tr>
<tr><td></td><td>0…4294967000</td><td>State change count.</td><td>1 = 1</td></tr>
<tr><td>10.102</td><td>RO2 toggle counter</td><td>Shows number of times relay output RO2 has changed states.</td><td>0</td></tr>
<tr><td></td><td>0…4294967000</td><td>State change count.</td><td>1 = 1</td></tr>
<tr><td>10.103</td><td>RO3 toggle counter</td><td>Shows number of times relay output RO3 has changed states.</td><td>0</td></tr>
<tr><td></td><td>0…4294967000</td><td>State change count.</td><td>1 = 1</td></tr>
</table>

11 Standard DIO, FI, FO		Configuration of the frequency input.	
11.05	DIO1 configuration	Selects whether DIO1 is used as a digital output or input, or a frequency input.	Input
	Digital output	DIO1 is used as a digital output.	0
	Input	DIO1 is used as a digital input.	1
	Frequency output	DIO1 is used as a frequency input.	2
11.21	DI5 configuration	(*Only visible with firmware ASCL2 and ASCL4*) Selects how digital input 6 is used.	Digital input
	Digital input	DI6 is used as a digital input.	0
	Frequency input	DI6 is used as a frequency input.	1

No.	Name/Value	Description	Def/ FbEq16
11.38	Freq in 1 actual value	Shows value of frequency input 1 (via DI6DI5 when it is used as a frequency input) before scaling. See parameter 11.42 Freq in 1 min. This parameter is read-only.	0
	0 … 16000 Hz	Unscaled value of frequency input 1.	1 = 1 Hz
11.39	Freq in 1 scaled value	Shows value of frequency input 1 (via DI5 or DI6 when it is used as a frequency input) after scaling. See parameter 11.42 Freq in 1 min. This parameter is read-only.	0
	-32768.000… 32767.000	Scaled value of frequency input 1 (DI5 or DI6).	1 = 1
11.42	Freq in 1 min	Defines the minimum for the frequency actually arriving at frequency input 1 (DI5 or DI6 when it is used as a frequency input). The incoming frequency signal (11.38 Freq in 1 actual value) is scaled into an internal signal (11.39 Freq in 1 scaled value) by parameters 11.42…11.45 as follows: 	0 Hz
	0 … 16000 Hz	Minimum frequency of frequency input 1 (DI5 or DI6).	1 = 1 Hz
11.43	Freq in 1 max	Defines the maximum for the frequency actually arriving at frequency input 1 (DI5 or DI6 when it is used as a frequency input). See parameter 11.42 Freq in 1 min.v	16000 Hz
	0 … 16000 Hz	Maximum frequency for frequency input 1 (DI5 or DI6).	1 = 1 Hz

No.	Name/Value	Description	Def/ FbEq16
11.44	Freq in 1 at scaled min	Defines the value that is required to correspond internally to the minimum input frequency defined by parameter 11.42 Freq in 1 min. See diagram at parameter 11.42 Freq in 1 min.	0.000
	-32768.000… 32767.000	Value corresponding to minimum of frequency input 1.	1 = 1
11.45	Freq in 1 at scaled max	Defines the value that is required to correspond internally to the maximum input frequency defined by parameter 11.43 Freq in 1 max. See diagram at parameter 11.42 Freq in 1 min.	50.000
	-32768.000… 32767.000	Value corresponding to maximum of frequency input 1.	1 = 1

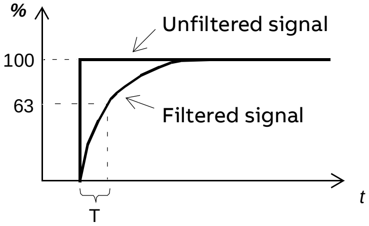
12 Standard AI		Configuration of standard analog inputs.	
12.02	AI force selection	The true readings of the analog inputs can be overridden for eg. testing purposes. A forced value parameter is provided for each analog input, and its value is applied whenever the corresponding bit in this parameter is 1. **Note:** AI filter times (parameters 12.16 AI1 filter time and 12.26 AI2 filter time) have no effect on forced AI values (parameters 12.13 AI1 forced value and 12.23 AI2 forced value). **Note:** Boot and power cycle reset the force selections (parameters 12.02 and 12.03).	0b0000

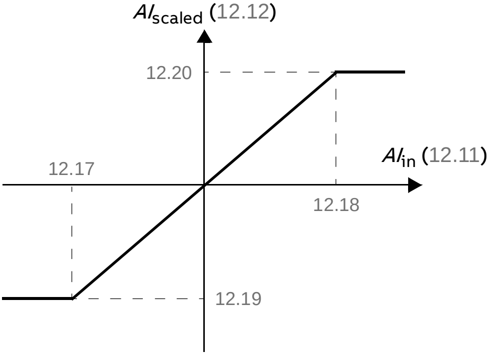
Bit	Value
0	1 = Force AI1 to value of parameter 12.13 AI1 forced value.
1	1 = Force AI2 to value of parameter 12.23 AI2 forced value.
2…15	Reserved

	0b000...0b1111	Forced values selector for analog inputs AI1 and AI2.	1 = 1
12.03	AI supervision function	Selects how the drive reacts when an analog input signal moves out of the minimum and/or maximum limits specified for the input. The inputs and the limits to be observed are selected by parameter 12.04 AI supervision selection.	No action
	No action	No action taken.	0
	Fault	Drive trips on 80A0 AI supervision.	1
	Warning	Drive generates an A8A0 AI supervision warning.	2

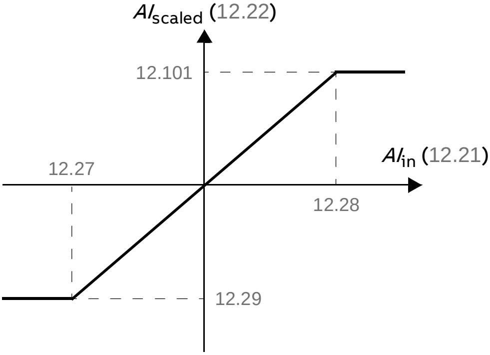
<table>
<tr><th>No.</th><th>Name/Value</th><th>Description</th><th>Def/
FbEq16</th></tr>
<tr><td>12.04</td><td>AI supervision selection</td><td>Specifies the analog input limits to be supervised. See parameter 12.03 AI supervision function.</td><td>0b0000</td></tr>
<tr><td></td><td colspan="3">
<table>
<tr><th>Bit</th><th>Name</th><th>Description</th></tr>
<tr><td>0</td><td>AI1 < MIN</td><td>1 = Minimum limit supervision of AI1 active.</td></tr>
<tr><td>1</td><td>AI1 > MAX</td><td>1 = Maximum limit supervision of AI1 active.</td></tr>
<tr><td>2</td><td>AI2 < MIN</td><td>1 = Minimum limit supervision of AI2 active.</td></tr>
<tr><td>3</td><td>AI2 > MAX</td><td>1 = Maximum limit supervision of AI2 active.</td></tr>
<tr><td>4…15</td><td colspan="2">Reserved</td></tr>
</table>
</td></tr>
<tr><td></td><td>0b000...0b1111</td><td>Activation of analog input supervision.</td><td>1 = 1</td></tr>
<tr><td>12.05</td><td>AI supervision force</td><td>Activates/deactivates analog input supervision for each control location (see section Local control vs. external control on page 35).
When a control location does not utilize AI for referencing, you can use this parameter to deactivate the AI supervision (12.04). This hides the warning or fault generated by AI supervision function (12.03), for the selected control location.
For example, if
12.04 AI supervision selection = Bit 0 or Bit 1 is 1
12.05 AI supervision force = Bit 0 is 0
then, AI1 supervision is masked in EXT1.</td><td>0b0000</td></tr>
<tr><td></td><td colspan="3">
<table>
<tr><th>Bit</th><th>Name</th><th>Description</th></tr>
<tr><td>0</td><td>AI1 Ext1</td><td>1 = AI1 supervision is active when EXT1 is used.</td></tr>
<tr><td>1</td><td>AI1 Ext2</td><td>1 = AI1 supervision is active when EXT2 is used.</td></tr>
<tr><td>2</td><td>AI1 Local</td><td>1 = AI1 supervision is active when local control is used.</td></tr>
<tr><td>3</td><td></td><td>Reserved</td></tr>
<tr><td>4</td><td>AI2 Ext1</td><td>1 = AI2 supervision is active when EXT1 is used.</td></tr>
<tr><td>5</td><td>AI2 Ext2</td><td>1 = AI2 supervision is active when EXT2 is used.</td></tr>
<tr><td>6</td><td>AI2 Local</td><td>1 = AI2 supervision is active when local control is used.</td></tr>
<tr><td>7...15</td><td colspan="2">Reserved</td></tr>
</table>
</td></tr>
<tr><td></td><td>0b000...0b1111</td><td>Activation/deactivation of analog input supervision.</td><td>1 = 1</td></tr>
<tr><td>12.11</td><td>AI1 actual value</td><td>Shows value of analog input AI1 in mA or V (depending on whether the input is set to current or voltage by a hardware setting).
This parameter is read-only.</td><td>0.000</td></tr>
<tr><td></td><td>0.000…11.000 V</td><td>Value of analog input AI1.</td><td>1000 = 1 unit</td></tr>
</table>

No.	Name/Value	Description	Def/ FbEq16
12.12	AI1 scaled value	Shows value of analog input AI1 after scaling. See parameters 12.19 AI1 scaled at AI1 min and 12.20 AI1 scaled at AI1 max. This parameter is read-only.	50.000
	-32768.000… 32767.000	Scaled value of analog input AI1.	1 = 1
12.13	AI1 forced value	Forced value that can be used instead of the true reading of the input. See parameter 12.02 AI force selection.	0
	0.000…11.000 V	Forced value of analog input AI1.	1000 = 1 unit
12.15	AI1 unit selection	Selects the unit for readings and settings related to analog input AI1. Note: In firmware ASCL2 and ASCL4), this setting must match the corresponding hardware setting on the drive control unit. See chapter *Electrical installation*, section Switches in the *Hardware manual* of the drive and the default control connections for the macro in use in chapter Control macros (page 75). Control board reboot (either by cycling the power or through parameter 96.08 Control board boot) is required to validate any changes in the hardware settings.	V
	V	Volts.	2
	mA	Milliamperes.	10

No.	Name/Value	Description	Def/ FbEq16
12.16	AI1 filter time	Defines the filter time constant for analog input AI1.  $O = I \times (1 - e^{-t/T})$ I = filter input (step) O = filter output t = time T = filter time constant **Note:** The signal is also filtered due to the signal interface hardware (approximately 0.25 ms time constant). This cannot be changed by any parameter.	0.100 s
	0.000… 30.000 s	Filter time constant.	1000 = 1
12.17	AI1 min	Defines the minimum site value for analog input AI1. Set the value actually sent to the drive when the analog signal from plant is wound to its minimum setting. See also parameter 12.19 AI1 scaled at AI1 min.	0.000
	0.000…11.000 V	Minimum value of AI1.	1000 = 1
12.18	AI1 max	Defines the maximum site value for analog input AI1. Set the value actually sent to the drive when the analog signal from plant is wound to its maximum setting. See also parameter 12.19 AI1 scaled at AI1 min.	10.000
	0.000…11.000 V	Maximum value of AI1.	1000 = 1

No.	Name/Value	Description	Def/ FbEq16
12.19	AI1 scaled at AI1 min	Defines the real internal value that corresponds to the minimum analog input AI1 value defined by parameter 12.17 AI1 min. (Changing the polarity settings of 12.19 and 12.20 can effectively invert the analog input.)  	0.000
	-32768.000… 32767.000	Real value corresponding to minimum AI1 value.	1 = 1
12.20	AI1 scaled at AI1 max	Defines the real internal value that corresponds to the maximum analog input AI1 value defined by parameter 12.18 AI1 max. See the drawing at parameter 12.19 AI1 scaled at AI1 min.	50.000
	-32768.000… 32767.000	Real value corresponding to maximum AI1 value.	1 = 1
12.21	AI2 actual value	Shows value of analog input AI2 in mA or V (depending on whether the input is set to current or voltage by a hardware setting). This parameter is read-only.	-
	0.000… 22.000 mA	Value of analog input AI2.	1000 = 1 unit
12.22	AI2 scaled value	Shows value of analog input AI2 after scaling. See parameters 12.29 AI2 scaled at AI2 min and 12.101 AI1 percent value. This parameter is read-only.	0.000
	-32768.000… 32767.000	Scaled value of analog input AI2.	1 = 1
12.23	AI2 forced value	Forced value that can be used instead of the true reading of the input. See parameter 12.02 AI force selection.	0.000
	0.000… 22.000 mA	Forced value of analog input AI2.	1000 = 1 unit

No.	Name/Value	Description	Def/ FbEq16
12.25	AI2 unit selection	Selects the unit for readings and settings related to analog input AI2. Note: In firmware ASCL2 and ASCL4), this setting must match the corresponding hardware setting on the drive control unit. chapter *Electrical installation*, section Switches in the *Hardware manual* of the drive and the default control connections for the macro in use in chapter Control macros (page 75). Control board reboot (either by cycling the power or through parameter 96.08 Control board boot) is required to validate any changes in the hardware settings.	mA
	V	Volts.	2
	mA	Milliamperes.	10
12.26	AI2 filter time	Defines the filter time constant for analog input AI2. See parameter 12.16 AI1 filter time.	0.100 s
	0.000… 30.000 s	Filter time constant.	1000 = 1 s
12.27	AI2 min	Defines the minimum site value for analog input AI2. Set the value actually sent to the drive when the analog signal from plant is wound to its minimum setting.	4.000 mA
	0.000…22.000	Minimum value of AI2.	1000 = 1 unit
12.28	AI2 max	Defines the maximum site value for analog input AI2. Set the value actually sent to the drive when the analog signal from plant is wound to its maximum setting.	20.000 mA
	0.000… 22.000 mA	Maximum value of AI2.	1000 = 1 unit

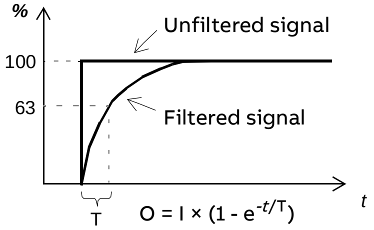
No.	Name/Value	Description	Def/ FbEq16
12.29	AI2 scaled at AI2 min	Defines the real value that corresponds to the minimum analog input AI2 value defined by parameter 12.27 AI2 min. (Changing the polarity settings of 12.29 and 12.101 can effectively invert the analog input.) 	0.000
	-32768.000… 32767.000	Real value corresponding to minimum AI2 value.	1 = 1
12.30	AI2 scaled at AI2 max	Defines the real value that corresponds to the minimum analog input AI2 value defined by parameter 12.28 AI2 max. See the drawing at parameter of 12.29 AI2 scaled at AI2 min.	50.000
	-32768.000… 32767.000	Real value corresponding to maximum AI2 value.	1 = 1
12.101	AI1 percent value	Value of analog input AI1 in percent of AI1 scaling (12.18 AI1 max - 12.17 AI1 min).	100.00
	0.00…100.00%	AI1 value	100 = 1%
12.102	AI2 percent value	Value of analog input AI2 in percent of AI2 scaling (12.28 AI2 max - 12.27 AI2 min).	0.00
	0.00…100.00%	AI2 value	100 = 1%
12.110	AI dead band	Defines AI dead band value in percentage where 100% = 10V in voltage mode and 100% = 20mA in current mode. This is applicable for both AI1 and AI2. **Note:** 10% of the AI dead-band value is internally added to the firmware as AI dead-band hysteresis (positive and negative). This value cannot be changed. For more information on dead-band function and its calculation, see section Dead-band function on page 70.	0.40%
	0.00…100.00%	Deadband for AI signals.	100 = 1%

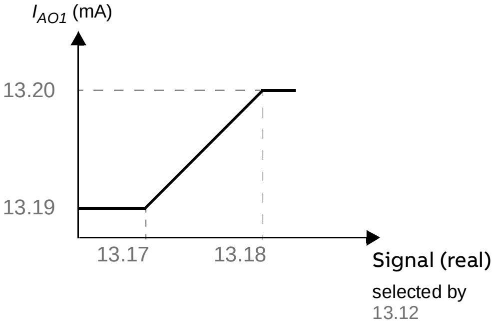
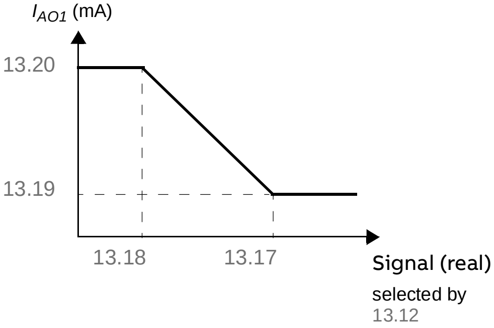
No.	Name/Value	Description	Def/ FbEq16
13 Standard AO		Configuration of standard analog outputs.	
13.02	AO force selection	The source signals of the analog outputs can be overridden for eg. testing purposes. A forced value parameter is provided for each analog output, and its value is applied whenever the corresponding bit in this parameter is 1. **Note:** Boot and power cycle reset the force selections (parameters 13.02 and 13.11).	0b0000

Bit	Value
0	1 = Force AO1 to value of parameter 13.13 AO1 forced value. (0 = Normal mode)
1	1 = Force AO2 to value of parameter 13.23 AO2 forced value. (0 = Normal mode)
2…15	Reserved

No.	Name/Value	Description	Def/ FbEq16
	0b0000… 0b1111	Forced values selector for analog outputs AO1 and AO2.	1 = 1
13.11	AO1 actual value	Shows value of AO1 in mA This parameter is read-only.	-
	0.000… 22.000 mA	Value of AO1.	1 = 1 mA
13.12	AO1 source	Selects a signal to be connected to analog output AO1.	Output frequency
	Zero	None.	0
	Motor speed used	01.01 Motor speed used (page 83).	1
	Output frequency	01.06 Output frequency (page 83).	3
	Motor current	01.07 Motor current (page 83).	4
	Motor current % of motor nominal	01.08 Motor current % of motor nom (page 83).	5
	Motor torque	01.10 Motor torque (page 84).	6
	DC voltage	01.11 DC voltage (page 84).	7
	Output power	01.14 Output power (page 84).	8
	Speed ref used		12
	Freq ref used	28.02 Frequency ref ramp output (page 137).	14
	Process PID out	40.01 Process PID output actual (page 190).	16

No.	Name/Value	Description	Def/ FbEq16
	Temp sensor 1 excitation	The output is used to feed an excitation current to the temperature sensor 1, see parameter 35.11 Temperature 1 source. See also section Motor thermal protection (page 58).	20
	Temp sensor 2 excitation	The output is used to feed an excitation current to the temperature sensor 2, see parameter 35.21 Temperature 2 source. See also section Motor thermal protection (page 58).	21
	Abs motor speed used	01.61 Abs motor speed used (page 87).	26
	Abs motor speed %	01.62 Abs motor speed % (page 87).	27
	Abs output frequency	01.63 Abs output frequency (page 87).	28
	Abs motor torque	01.64 Abs motor torque (page 87).	30
	Abs output power	01.65 Abs output power (page 87).	31
	Abs motor shaft power	01.68 Abs motor shaft power (page 88).	32
	AO1 data storage	13.91 AO1 data storage (page 122).	37
	AO2 data storage	13.92 AO2 data storage (page 122).	38
	Other	Source selection (see Terms and abbreviations on page 80).	-
13.13	AO1 forced value	Forced value that can be used instead of the selected output signal. See parameter 13.02 AO force selection.	0.000 mA
	0.000… 22.000 mA / 0.000…11.000 V	Forced value for AO1.	1 = 1 unit

No.	Name/Value	Description	Def/ FbEq16
13.15	AO1 unit selection	Selects the unit for readings and settings related to analog input AO1. Note: In firmware ASCL2 and ASCL4), this setting must match the corresponding hardware setting on the drive control unit. See chapter *Electrical installation*, section Switches in the *Hardware manual* of the drive and the default control connections for the macro in use in chapter Control macros (page 75). Control board reboot (either by cycling the power or through parameter 96.08 Control board boot) is required to validate any changes in the hardware settings.	mA
	V	Volts.	2
	mA	Milliamperes.	10
13.16	AO1 filter time	Defines the filtering time constant for analog output AO1.  $O = I \times (1 - e^{-t/T})$ I = filter input (step) O = filter output *t* = time T = filter time constant	0.100 s
	0.000 … 30.000 s	Filter time constant.	1000 = 1 s

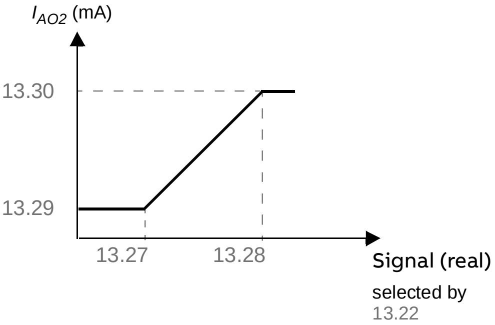
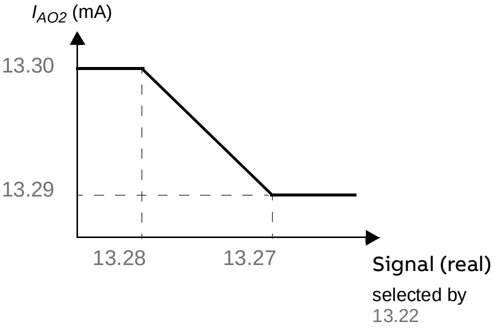
No.	Name/Value	Description	Def/ FbEq16
13.17	AO1 source min	Defines the real minimum value of the signal (selected by parameter 13.12 AO1 source) that corresponds to the minimum required AO1 output value (defined by parameter 13.19 AO1 out at AO1 src min).  Programming 13.17 as the maximum value and 13.18 as the minimum value inverts the output.  	0.0

No.	Name/Value	Description	Def/ FbEq16
	AO has automatic scaling. Every time the source for the AO is changed, the scaling range is changed accordingly. User given minimum and maximum values override the automatic values.		

	13.12 AO1 source, 13.22 AO2 source	13.17 AO1 source min, 13.27 AO2 source min	13.18 AO1 source max, 13.28 AO2 source max
0	Zero	N/A (Output is constant zero.)	
1	Motor speed used	0	99.09 Motor nominal speed
3	Output frequency	0	99.08 Motor nominal frequency
4	Motor current	0	30.17 Maximum current
5	Motor current % of motor nominal	0%	100%
6	Motor torque	0	46.03 Torque scaling
7	DC voltage	Min. value of 01.11 DC voltage	Max. value of 01.11 DC voltage
8	Output power	0	46.04 Power scaling
12	Speed ref used	0	99.09 Motor nominal speed
14	Freq ref used	0	99.08 Motor nominal frequency
16	Process PID out	Min. value of 40.01 Process PID output actual	Max. value of 40.01 Process PID output actual
20	Temp sensor 1 excitation	N/A (Analog output is not scaled; it is determined by the sensor's triggering voltage.)	
21	Temp sensor 2 excitation		
26	Abs motor speed used	0	99.09 Motor nominal speed
27	Abs motor speed %	0	99.09 Motor nominal speed
28	Abs output frequency	0	99.08 Motor nominal frequency
30	Abs motor torque	0	46.03 Torque scaling
31	Abs output power	0	46.04 Power scaling
32	Abs motor shaft power	0	46.04 Power scaling
37	AO1 data storage	13.91 AO1 data storage (page 122).	13.91 AO1 data storage
38	AO2 data storage	13.92 AO2 data storage (page 122).	13.92 AO2 data storage
	Other	Min. value of the selected parameter	Max. value of the selected parameter

No.	Name/Value	Description	Def/ FbEq16
	-32768.0… 32767.0	Real signal value corresponding to minimum AO1 output value.	1 = 1

No.	Name/Value	Description	Def/ FbEq16
13.18	AO1 source max	Defines the real maximum value of the signal (selected by parameter 13.12 AO1 source) that corresponds to the maximum required AO1 output value (defined by parameter 13.20 AO1 out at AO1 src max). See parameter 13.17 AO1 source min.	50.0
	-32768.0… 32767.0	Real signal value corresponding to maximum AO1 output value.	1 = 1
13.19	AO1 out at AO1 src min	Defines the minimum output value for analog output AO1. See also drawing at parameter 13.17 AO1 source min.	0.000 mA
	0.000… 22.000 mA / 0.000…11.000 V	Minimum AO1 output value.	1000 = 1 mA
13.20	AO1 out at AO1 src max	Defines the maximum output value for analog output AO1. See also drawing at parameter 13.17 AO1 source min.	20.000 mA
	0.000… 22.000 mA / 0.000…11.000 V	Maximum AO1 output value.	1000 = 1 mA
13.21	AO2 actual value	Shows value of AO2 in mA. This parameter is read-only.	0.000
	0.000 … 22.000 mA	Value of AO2.	1000 = 1 mA
13.22	AO2 source	Selects a signal to be connected to analog output AO2. Alternatively, sets the output to excitation mode to feed a constant current to a temperature sensor. For the selections, see parameter 13.12 AO1 source.	Motor current
13.23	AO2 forced value	Forced value that can be used instead of the selected output signal. See parameter 13.02 AO force selection.	0.000 mA
	0.000 … 22.000 mA	Forced value for AO2.	1000 = 1 mA
13.26	AO2 filter time	Defines the filtering time constant for analog output AO2. See parameter 13.16 AO1 filter time.	0.100 s
	0.000 … 30.000 s	Filter time constant.	1000 = 1 s

No.	Name/Value	Description	Def/ FbEq16
13.27	AO2 source min	Defines the real minimum value of the signal (selected by parameter 13.22 AO2 source) that corresponds to the minimum required AO2 output value (defined by parameter 13.29 AO2 out at AO2 src min). See parameter 13.17 AO1 source min about the AO automatic scaling.  Programming 13.27 as the maximum value and 13.28 as the minimum value inverts the output.  	0.0
	-32768.0… 32767.0	Real signal value corresponding to minimum AO2 output value.	1 = 1
13.28	AO2 source max	Defines the real maximum value of the signal (selected by parameter 13.22 AO2 source) that corresponds to the maximum required AO2 output value (defined by parameter 13.30 AO2 out at AO2 src max). See parameter 13.27 AO2 source min. See parameter 13.17 AO1 source min about the AO automatic scaling.	3.2 A
	-32768.0… 32767.0	Real signal value corresponding to maximum AO2 output value.	1 = 1

No.	Name/Value	Description	Def/ FbEq16
13.29	AO2 out at AO2 src min	Defines the minimum output value for analog output AO2. See also drawing at parameter 13.27 AO2 source min.	0.000 mA
	0.000 … 22.000 mA	Minimum AO2 output value.	1000 = 1 mA
13.30	AO2 out at AO2 src max	Defines the maximum output value for analog output AO2. See also drawing at parameter 13.27 AO2 source min.	20.000 mA
	0.000 … 22.000 mA	Maximum AO2 output value.	1000 = 1 mA
13.91	AO1 data storage	Storage parameter for controlling analog output AO1 eg. through fieldbus. In 13.12 AO1 source, select AO1 data storage. Then set this parameter as the target of the incoming value data. With the embedded fieldbus interface, simply set the target selection parameter of that particular data (58.101…58.114) to AO1 data storage.	0.00
	-327.68…327.67	Storage parameter for AO1.	100 = 1
13.92	AO2 data storage	Storage parameter for controlling analog output AO1 eg. through fieldbus. In 13.22 AO2 source, select AO2 data storage. Then set this parameter as the target of the incoming value data. With the embedded fieldbus interface, simply set the target selection parameter of that particular data (58.101…58.114) to AO2 data storage.	0.00
	-327.68…327.67	Storage parameter for AO2.	100 = 1

No.	Name/Value	Description	Def/ FbEq16
21 Start/stop mode		Start and stop modes.	
21.01	Start mode	Selects the motor start function for the vector motor control mode, ie. when 99.04 Motor control mode is set to Vector. **Notes**: • The start function for the scalar motor control mode is selected by parameter 21.19 Scalar start mode. • Starting into a rotating motor is not possible when DC magnetizing is selected (Fast or Const time). • With permanent magnet motors, Automatic start mode must be used. • This parameter cannot be changed while the drive is running.	Automatic
	Fast	The drive pre-magnetizes the motor before start. The pre-magnetizing time is determined automatically, being typically 200 ms to 2 s depending on motor size. This mode should be selected if a high break-away torque is required.	0
	Const time	The drive pre-magnetizes the motor before start. The pre-magnetizing time is defined by parameter 21.02 Magnetization time. This mode should be selected if constant pre-magnetizing time is required (e.g. if the motor start must be synchronized with the release of a mechanical brake). This setting also guarantees the highest possible break-away torque when the pre-magnetizing time is set long enough. ⚠ **WARNING!** The drive will start after the set magnetizing time has passed even if motor magnetization is not completed. In applications where a full break-away torque is essential, ensure that the constant magnetizing time is long enough to allow generation of full magnetization and torque.	1

<table>
<tr><th>No.</th><th>Name/Value</th><th>Description</th><th>Def/
FbEq16</th></tr>
<tr><td></td><td>Automatic</td><td>Automatic start guarantees optimal motor start in most cases. It includes the flying start function (starting into a rotating motor) and the automatic restart function. The drive motor control program identifies the flux as well as the mechanical state of the motor and starts the motor instantly under all conditions.
Note: If parameter 99.04 Motor control mode is set to Scalar, no flying start or automatic restart is possible unless parameter 21.19 Scalar start mode is set to Automatic.</td><td>2</td></tr>
<tr><td>21.02</td><td>Magnetization time</td><td>Defines the pre-magnetization time when
• parameter 21.01 Start mode is set to Const time (in vector motor control mode), or
• parameter 21.19 Scalar start mode is set to Const time (in scalar motor control mode).
After the start command, the drive automatically premagnetizes the motor for the set time. To ensure full magnetizing, set this parameter to the same value as, or higher than, the rotor time constant. If not known, use the rule-of-thumb value given in the table below:
<table>
<tr><th>Motor rated power</th><th>Constant magnetizing time</th></tr>
<tr><td>< 1 kW</td><td>≥ 50 to 100 ms</td></tr>
<tr><td>1 to 10 kW</td><td>≥ 100 to 200 ms</td></tr>
<tr><td>10 to 200 kW</td><td>≥ 200 to 1000 ms</td></tr>
<tr><td>200 to 1000 kW</td><td>≥ 1000 to 2000 ms</td></tr>
</table>
Note: This parameter cannot be changed while the drive is running.</td><td>500</td></tr>
<tr><td></td><td>0…10000 ms</td><td>Constant DC magnetizing time.</td><td>1 = 1</td></tr>
<tr><td>21.03</td><td>Stop mode</td><td>Selects the way the motor is stopped when a stop command is received.</td><td>Coast</td></tr>
<tr><td></td><td>Coast</td><td>Stop by switching off the output semiconductors of the drive. The motor coasts to a stop.
⚠ WARNING! If a mechanical brake is used, make sure that it is safe to stop the drive by coasting.</td><td>0</td></tr>
<tr><td></td><td>Ramp</td><td>Stop along the active deceleration ramp. See parameter group 23 Speed reference ramp on page 129 or 28 Frequency reference chain on page 137.</td><td>1</td></tr>
</table>

No.	Name/Value	Description	Def/ FbEq16
21.04	Emergency stop mode	Selects the way the motor is stopped when an emergency stop command is received. The source of the emergency stop signal is selected by parameter 21.05 Emergency stop source. **Note:** After the drive stops, you can restore the emergency stop signal and switch the start signal from 0 to 1 to restart the drive. This is not required if 79.10 Operating mode is set to Auto.	Ramp stop (Off1)
	Ramp stop (Off1)	With the drive running: • 1 = Normal operation. • 0 = Normal stop along the standard deceleration ramp for the below reference types: • 23.13 Deceleration time 1 in speed mode • 28.73 Freq deceleration time 1 in frequency mode With the drive stopped: • 1 = Starting allowed. • 0 = Starting not allowed.	0
	Coast stop (Off2)	With the drive running: • 1 = Normal operation. • 0 = Stop by coasting. The drive can be restarted by restoring the start interlock signal and switching the start signal from 0 to 1. With the drive stopped: • 1 = Starting allowed. • 0 = Starting not allowed.	1
	Eme ramp stop (Off3)	With the drive running: • 1 = Normal operation • 0 = Stop by ramping along emergency stop ramp defined by parameter 23.23 Emergency stop time. After the drive has stopped, it can be restarted by removing the emergency stop signal and switching the start signal from 0 to 1. With the drive stopped: • 1 = Starting allowed • 0 = Starting not allowed	2

No.	Name/Value	Description	Def/ FbEq16
21.05	Emergency stop source	Selects the source of the emergency stop signal. The stop mode is selected by parameter 21.04 Emergency stop mode. 0 = Emergency stop active 1 = Normal operation **Note:** This parameter cannot be changed while the drive is running.	Inactive (true)
	Active (false)	0.	0
	Inactive (true)	1.	1
	Reserved		2
	DI1	Digital input DI1 (10.02 DI delayed status, bit 0).	3
	DI2	Digital input DI2 (10.02 DI delayed status, bit 1).	4
	DI3	Digital input DI3 (10.02 DI delayed status, bit 2).	5
	DI4	Digital input DI4 (10.02 DI delayed status, bit 3).	6
	DI5	Digital input DI5 (10.02 DI delayed status, bit 4).	7
	DI6	Digital input DI6 (10.02 DI delayed status, bit 5).	8
	Other [bit]	Source selection (see Terms and abbreviations on page 80).	-
21.19	Scalar start mode	Selects the motor start function for the scalar motor control mode, ie. when 99.04 Motor control mode is set to Scalar. **Note**: This parameter cannot be changed while the drive is running.	Normal
	Normal	Immediate start from zero speed.	0
	Const time	The drive pre-magnetizes for 500ms the motor before start. This mode should be selected if constant pre-magnetizing time is required. This setting also guarantees the highest possible break-away torque when the pre-magnetizing time is set long enough. **Note:** This mode cannot be used to start into a rotating motor. ⚠ **WARNING!** The drive will start after the set pre-magnetizing time has passed even if motor magnetization is not completed. In applications where a full break-away torque is essential, ensure that the constant magnetizing time is long enough to allow generation of full magnetization and torque.	1

No.	Name/Value	Description	Def/ FbEq16
	Automatic	The drive automatically selects the correct output frequency to start a rotating motor. This is useful for flying starts: if the motor is already rotating, the drive will start smoothly at the current frequency. **Note:** This mode cannot be used in multimotor systems.	2
	Torque boost	The drive pre-magnetizes for 500ms the motor before the start. Torque boost is applied at start. Torque boost is stopped when output frequency exceeds 20 Hz or when it is equal to the reference value. **Note**: This mode should be selected if a high break-away torque is required. **Note:** This mode cannot be used to start a rotating motor. ⚠ **WARNING!** The drive will start after the set pre-magnetizing time has passed even if motor magnetization is not completed. In applications where a full break-away torque is essential, ensure that the constant magnetizing time is long enough to allow generation of full magnetization and torque.	3
	Automatic+ boost	Automatic start with torque boost. Automatic start is performed first and the motor is magnetized. If the speed is found to be zero, torque boost is applied.	4
21.22	Start delay	Defines the start delay. After the conditions for start have been fulfilled, the drive waits until the delay has elapsed and then starts the motor. During the delay, warning AFE9 Start delay is shown. **Note**: Start delay can be used with all start modes.	10.00
	0.00…60.00 s	Start delay	1 = 1

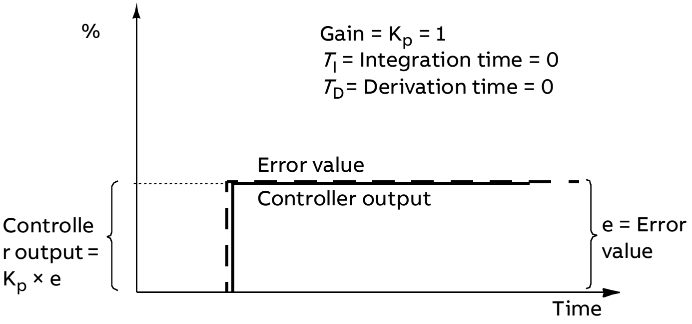
No.	Name/Value	Description	Def/ FbEq16
21.23	Smooth start	Selects the forced current vector rotation mode at low speeds. When smooth start mode is selected, the rate of acceleration is limited by the acceleration and deceleration ramp times. If the process driven by the permanent magnet synchronous motor has high inertia, slow ramp times are recommended. **Note**: Can be used for permanent magnet synchronous motors only.	Disabled
	Disabled	Disabled.	0
	Enabled always	Enabled always.	1
	Start only	Enabled when starting the motor.	2
21.24	Smooth start current	Current used in the current vector rotation at low speeds. Increase the smooth start current if the application requires motor shaft swinging to be minimized. **Note**: Accurate torque control is not possible in the current vector rotation mode. **Note**: Can be used only for permanent magnet synchronous motors.	50.0%
	10.00...100.0%	Value in percent of the nominal motor current.	1 = 1%
21.25	Smooth start speed	Output frequency up to which the current vector rotation is used. See parameter 21.19 Scalar start mode. **Note**: Can be used for permanent magnet synchronous motors only.	10.0%
	2.0...100.0%	Value as a percentage of the nominal motor frequency.	1 = 1%
21.27	Torque boost time	Defines the minimum and maximum torque boost time. If torque boost time is less than 40% of frequency acceleration time (see parameter 28.72), then torque boost time is set at 40% of frequency acceleration time.	20.0 s
	0.0...60.0 s	Nominal motor time.	1 = 1%

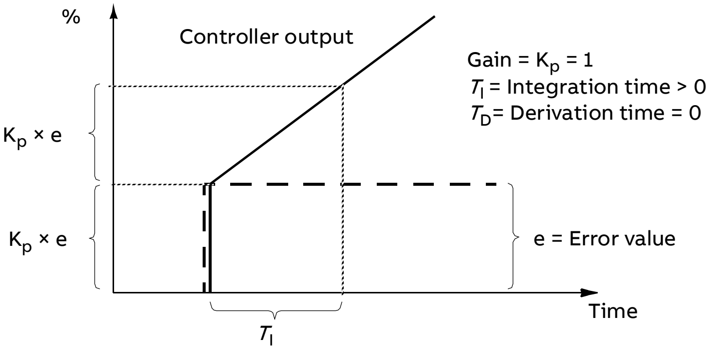
No.	Name/Value	Description	Def/ FbEq16
23 Speed reference ramp		Speed reference ramp settings (programming of the acceleration and deceleration rates for the drive).	
23.01	Speed ref ramp input	Shows used speed reference (in rpm) before it enters the ramping and shaping functions. This parameter is read-only.	0.00
	-30000.00… 30000.00 rpm	Speed reference before ramping and shaping.	1 = 1
23.02	Speed ref ramp output	Shows ramped and shaped speed reference in rpm. This parameter is read-only.	0.00
	-30000.00… 30000.00 rpm	Speed reference after ramping and shaping.	1 = 1
23.12	Acceleration time 1	This parameter is not applicable. Speed reference is provided by MPPT. For more information, see section MPPT control program on page 42.	20.000
	0.000… 1800.000 s	Deceleration time 1.	10 = 1 s

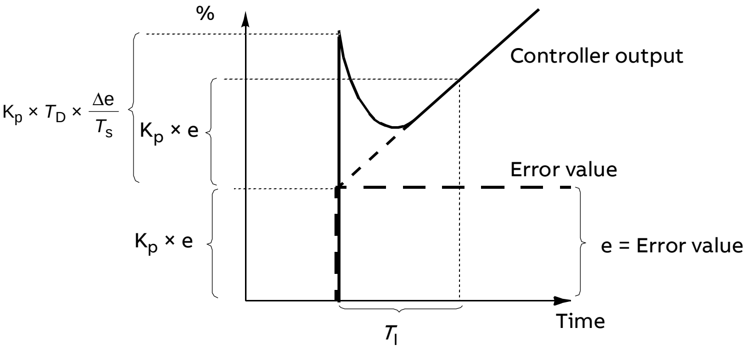
No.	Name/Value	Description	Def/ FbEq16
23.13	Deceleration time 1	Defines the time required for the speed to change from the speed defined by parameter 46.01 Speed scaling (**not** from parameter 30.12 Maximum speed) to zero. If the speed reference decreases slower than the set deceleration rate, the motor speed will follow the reference. If the reference changes faster than the set deceleration rate, the motor speed will follow the deceleration rate. If the deceleration rate is set too short, the drive will automatically prolong the deceleration in order not to exceed drive torque limits (or not to exceed a safe DC link voltage). **Notes:** • Applicable only for ramp stop condition. For all normal reference changes (except pump cleaning operation, as it has it's own ramp times) from MPPT reference, zero deceleration ramp time is considered. • If a short deceleration time is needed for a high inertia application, the drive should be equipped with braking equipment such as a brake chopper and brake resistor.	20.000
	0.000… 1800.000 s	Deceleration time 1.	10 = 1 s

No.	Name/Value	Description	Def/ FbEq16
23.23	Emergency stop time	Defines the time inside which the drive is stopped if an emergency stop Off3 is activated (i.e. the time required for the speed to change from 99.09 Motor nominal speed in vector mode/99.08 Motor nominal frequency in scalar mode to 0 rpm in vector mode/0Hz in scalar mode). Emergency stop mode and activation source are selected by parameters 21.04 Emergency stop mode and 21.05 Emergency stop source respectively. Emergency stop can also be activated through fieldbus and can be used even when pump cleaning is active. **Notes:** • Emergency stop Off1 uses the standard deceleration ramp defined by parameter 23.13 Deceleration time 1 in vector mode and 28.72 Freq deceleration time 1 in scalar mode. • The same parameter value is also used in frequency control mode (ramp parameters).	3.000 s
	0.000… 1800.000 s	Emergency stop Off3 deceleration time.	10 = 1 s

24 Speed reference conditioning		Speed error calculation; speed error window control configuration; speed error step.	
24.01	Used speed reference	Displays the ramped and corrected speed reference (before speed error calculation). This parameter is read-only.	-
	-30000.00… 30000.00 rpm	Speed reference used for speed error calculation.	See par. 46.01
24.02	Used speed feedback	Displays the speed feedback used for speed error calculation. This parameter is read-only.	-
	-30000.00… 30000.00 rpm	Speed feedback used for speed error calculation.	See par. 46.01
24.03	Speed error filtered	Displays the filtered speed error. This parameter is read-only.	-
	-30000.0… 30000.0 rpm	Filtered speed error.	See par. 46.01

No.	Name/Value	Description	Def/ FbEq16
24.12	Speed error filter time	Defines the time constant of the speed error low-pass filter. If the used speed reference changes rapidly, the possible interferences in the speed measurement can be filtered with the speed error filter. Reducing the ripple with this filter may cause speed controller tuning problems. A long filter time constant and fast acceleration time contradict one another. A very long filter time results in unstable control.	0 ms
	0…10000 ms	Speed error filtering time constant. 0 = filtering disabled.	1 = 1 ms
25 Speed control		Speed controller settings.	
25.01	Torque reference speed control	Shows speed controller output that is transferred to the torque controller. This parameter is read-only.	0.0
	-1600.0… 1600.0%	Limited speed controller output torque.	10 = 1
25.02	Speed proportional gain	Defines the proportional gain (K_p) of the speed controller. Too high a gain may cause speed oscillation. The figure below shows the speed controller output after an error step when the error remains constant. **Note:** ABB recommends not to change the default value. This can impact the MPPT efficiency.  If gain is set to 1, a 10% change in error value (reference - actual value) causes the speed controller output to change by 10%, ie. the output value is input × gain.	5.00
	0.00…250.00	Proportional gain for speed controller.	100 = 1

<table>
<tr><th>No.</th><th>Name/Value</th><th>Description</th><th>Def/
FbEq16</th></tr>
<tr><td>25.03</td><td>Speed integration time</td><td>Defines the integration time of the speed controller.
The integration time defines the rate at which the controller output changes when the error value is constant and the proportional gain of the speed controller is 1. The shorter the integration time, the faster the continuous error value is corrected. This time constant must be set to the same order of magnitude as the time constant (time to respond) of the actual mechanical system being controlled, otherwise instability will result.
Setting the integration time to zero disables the I-part of the controller. This is useful to do when tuning the proportional gain; adjust the proportional gain first, then return the integration time.
Anti-windup (the integrator just integrates up to 100%) stops the integrator if the controller output is limited.
The figure below shows the speed controller output after an error step when the error remains constant.
Note: ABB recommends not to change the default value. This can impact the MPPT efficiency.</td><td>0.50</td></tr>
<tr><td colspan="4">
</td></tr>
<tr><td></td><td>0.00…1000.00 s</td><td>Integration time for speed controller.</td><td>10 = 1</td></tr>
</table>

No.	Name/Value	Description	Def/ FbEq16
25.04	Speed derivation time	Defines the derivation time of the speed controller. Derivative action boosts the controller output if the error value changes. The longer the derivation time, the more the speed controller output is boosted during the change. If the derivation time is set to zero, the controller works as a PI controller, otherwise as a PID controller. The derivation makes the control more responsive for disturbances. For simple applications, derivative time is not normally required and should be left at zero. The speed error derivative must be filtered with a low pass filter to eliminate disturbances. The figure below shows the speed controller output after an error step when the error remains constant. **Note:** ABB recommends not to change the default value. This can impact the MPPT efficiency.  Gain = $K_p = 1$ T_I = Integration time > 0 T_D= Derivation time > 0 T_s= Sample time period = 250 µs Δe = Error value change between two samples	0.000
	0.000…10.000 s	Derivation time for speed controller.	1000 = 1

No.	Name/Value	Description	Def/ FbEq16
25.05	Derivation filter time	Defines the derivation filter time constant. See parameter 25.04 Speed derivation time. **Note:** ABB recommends not to change the default value. This can impact the MPPT efficiency.	8
	0…10000 ms	Derivation filter time constant.	1 = 1
25.15	Proportional gain em stop	Defines the proportional gain for the speed controller when an emergency stop is active. See parameter 25.02 Speed proportional gain.	10.00
	1.00…250.00	Proportional gain upon an emergency stop.	100 = 1
25.30	Flux adaptation enable	Enables/disables the flux optimization function. Flux Optimization reduces the total energy consumption and noise when the drive operates below the nominal load. This must be enables for drives that usually operate below nominal load.	Enable
	Enable	Enables the flux optimization. Changes the magnitude of the flux depending on the actual load.	1
	Disable	Disables the flux optimization.	0
25.33	Speed controller auto tune	Activates (or selects a source that activates) the speed controller auto tune function.	Off
	Off	Not activated.	0
	On	Activated.	1
25.34	Auto tune control preset	Defines a control preset for the speed controller auto tune function. The setting affects the way the torque reference will respond to a speed reference step.	Normal
	Smooth	Slow yet robust response.	0
	Normal	Normal response.	1
	Tight	Fast response which can produce high gain value.	2
25.37	Mechanical time constant	Mechanical time constant of the drive and the machinery as determined by the speed controller autotune function. The value can be adjusted manually.	0.00 s
	0.00 … 1000.00 s	Mechanical time constant.	10 = 1 s

No.	Name/Value	Description	Def/ FbEq16
25.38	Auto tune torque step	Defines an added torque value used by the auto tune function. This value is scaled to the motor nominal torque. **Note**: The torque used by the auto tune function can also be limited by the torque limits (in parameter group 30 Limits) and the nominal motor torque.	10.00%
	0.00 … 20.00%	Torque step.	100 = 1%
25.39	Auto tune speed step	Defines a speed value added to the initial speed for the auto tune function. The initial speed (used when auto tune is activated) plus the value of this parameter is the calculated maximum speed used by the auto tune routine. The maximum speed can also be limited by the speed limits (in parameter group 30 Limits) and nominal motor speed. The value is scaled to the motor nominal speed. **Note:** The motor will exceed the calculated maximum speed slightly at the end of each acceleration stage.	10.00%
	0.00 … 20.00%	Speed step.	100 = 1%
25.40	Auto tune repeat times	Determines how many acceleration/deceleration cycles are performed during the auto tune routine. Increasing the value will improve the accuracy of the auto tune function, and allow the use of smaller torque or speed step values	5
	0 … 10	Number of steps for auto tune.	1 = 1
25.53	Torque prop reference	Shows output of the proportional (P) part of the speed controller. This parameter is read-only.	0.0
	-30000.0… 30000.0%	P-part output of speed controller.	See par. 46.03
25.54	Torque integral reference	Shows output of the integral (I) part of the speed controller. This parameter is read-only.	0.0
	-30000.0… 30000.0%	I-part output of speed controller.	See par. 46.03
25.55	Torque deriv reference	Shows output of the derivative (D) part of the speed controller. This parameter is read-only.	0.0
	-30000.0… 30000.0%	D-part output of speed controller.	See par. 46.03

No.	Name/Value	Description	Def/ FbEq16
28 Frequency reference chain		Settings for the frequency reference chain.	
28.01	Frequency ref ramp input	Shows used frequency reference before ramping. This parameter is read-only.	0.00
	-500.00… 500.00 Hz	Frequency reference before ramping.	10 = 1
28.02	Frequency ref ramp output	Shows final frequency reference (after selection, limitation and ramping). This parameter is read-only.	0.00
	-500.00… 500.00 Hz	Final frequency reference.	10 = 1
28.72	Freq acceleration time 1	*This parameter is not applicable.* Speed reference is provided by MPPT. For more information, see section MPPT control program on page 42.	
28.73	Freq deceleration time 1	Defines the time required for the frequency to change from the frequency defined by parameter 46.02 Frequency scaling (**not** from parameter 30.14 Maximum frequency) to zero. **Notes:** • Applicable only for ramp stop condition. For all normal reference changes (except pump cleaning operation, as it has it's own ramp times) from MPPT reference, zero deceleration ramp time is considered. • If a short deceleration time is needed for a high inertia application, the drive should be equipped with braking equipment such as a brake chopper and brake resistor.	20.000 s
	0.000… 1800.000 s	Deceleration time 1.	10 = 1 s

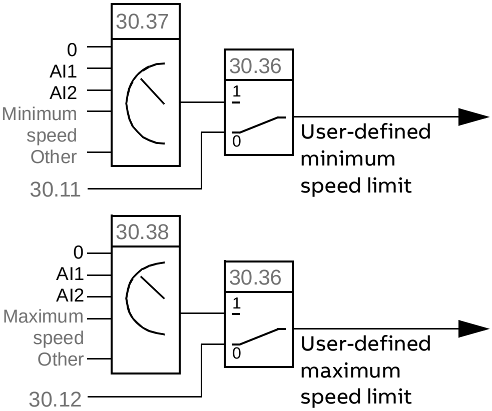
No.	Name/Value	Description	Def/ FbEq16
30 Limits		Drive operation limits.	
30.01	Limit word 1	Shows limit word 1. This parameter is read-only.f	0b0000

Bit	Name	Description
0	Torq lim	1 = Drive torque is limited by the motor control (undervoltage control, current control, load angle control or pull-out control), or by the torque limits defined by parameters.
1…6	Reserved	
7	Max speed ref lim	1 = Speed reference is being limited by 30.12 Maximum speed
8	Min speed ref lim	1 = Speed reference is being limited by 30.11 Minimum speed
9	Max freq ref lim	1 = Frequency reference is being limited by 30.14 Maximum frequency
10	Min freq ref lim	1 = Frequency reference is being limited by 30.13 Minimum frequency
11…15	Reserved	

	0b0000… 0b1111	Limit word 1.	1 = 1

<table>
<tr><th>No.</th><th>Name/Value</th><th>Description</th><th>Def/
FbEq16</th></tr>
<tr><td>30.02</td><td>Torque limit status</td><td>Shows torque controller limitation status word.
This parameter is read-only.</td><td>0b0000</td></tr>
<tr><td></td><td colspan="3">
<table>
<tr><th>Bit</th><th>Name</th><th>Description</th></tr>
<tr><td>0</td><td>Undervoltage</td><td>*1 = Intermediate DC circuit undervoltage</td></tr>
<tr><td>1</td><td>Overvoltage</td><td>*1 = Intermediate DC circuit overvoltage</td></tr>
<tr><td>2</td><td>Minimum torque</td><td>*1 = Torque is being limited by 30.19 Minimum torque 1</td></tr>
<tr><td>3</td><td>Maximum torque</td><td>*1 = Torque is being limited by 30.20 Maximum torque 1</td></tr>
<tr><td>4</td><td>Internal current</td><td>1 = An inverter current limit (identified by bits 8…11) is active</td></tr>
<tr><td>5</td><td>Load angle</td><td>(With permanent magnet motors and reluctance motors only)
1 = Load angle limit is active, ie. the motor cannot produce any more torque</td></tr>
<tr><td>6</td><td>Motor pullout</td><td>(With asynchronous motors only)
Motor pull-out limit is active, ie. the motor cannot produce any more torque</td></tr>
<tr><td>7</td><td colspan="2">Reserved</td></tr>
<tr><td>8</td><td>Thermal</td><td>1 = Input current is being limited by the main circuit thermal limit</td></tr>
<tr><td>9</td><td>Max current</td><td>*1 = Maximum output current (I_{MAX}) is being limited</td></tr>
<tr><td>10</td><td>User current</td><td>*1 = Output current is being limited by 30.17 Maximum current</td></tr>
<tr><td>11</td><td>Thermal IGBT</td><td>*1 = Output current is being limited by a calculated thermal current value</td></tr>
<tr><td>12…15</td><td colspan="2">Reserved</td></tr>
<tr><td colspan="3">*Only one out of bits 0…3, and one out of bits 9…11 can be on simultaneously. The bit typically indicates the limit that is exceeded first.</td></tr>
</table>
</td></tr>
<tr><td></td><td>0b0000…
0b1111</td><td>Torque limitation status word.</td><td>1 = 1</td></tr>
<tr><td>30.09</td><td>Cur Lim Monitor Time</td><td>Defines the drive current limit monitor time after which action is taken as specified in the parameter 30.10.</td><td>10.00</td></tr>
<tr><td></td><td>0.00...120.00s</td><td>Current limit monitor time.</td><td>100=1</td></tr>
<tr><td>30.10</td><td>Current Limit Actions</td><td>Selects how the drive reacts when the drive reaches the current limit (30.17 Maximum current) and exceeds the monitor time set by parameter 30.09 Cur Lim Monitor Time.</td><td>Warning</td></tr>
<tr><td></td><td>No action</td><td>None (current limit action disabled).</td><td>0</td></tr>
<tr><td></td><td>Warning</td><td>The drive generates an A8B6 Current limit warning.</td><td>1</td></tr>
<tr><td></td><td>Fault</td><td>The drive trips on fault 8009 Current limit.</td><td>2</td></tr>
</table>

No.	Name/Value	Description	Def/ FbEq16
30.11	Minimum speed	Defines the minimum allowed speed. ⚠ **WARNING!** This value must not be higher than 30.12 Maximum speed. ⚠ **WARNING!** In speed control mode only. In frequency control mode, use frequency limits (30.13 and 30.14). **Note:** Set the value to 0 to prevent the pump to run in negative directive.	-3000.00 rpm
	-30000.00… 30000.00 rpm	Minimum allowed speed.	1 = 1
30.12	Maximum speed	Defines the maximum allowed speed. ⚠ **WARNING!** This value must not be lower than 30.11 Minimum speed. ⚠ **WARNING!** In speed control mode only. In frequency control mode, use frequency limits (30.13 and 30.14).	3000.00 rpm
	-30000.00… 30000.00 rpm	Maximum speed.	1 = 1
30.13	Minimum frequency	Defines the minimum allowed frequency. ⚠ **WARNING!** This value must not be higher than 30.14 Maximum frequency. ⚠ **WARNING!** in frequency control mode only.	-300.00 Hz
	-500.00… 500.00 Hz	Minimum frequency.	10 = 1
30.14	Maximum frequency	Defines the maximum allowed frequency. ⚠ **WARNING!** This value must not be lower than 30.13 Minimum frequency. ⚠ **WARNING!** In frequency control mode only.	300.00 Hz
	-500.00… 500.00 Hz	Maximum frequency.	10 = 1
30.17	Maximum current	Defines the maximum allowed drive current.	3.24 A
	0.00…3.24 A	Maximum drive current.	1 = 1 A
30.19	Minimum torque 1	Defines a minimum torque limit for the drive (in percent of nominal motor torque).	-300.0%
	-1600.0…0.0%	Minimum torque limit 1.	10 = 1
30.20	Maximum torque 1	Defines a maximum torque limit for the drive (in percent of nominal motor torque).	300.0%
	0.0…1600.0%	Maximum torque 1.	10 = 1

No.	Name/Value	Description	Def/ FbEq16
30.35	Thermal current limitation	Enables/disables temperature-based output current limitation. The limitation should only be disabled if required by the application.	Enable
	Disable	Thermal current limitation disabled.	0
	Enable	Thermal current limitation enabled.	1
30.36	Speed limit selection	Selects a source that switches between two different predefined adjustable speed limit sets. 0 = minimum speed limit defined by 30.11 and maximum speed limit defined by 30.12 are active 1 = minimum speed limit selected by 30.37 and maximum speed limit defined by 30.38 are active. The user can define two sets of speed limits, and switch between the sets using a binary source such as a digital input. The user can define two sets of speed limits, and switch between the sets using a binary source such as a digital input. The first set of limits is defined by parameters 30.11 Minimum speed and 30.12 Maximum speed. The second set has selector parameters for both the minimum (30.37) and maximum (30.38) limits that allows the use of a selectable analog source (such as an analog input).  	Not selected

No.	Name/Value	Description	Def/ FbEq16
	Not selected	Adjustable speed limits are disabled. (Minimum speed limit defined by 30.11 Minimum speed and maximum speed limit defined by 30.12 Maximum speed are active).	0
	Selected	Adjustable speed limits are enabled. (Minimum speed limit defined by 30.37 Min speed source source and maximum speed limit defined by 30.38 Max speed source are active).	1
	Ext1 active	Adjustable speed limits are enabled if EXT1 is active.	2
	Ext2 active	Adjustable speed limits are enabled if EXT2 is active.	3
	Torque control	Adjustable speed limits are enabled if Torque control mode (vector motor control) is active.	4
	DI1	Digital input DI1 (10.02 DI delayed status, bit 0).	5
	DI2	Digital input DI2 (10.02 DI delayed status, bit 1).	6
	DI3	Digital input DI3 (10.02 DI delayed status, bit 2).	7
	DI4	Digital input DI4 (10.02 DI delayed status, bit 3).	8
	DI5	Digital input DI5 (10.02 DI delayed status, bit 4).	9
	DI6	Digital input DI6 (10.02 DI delayed status, bit 5).	10
	Other	Source selection (see Terms and abbreviations on page 80).	-
30.37	Min speed source	Defines the source of a minimum speed limit for the drive when the source is selected by 30.36 Speed limit selection. ⚠ **WARNING!** In vector motor control mode only. In scalar motor control mode, use frequency limits 30.13 and 30.14.	Minimum speed
	Zero	None.	0
	AI1 scaled	12.12 AI1 scaled value.	1
	AI2 scaled	12.22 AI2 scaled value.	2
	Minimum speed	30.11 Minimum speed.	11
	Other	Source selection (see Terms and abbreviations on page 80).	-
30.38	Max speed source	Defines the source of a maximum speed limit for the drive when the source is selected by 30.36 Speed limit selection. ⚠ **WARNING!** In vector motor control mode only. In scalar motor control mode, use frequency limits 30.13 and 30.14.	Maximum speed
	Zero	None.	0

No.	Name/Value	Description	Def/ FbEq16
	AI1 scaled	12.12 AI1 scaled value.	1
	AI2 scaled	12.22 AI2 scaled value.	2
	Maximum speed	30.12 Maximum speed.	12
	Other	Source selection (see Terms and abbreviations on page 80).	-

31 Fault functions		Configuration of external events; selection of behavior of the drive upon fault situations.	
31.01	External event 1 source	Defines the source of external event 1. See also parameter 31.02 External event 1 type. 0 = Trigger event 1 = Normal operation	Inactive (true)
	Active (false)	0.	0
	Inactive (true)	1.	1
	DI1	Digital input DI1 (10.02 DI delayed status, bit 0).	3
	DI2	Digital input DI2 (10.02 DI delayed status, bit 1).	4
	DI3	Digital input DI3 (10.02 DI delayed status, bit 2).	5
	DI4	Digital input DI4 (10.02 DI delayed status, bit 3).	6
	DI5	Digital input DI5 (10.02 DI delayed status, bit 4).	7
	DI6	Digital input DI6 (10.02 DI delayed status, bit 5).	8
	Other [bit]	Source selection (see Terms and abbreviations on page 80).	-
31.02	External event 1 type	Selects the type of external event 1.	Fault
	Fault	The external event generates a fault.	0
	Warning	The external event generates a warning.	1
31.03	External event 2 source	Defines the source of external event 2. See also parameter 31.04 External event 2 type. For the selections, see parameter 31.01 External event 1 source.	Inactive (true)
31.04	External event 2 type	Selects the type of external event 2.	Fault
	Fault	The external event generates a fault.	0
	Warning	The external event generates a warning.	1
31.05	External event 3 source	Defines the source of external event 3. See also parameter 31.06 External event 3 type. For the selections, see parameter 31.01 External event 1 source.	Inactive (true)

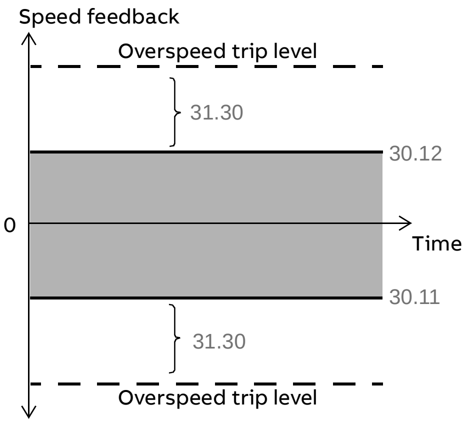
No.	Name/Value	Description	Def/ FbEq16
31.06	External event 3 type	Selects the type of external event 3.	Fault
	Fault	The external event generates a fault.	0
	Warning	The external event generates a warning.	1
31.07	External event 4 source	Defines the source of external event 4. See also parameter 31.08 External event 4 type. For the selections, see parameter 31.01 External event 1 source.	Inactive (true)
31.08	External event 4 type	Selects the type of external event 4.	Fault
	Fault	The external event generates a fault.	0
	Warning	The external event generates a warning.	1
31.09	External event 5 source	Defines the source of external event 5. See also parameter 31.10 External event 5 type. For the selections, see parameter 31.01 External event 1 source.	Inactive (true)
31.10	External event 5 type	Selects the type of external event 5.	Fault
	Fault	The external event generates a fault.	0
	Warning	The external event generates a warning.	1
31.11	Fault reset selection	Selects the source of an external fault reset signal. The signal resets the drive after a fault trip if the cause of the fault no longer exists. 0 -> 1 = Reset **Notes:** Whenever the remote control mode is in fieldbus (Start stop command and reference is through fieldbus), the fault can be reset from the fieldbus regardless of the selection of the parameter.	Not selected
	Not selected	0.	0
	Selected	1.	1
	DI1	Digital input DI1 (10.02 DI delayed status, bit 0).	2
	DI2	Digital input DI2 (10.02 DI delayed status, bit 1).	3
	DI3	Digital input DI3 (10.02 DI delayed status, bit 2).	4
	DI4	Digital input DI4 (10.02 DI delayed status, bit 3).	5
	DI5	Digital input DI5 (10.02 DI delayed status, bit 4).	6
	DI6	Digital input DI6 (10.02 DI delayed status, bit 5).	7
	Reserved		8...17
	Timed function 1	Bit 0 of 34.01 Timed functions status (see page 166).	18

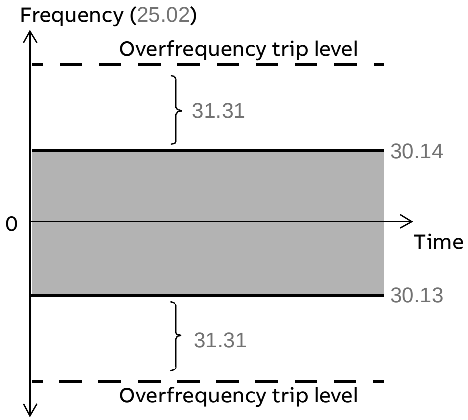
No.	Name/Value	Description	Def/ FbEq16
	Timed function 2	Bit 1 of 34.01 Timed functions status (see page 166).	19
	Timed function 3	Bit 2 of 34.01 Timed functions status (see page 166).	20
	Reserved		21...23
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 152).	24
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 152).	25
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 152).	26
	Reserved		27...29
	FBA A MCW bit 7	Control word bit 7 received through fieldbus interface A.	30
	EFB MCW bit 7	Control word bit 7 received through the embedded fieldbus interface.	32
	Other [bit]	Source selection (see Terms and abbreviations on page 80).	-
31.19	Motor phase loss	Selects how the drive reacts when a motor phase loss is detected.	Fault
	No action	No action taken.	0
	Fault	The drive trips on fault 3381 Output phase loss.	1
31.20	Earth fault	Selects how the drive reacts when an earth (ground) fault or current unbalance is detected in the motor or the motor cable.	Fault
	No action	No action taken.	0
	Warning	The drive generates an A2B3 Earth leakage warning.	1
	Fault	The drive trips on fault 2330 Earth leakage.	2
31.21	Supply phase loss	Selects how the drive reacts when a supply phase loss is detected.	Fault
	No action	Output current is limited to 50% when supply phase loss is detected. No fault or warning is displayed.	0
	Fault	Drive trips on fault 3130 Input phase loss.	1

<table>
<tr><th>No.</th><th>Name/Value</th><th>Description</th><th>Def/ FbEq16</th></tr>
<tr><td>31.22</td><td>STO indication run/stop</td><td><p>Selects which indications are given when one or both Safe torque off (STO) signals are switched off or lost. The indications also depend on whether the drive is running or stopped when this occurs.</p><p>The tables at each selection below show the indications generated with that particular setting.</p><p>Notes:</p>
This parameter does not affect the operation of the STO function itself. The STO function will operate regardless of the setting of this parameter: a running drive will stop upon removal of one or both STO signals, and will not start until both STO signals are restored and all faults reset.
The loss of only one STO signal always generates a fault as it is interpreted as a malfunction.
<p>For more information on the STO, see chapter The Safe torque off function in the <i>Hardware manual</i> of the drive.</p></td><td>Fault/Fault</td></tr>
<tr><td></td><td>Fault/Fault</td><td><table>
<tr><th colspan="2">Inputs</th><th rowspan="2">Indication (running or stopped)</th></tr>
<tr><th>IN1</th><th>IN2</th></tr>
<tr><td>0</td><td>0</td><td>Fault 5091 Safe torque off</td></tr>
<tr><td>0</td><td>1</td><td>Faults 5091 Safe torque off and
FA81 Safe torque off 1 loss</td></tr>
<tr><td>1</td><td>0</td><td>Faults 5091 Safe torque off and
FA82 Safe torque off 2 loss</td></tr>
<tr><td>1</td><td>1</td><td>(Normal operation)</td></tr>
</table></td><td>0</td></tr>
</table>

<table>
<tr><th>No.</th><th>Name/Value</th><th>Description</th><th>Def/
FbEq16</th></tr>
<tr><td></td><td>Fault/Warning</td><td>
<table>
<tr><td colspan="2">Inputs</td><td colspan="2">Indication</td></tr>
<tr><td>IN1</td><td>IN2</td><td>Running</td><td>Stopped</td></tr>
<tr><td>0</td><td>0</td><td>Fault 5091 Safe torque off</td><td>Warning A5A0 Safe torque off</td></tr>
<tr><td>0</td><td>1</td><td>Faults 5091 Safe torque off and FA81 Safe torque off 1 loss</td><td>Warning A5A0 Safe torque off and fault FA81 Safe torque off 1 loss</td></tr>
<tr><td>1</td><td>0</td><td>Faults 5091 Safe torque off and FA82 Safe torque off 2 loss</td><td>Warning A5A0 Safe torque off and fault FA82 Safe torque off 2 loss</td></tr>
<tr><td>1</td><td>1</td><td colspan="2">(Normal operation)</td></tr>
</table>
</td><td>1</td></tr>
<tr><td></td><td>Fault/Event</td><td>
<table>
<tr><td colspan="2">Inputs</td><td colspan="2">Indication</td></tr>
<tr><td>IN1</td><td>IN2</td><td>Running</td><td>Stopped</td></tr>
<tr><td>0</td><td>0</td><td>Fault 5091 Safe torque off</td><td>Event B5A0 Safe torque off</td></tr>
<tr><td>0</td><td>1</td><td>Faults 5091 Safe torque off and FA81 Safe torque off 1 loss</td><td>Event B5A0 Safe torque off and fault FA81 Safe torque off 1 loss</td></tr>
<tr><td>1</td><td>0</td><td>Faults 5091 Safe torque off and FA82 Safe torque off 2 loss</td><td>Event B5A0 Safe torque off and fault FA82 Safe torque off 2 loss</td></tr>
<tr><td>1</td><td>1</td><td colspan="2">(Normal operation)</td></tr>
</table>
</td><td>2</td></tr>
<tr><td></td><td>Warning/
Warning</td><td>
<table>
<tr><td colspan="2">Inputs</td><td rowspan="2">Indication (running or stopped)</td></tr>
<tr><td>IN1</td><td>IN2</td></tr>
<tr><td>0</td><td>0</td><td>Warning A5A0 Safe torque off</td></tr>
<tr><td>0</td><td>1</td><td>Warning A5A0 Safe torque off and fault FA81 Safe torque off 1 loss</td></tr>
<tr><td>1</td><td>0</td><td>Warning A5A0 Safe torque off and fault FA82 Safe torque off 2 loss</td></tr>
<tr><td>1</td><td>1</td><td>(Normal operation)</td></tr>
</table>
</td><td>3</td></tr>
</table>

<table>
<tr><th>No.</th><th>Name/Value</th><th>Description</th><th>Def/ FbEq16</th></tr>
<tr><td></td><td>Event/Event</td><td>
<table>
<tr><th colspan="2">Inputs</th><th>Indication (running or stopped)</th></tr>
<tr><th>IN1</th><th>IN2</th><th></th></tr>
<tr><td>0</td><td>0</td><td>Event B5A0 STO event</td></tr>
<tr><td>0</td><td>1</td><td>Event B5A0 STO event and fault FA81 Safe torque off 1 loss</td></tr>
<tr><td>1</td><td>0</td><td>Event B5A0 STO event and fault FA82 Safe torque off 2 loss</td></tr>
<tr><td>1</td><td>1</td><td>(Normal operation)</td></tr>
</table>
</td><td>4</td></tr>
<tr><td></td><td>No indication/No indication</td><td>
<table>
<tr><th colspan="2">Inputs</th><th>Indication (running or stopped)</th></tr>
<tr><th>IN1</th><th>IN2</th><th></th></tr>
<tr><td>0</td><td>0</td><td>None</td></tr>
<tr><td>0</td><td>1</td><td>Fault FA81 Safe torque off 1 loss</td></tr>
<tr><td>1</td><td>0</td><td>Fault FA82 Safe torque off 2 loss</td></tr>
<tr><td>1</td><td>1</td><td>(Normal operation)</td></tr>
</table>
</td><td>5</td></tr>
<tr><td>31.23</td><td>Wiring or earth fault</td><td>Selects how the drive reacts to incorrect input power and motor cable connection (i.e. input power cable is connected to drive motor connection).</td><td>Fault</td></tr>
<tr><td></td><td>No action</td><td>No action taken.</td><td>0</td></tr>
<tr><td></td><td>Fault</td><td>The drive trips on fault 3181 Wiring or earth fault.</td><td>1</td></tr>
<tr><td>31.24</td><td>Stall function</td><td>Selects how the drive reacts to a stall condition.
A stall condition is defined as follows:
• The drive exceeds the stall current limit (31.25 Stall current limit), and
• the output frequency is below the level set by parameter 31.27 Stall frequency limit or the motor speed is below the level set by parameter 31.26 Stall speed limit, and
• the conditions above have been true longer than the time set by parameter 31.28 Stall time.</td><td>Fault</td></tr>
<tr><td></td><td>No action</td><td>None (stall supervision disabled).</td><td>0</td></tr>
<tr><td></td><td>Warning</td><td>The drive generates an A780 Motor stall warning.</td><td>1</td></tr>
<tr><td></td><td>Fault</td><td>The drive trips on fault 7121 Motor stall.</td><td>2</td></tr>
<tr><td>31.25</td><td>Stall current limit</td><td>Stall current limit in percent of the nominal current of the motor. See parameter 31.24 Stall function.</td><td>200.0%</td></tr>
<tr><td></td><td>0.0…1600.0%</td><td>Stall current limit.</td><td>-</td></tr>
</table>

No.	Name/Value	Description	Def/ FbEq16
31.26	Stall speed limit	Stall speed limit in rpm. See parameter 31.24 Stall function.	150.00 rpm
	0.00… 10000.00 rpm	Stall speed limit.	1 = 1
31.27	Stall frequency limit	Stall frequency limit. See parameter 31.24 Stall function. **Note:** Setting the limit below 10 Hz is not recommended.	10.00 Hz
	0.00… 1000.00 Hz	Stall frequency limit.	10 = 1
31.28	Stall time	Stall time. See parameter 31.24 Stall function.	10 s
	0…3600 s	Stall time.	-
31.30	Overspeed trip margin	Defines, together with 30.11 Minimum speed and 30.12 Maximum speed, the maximum allowed speed of the motor (overspeed protection). If the speed feedback exceeds the speed limit defined by parameter 30.11 or 30.12 by more than the value of this parameter, the drive trips on the 7310 Overspeed fault. ⚠ **WARNING!** This function only supervises the speed in vector motor control mode. The function is not effective in scalar motor control mode. **Example:** If the maximum speed is 1420 rpm and speed trip margin is 300 rpm, the drive trips at 1720 rpm. 	500.00 rpm
	0.00… 10000.00 rpm	Overspeed trip margin.	1 = 1

No.	Name/Value	Description	Def/ FbEq16
31.31	Frequency trip margin	Defines, together with 30.13 Minimum frequency and 30.14 Maximum frequency, the maximum allowed frequency of the motor. If the speed (28.01 Frequency ref ramp input) exceeds the frequency limit defined by parameter 30.13 or 30.14 by more than the value of this parameter, the drive trips on the73F0 Overfrequency fault. ⚠ **WARNING!** This function only supervises the speed in scalar motor control mode. The function is not effective in vector motor control mode. **Example:** If the maximum speed is 40 Hz and speed trip margin is 10 Hz, the drive trips at 50 Hz. 	15.00 Hz
	0.00… 10000.00 Hz	Overfrequency trip margin.	See par. 46.02

<table>
<tr><th>No.</th><th>Name/Value</th><th>Description</th><th>Def/ FbEq16</th></tr>
<tr><td>31.40</td><td>Disable warning messages</td><td>Selects the warnings to be suppressed.
This parameter is a 16-bit word with each bit corresponding to a warning. Whenever a bit is set to 1, the corresponding warning is suppressed.</td><td>0000h</td></tr>
<tr><td></td><td colspan="3">
<table>
<tr><th>Bit</th><th>Name</th><th>Description</th></tr>
<tr><td>0</td><td colspan="2">Reserved</td></tr>
<tr><td>1</td><td>DC link undervoltage</td><td>1 = Warning A3A2 DC link undervoltage is suppressed.</td></tr>
<tr><td>2...4</td><td colspan="2">Reserved</td></tr>
<tr><td>5</td><td>Emergency stop (off2)</td><td>1 = Warning AFE1 Emergency stop (off2) is suppressed.</td></tr>
<tr><td>6</td><td>Emergency stop (off1or off3)</td><td>1 = Warning AFE2 Emergency stop (off1 or off3) is suppressed.</td></tr>
<tr><td>7....15</td><td colspan="2">Reserved</td></tr>
</table>
</td></tr>
<tr><td></td><td>0000h…FFFFh</td><td>Word for disabling warnings.</td><td>1 = 1</td></tr>
<tr><td>31.54</td><td>Fault action</td><td>Selects the stop mode when a non-critical fault occurs.</td><td>Coast</td></tr>
<tr><td></td><td>Coast</td><td>Drive coasts to a stop.</td><td>0</td></tr>
<tr><td></td><td>Emergency ramp</td><td>Drive follows the ramp specified for an emergency stop in parameter 23.23 Emergency stop time.</td><td>1</td></tr>
</table>

No.	Name/Value	Description	Def/ FbEq16
32 Supervision		Configuration of signal supervision functions 1…6. Six values can be chosen to be monitored; a warning or fault is generated whenever predefined limits are exceeded. See also section Signal supervision (page 65).	
32.01	Supervision status	Signal supervision status word. Indicates whether the values monitored by the signal supervision functions are within or outside their respective limits. **Note:** This word is independent of the drive actions defined by parameters 32.06, 32.16, 32.26, 32.36, 32.46 and 32.56.	0b000

Bit	Name	Description
0	Supervision 1 active	1 = Signal selected by 32.07 is outside its limits.
1	Supervision 2 active	1 = Signal selected by 32.17 is outside its limits.
2	Supervision 3 active	1 = Signal selected by 32.27 is outside its limits.
3	Supervision 4 active	1 = Signal selected by 32.37 is outside its limits.
4	Supervision 5 active	1 = Signal selected by 32.47 is outside its limits.
5	Supervision 6 active	1 = Signal selected by 32.27 is outside its limits.
6…15	Reserved	

	0b0000… 0b1111	Signal supervision status word.	1 = 1
32.05	Supervision 1 function	Selects the mode of signal supervision function 1. Determines how the monitored signal (see parameter 32.07) is compared to its lower and upper limits (32.09 and 32.10 respectively). The action to be taken when the condition is fulfilled is selected by 32.06.	Disabled
	Disabled	Signal supervision 1 not in use.	0
	Low	Action is taken whenever signal is below 'Supervision low' limit - 0.5 * hysteresis. Action is deactivated whenever signal is above 'Supervision low' limit + 0.5 * hysteresis.	1
	High	Action is taken whenever signal is above Supervision High limit + 0.5 * hysteresis. Action is deactivated whenever signal is below Supervision High limit - 0.5 * hysteresis.	2
	Abs low	Action is taken whenever absolute value of signal is below absolute value of Supervision Low limit - 0.5 * hysteresis. Action is deactivated whenever absolute value of signal is above absolute value of Supervision Low limit + 0.5 * hysteresis.	3

No.	Name/Value	Description	Def/ FbEq16
	Abs high	Action is taken whenever absolute value of signal is above absolute value of Supervision High limit + 0.5 * hysteresis. Action is deactivated whenever absolute value of signal is below absolute value of Supervision High limit - 0.5 * hysteresis.	4
	Both	Action is taken whenever signal is above Supervision High limit + 0.5 * hysteresis or below Supervision Low limit - 0.5*hysteresis. Action is deactivated whenever signal is in between Supervision High limit - 0.5 * hysteresis and 'Supervision Low' limit + 0.5*hysteresis.	5
	Abs both	Action is taken whenever absolute value of signal is above absolute value of Supervision High limit + 0.5 * hysteresis or below absolute value of Supervision Low limit - 0.5*hysteresis. Action is deactivated whenever absolute value of signal is in between absolute value of 'Supervision High' limit - 0.5 * hysteresis and absolute value of 'Supervision Low' limit + 0.5*hysteresis.	6
	Hysteresis	Action is taken whenever signal is above 'Supervision High' limit + 0.5 * hysteresis. Action is deactivated whenever signal is below 'Supervision Low' limit - 0.5 * hysteresis. The status is unchanged when signal value is in between Supervision High limit + 0.5 * hysteresis and Supervision Low limit - 0.5 * hysteresis.	7
	Low falling	Action is taken whenever the signal falls from a value higher than the Supervision low limit + (0.5 * hysteresis) to a value which is lower than Supervision low limit - (0.5 * hysteresis). Action is deactivated when the signal rises to a higher value than Supervision low limit + (0.5*hysteresis).	8
	High rising	Action is taken whenever the signal rises from a value lower than Supervision high limit - (0.5 * hysteresis) to a value which is higher than Supervision high' limit + (0.5 * hysteresis). Action is deactivated when the signal falls to a value lower than Supervision high limit - (0.5*hysteresis).	9

No.	Name/Value	Description	Def/ FbEq16
32.06	Supervision 1 action	Selects whether the drive generates a fault, warning or neither when the value monitored by signal supervision 1 exceeds its limits. **Note:** This parameter does not affect the status indicated by 32.01 Supervision status.	No action
	No action	No warning or fault generated.	0
	Warning	Warning A8B0 Signal supervision 1 is generated.	1
	Fault	Drive trips on fault 80B0 Signal supervision 1.	2
	Fault if running	If running, the drive trips on fault 80B0 Signal supervision 1.	3
32.07	Supervision 1 signal	Selects the signal to be monitored by signal supervision function 1.	Frequency
	Zero	None.	0
	Speed	01.01 Motor speed used (page 83).	1
	Frequency	01.06 Output frequency (page 83).	3
	Current	01.07 Motor current (page 83).	4
	Torque	01.10 Motor torque (page 84).	6
	DC voltage	01.11 DC voltage (page 84).	7
	Output power	01.14 Output power (page 84).	8
	AI1	12.11 AI1 actual value (page 109).	9
	AI2	12.21 AI2 actual value (page 112).	10
	Freq ref used	28.02 Frequency ref ramp output (page 137).	22
	Inverter temperature	05.11 Inverter temperature (page 91).	23
	Process PID output	40.01 Process PID output actual (page 190).	24
	Process PID feedback	40.02 Process PID feedback actual (page 190).	25
	Process PID setpoint	40.03 Process PID setpoint actual (page 191).	26
	Process PID deviation	40.04 Process PID deviation actual (page 191).	27
	Other	Source selection (see Terms and abbreviations on page 80).	-
32.08	Supervision 1 filter time	Defines a filter time constant for the signal monitored by signal supervision 1.	0.000 s
	0.000 … 30.000 s	Signal filter time.	1000 = 1 s

No.	Name/Value	Description	Def/ FbEq16
32.09	Supervision 1 low	Defines the lower limit for signal supervision 1.	0.00
	-21474836.00… 21474836.00	Low limit.	-
32.10	Supervision 1 high	Defines the upper limit for signal supervision 1.	0.00
	-21474836.00… 21474836.00	Upper limit.	-
32.11	Supervision 1 hysteresis	Defines the hysteresis for the signal monitored by signal supervision 1.	0.00
	0.00… 100000.00	Hysteresis.	-
32.15	Supervision 2 function	Selects the mode of signal supervision function 2. Determines how the monitored signal (see parameter 32.17) is compared to its lower and upper limits (32.19 and 32.20 respectively). The action to be taken when the condition is fulfilled is selected by 32.16.	Disabled
	Disabled	Signal supervision 2 not in use.	0
	Low	Action is taken whenever signal is below Supervision low limit - (0.5 * hysteresis). Action is deactivated whenever signal is above Supervision low limit + (0.5 * hysteresis).	1
	High	Action is taken whenever signal is above Supervision high limit + (0.5 * hysteresis). Action is deactivated whenever signal is below Supervision high limit - (0.5 * hysteresis).	2
	Abs low	Action is taken whenever absolute value of signal is below absolute value of Supervision low limit - (0.5 * hysteresis). Action is deactivated whenever absolute value of signal is above absolute value of Supervision low limit + (0.5 * hysteresis).	3
	Abs high	Action is taken whenever absolute value of signal is above absolute value of Supervision high limit + (0.5 * hysteresis). Action is deactivated whenever absolute value of signal is below absolute value of Supervision high limit - (0.5 * hysteresis)	4

No.	Name/Value	Description	Def/ FbEq16
	Both	Action is taken whenever signal is above Supervision high limit + (0.5 * hysteresis) or below Supervision low limit - (0.5*hysteresis). Action is deactivated whenever signal is in between Supervision high limit - (0.5 * hysteresis) and Supervision low limit + (0.5*hysteresis).	5
	Abs both	Action is taken whenever absolute value of signal is above absolute value of Supervision high limit + (0.5 * hysteresis) or below absolute value of Supervision low limit - (0.5*hysteresis). Action is deactivated whenever absolute value of signal is in between absolute value of Supervision high limit - (0.5 * hysteresis) and absolute value of Supervision low limit + (0.5*hysteresis).	6
	Hysteresis	Action is taken whenever signal is above Supervision high limit + 0.5 * hysteresis. Action is deactivated whenever signal is below Supervision low limit - (0.5 * hysteresis). The status is unchanged when signal value is in between Supervision high limit + (0.5 * hysteresis) and 'Supervision Low' limit - (0.5 * hysteresis)	7
	Low falling	Action is taken whenever the signal falls from a value higher than the Supervision low limit + (0.5 * hysteresis) to a value which is lower than Supervision low limit - (0.5 * hysteresis). Action is deactivated when the signal rises to a higher value than Supervision low limit + (0.5*hysteresis).	8
	High rising	Action is taken whenever the signal rises from a value lower than Supervision high limit - (0.5 * hysteresis) to a value which is higher than Supervision high' limit + (0.5 * hysteresis). Action is deactivated when the signal falls to a value lower than Supervision high limit - (0.5*hysteresis).	9
32.16	Supervision 2 action	Selects whether the drive generates a fault, warning or neither when the value monitored by signal supervision 2 exceeds its limits. **Note:** This parameter does not affect the status indicated by 32.01 Supervision status.	No action
	No action	No warning or fault generated.	0
	Warning	Warning A8B1 Signal supervision 2 is generated.	1
	Fault	Drive trips on fault 80B1 Signal supervision 2.	2

No.	Name/Value	Description	Def/ FbEq16
	Fault if running	If running, the drive trips on fault 80B0 Signal supervision 1.	3
32.17	Supervision 2 signal	Selects the signal to be monitored by signal supervision function 2. For the available selections, see parameter 32.07 Supervision 1 signal.	Current
32.18	Supervision 2 filter time	Defines a filter time constant for the signal monitored by signal supervision 2.	0.000 s
	0.000 … 30.000 s	Signal filter time.	1000 = 1 s
32.19	Supervision 2 low	Defines the lower limit for signal supervision 2.	0.00
	-21474836.00… 21474836.00	Low limit.	-
32.20	Supervision 2 high	Defines the upper limit for signal supervision 2.	0.00
	-21474836.00… 21474836.00	Upper limit.	-
32.21	Supervision 2 hysteresis	Defines the hysteresis for the signal monitored by signal supervision 2.	0.00
	0.00… 100000.00	Hysteresis.	-
32.25	Supervision 3 function	Selects the mode of signal supervision function 3. Determines how the monitored signal (see parameter 32.27) is compared to its lower and upper limits (32.29 and 32.30 respectively). The action to be taken when the condition is fulfilled is selected by 32.26.	Disabled
	Disabled	Signal supervision 3 not in use.	0
	Low	Action is taken whenever signal is below Supervision low limit - (0.5 * hysteresis). Action is deactivated whenever signal is above Supervision low limit + (0.5 * hysteresis).	1
	High	Action is taken whenever signal is above Supervision high limit + (0.5 * hysteresis). Action is deactivated whenever signal is below Supervision high limit - (0.5 * hysteresis).	2
	Abs low	Action is taken whenever absolute value of signal is below absolute value of Supervision low limit - (0.5 * hysteresis). Action is deactivated whenever absolute value of signal is above absolute value of Supervision low limit + (0.5 * hysteresis).	3

No.	Name/Value	Description	Def/ FbEq16
	Abs high	Action is taken whenever absolute value of signal is above absolute value of Supervision high limit + (0.5 * hysteresis). Action is deactivated whenever absolute value of signal is below absolute value of Supervision high limit - (0.5 * hysteresis)	4
	Both	Action is taken whenever signal is above Supervision high limit + (0.5 * hysteresis) or below Supervision low limit - (0.5*hysteresis). Action is deactivated whenever signal is in between Supervision high limit - (0.5 * hysteresis) and Supervision low limit + (0.5*hysteresis).	5
	Abs both	Action is taken whenever absolute value of signal is above absolute value of Supervision high limit + (0.5 * hysteresis) or below absolute value of Supervision low limit - (0.5*hysteresis). Action is deactivated whenever absolute value of signal is in between absolute value of Supervision high limit - (0.5 * hysteresis) and absolute value of Supervision low limit + (0.5*hysteresis).	6
	Hysteresis	Action is taken whenever signal is above Supervision high limit + 0.5 * hysteresis. Action is deactivated whenever signal is below Supervision low limit - (0.5 * hysteresis). The status is unchanged when signal value is in between Supervision high limit + (0.5 * hysteresis) and 'Supervision Low' limit - (0.5 * hysteresis)	7
	Low falling	Action is taken whenever the signal falls from a value higher than the Supervision low limit + (0.5 * hysteresis) to a value which is lower than Supervision low limit - (0.5 * hysteresis). Action is deactivated when the signal rises to a higher value than Supervision low limit + (0.5*hysteresis).	8
	High rising	Action is taken whenever the signal rises from a value lower than Supervision high limit - (0.5 * hysteresis) to a value which is higher than Supervision high' limit + (0.5 * hysteresis). Action is deactivated when the signal falls to a value lower than Supervision high limit - (0.5*hysteresis).	9

No.	Name/Value	Description	Def/ FbEq16
32.26	Supervision 3 action	Selects whether the drive generates a fault, warning or neither when the value monitored by signal supervision 3 exceeds its limits. **Note:** This parameter does not affect the status indicated by 32.01 Supervision status.	No action
	No action	No warning or fault generated.	0
	Warning	Warning A8B2 Signal supervision 3 is generated.	1
	Fault	Drive trips on fault 80B2 Signal supervision 3.	2
	Fault if running	If running, the drive trips on fault 80B0 Signal supervision 1.	3
32.27	Supervision 3 signal	Selects the signal to be monitored by signal supervision function 3. For the available selections, see parameter 32.07 Supervision 1 signal.	Torque
32.28	Supervision 3 filter time	Defines a filter time constant for the signal monitored by signal supervision 3.	0.000 s
	0.000 … 30.000 s	Signal filter time.	1000 = 1 s
32.29	Supervision 3 low	Defines the lower limit for signal supervision 3.	0.00
	-21474836.00… 21474836.00	Low limit.	-
32.30	Supervision 3 high	Defines the upper limit for signal supervision 3.	0.00
	-21474836.00… 21474836.00	Upper limit.	-
32.31	Supervision 3 hysteresis	Defines the hysteresis for the signal monitored by signal supervision 3.	0.00
	0.00… 100000.00	Hysteresis.	-
32.35	Supervision 4 function	Selects the mode of signal supervision function 4. Determines how the monitored signal (see parameter 32.37) is compared to its lower and upper limits (32.39 and 32.30 respectively). The action to be taken when the condition is fulfilled is selected by 32.36.	Disabled
	Disabled	Signal supervision 4 not in use.	0
	Low	Action is taken whenever signal is below Supervision low limit - (0.5 * hysteresis). Action is deactivated whenever signal is above Supervision low limit + (0.5 * hysteresis).	1

No.	Name/Value	Description	Def/ FbEq16
	High	Action is taken whenever signal is above Supervision high limit + (0.5 * hysteresis). Action is deactivated whenever signal is below Supervision high limit - (0.5 * hysteresis).	2
	Abs low	Action is taken whenever absolute value of signal is below absolute value of Supervision low limit - (0.5 * hysteresis). Action is deactivated whenever absolute value of signal is above absolute value of Supervision low limit + (0.5 * hysteresis).	3
	Abs high	Action is taken whenever absolute value of signal is above absolute value of Supervision high limit + (0.5 * hysteresis). Action is deactivated whenever absolute value of signal is below absolute value of Supervision high limit - (0.5 * hysteresis)	4
	Both	Action is taken whenever signal is above Supervision high limit + (0.5 * hysteresis) or below Supervision low limit - (0.5*hysteresis). Action is deactivated whenever signal is in between Supervision high limit - (0.5 * hysteresis) and Supervision low limit + (0.5*hysteresis).	5
	Abs both	Action is taken whenever absolute value of signal is above absolute value of Supervision high limit + (0.5 * hysteresis) or below absolute value of Supervision low limit - (0.5*hysteresis). Action is deactivated whenever absolute value of signal is in between absolute value of Supervision high limit - (0.5 * hysteresis) and absolute value of Supervision low limit + (0.5*hysteresis).	6
	Hysteresis	Action is taken whenever signal is above Supervision high limit + 0.5 * hysteresis. Action is deactivated whenever signal is below Supervision low limit - (0.5 * hysteresis). The status is unchanged when signal value is in between Supervision high limit + (0.5 * hysteresis) and 'Supervision Low' limit - (0.5 * hysteresis)	7
	Low falling	Action is taken whenever the signal falls from a value higher than the Supervision low limit + (0.5 * hysteresis) to a value which is lower than Supervision low limit - (0.5 * hysteresis). Action is deactivated when the signal rises to a higher value than Supervision low limit + (0.5*hysteresis).	8

No.	Name/Value	Description	Def/ FbEq16
	High rising	Action is taken whenever the signal rises from a value lower than Supervision high limit - (0.5 * hysteresis) to a value which is higher than Supervision high' limit + (0.5 * hysteresis). Action is deactivated when the signal falls to a value lower than Supervision high limit - (0.5*hysteresis).	9
32.36	Supervision 4 action	Selects whether the drive generates a fault, warning or neither when the value monitored by signal supervision 4 exceeds its limits. **Note:** This parameter does not affect the status indicated by 32.01 Supervision status.	No action
	No action	No warning or fault generated.	0
	Warning	Warning A8B3 Signal supervision 4 is generated.	1
	Fault	Drive trips on fault 80B3 Signal supervision 4.	2
	Fault if running	Drive trips on fault 80B0 Signal supervision 1 if the motor is running.	3
32.37	Supervision 4 signal	Selects the signal to be monitored by signal supervision function 4. For the available selections, see parameter 32.07 Supervision 1 signal.	Zero
32.38	Supervision 4 filter time	Defines a filter time constant for the signal monitored by signal supervision 4.	0.000 s
	0.000 … 30.000 s	Signal filter time.	1000 = 1 s
32.39	Supervision 4 low	Defines the lower limit for signal supervision 4.	0.00
	-21474836.00… 21474836.00	Low limit.	-
32.40	Supervision 4 high	Defines the upper limit for signal supervision 4.	0.00
	-21474836.00… 21474836.00	Upper limit.	-
32.41	Supervision 4 hysteresis	Defines the hysteresis for the signal monitored by signal supervision 4.	0.00
	0.00… 100000.00	Hysteresis.	-

No.	Name/Value	Description	Def/ FbEq16
32.45	Supervision 5 function	Selects the mode of signal supervision function 5. Determines how the monitored signal (see parameter 32.47) is compared to its lower and upper limits (32.49 and 32.40 respectively). The action to be taken when the condition is fulfilled is selected by 32.46.	Disabled
	Disabled	Signal supervision 5 not in use.	0
	Low	Action is taken whenever signal is below Supervision low limit - (0.5 * hysteresis). Action is deactivated whenever signal is above Supervision low limit + (0.5 * hysteresis).	1
	High	Action is taken whenever signal is above Supervision high limit + (0.5 * hysteresis). Action is deactivated whenever signal is below Supervision high limit - (0.5 * hysteresis).	2
	Abs low	Action is taken whenever absolute value of signal is below absolute value of Supervision low limit - (0.5 * hysteresis). Action is deactivated whenever absolute value of signal is above absolute value of Supervision low limit + (0.5 * hysteresis).	3
	Abs high	Action is taken whenever absolute value of signal is above absolute value of Supervision high limit + (0.5 * hysteresis). Action is deactivated whenever absolute value of signal is below absolute value of Supervision high limit - (0.5 * hysteresis)	4
	Both	Action is taken whenever signal is above Supervision high limit + (0.5 * hysteresis) or below Supervision low limit - (0.5*hysteresis). Action is deactivated whenever signal is in between Supervision high limit - (0.5 * hysteresis) and Supervision low limit + (0.5*hysteresis).	5
	Abs both	Action is taken whenever absolute value of signal is above absolute value of Supervision high limit + (0.5 * hysteresis) or below absolute value of Supervision low limit - (0.5*hysteresis). Action is deactivated whenever absolute value of signal is in between absolute value of Supervision high limit - (0.5 * hysteresis) and absolute value of Supervision low limit + (0.5*hysteresis).	6

No.	Name/Value	Description	Def/ FbEq16
	Hysteresis	Action is taken whenever signal is above Supervision high limit + 0.5 * hysteresis. Action is deactivated whenever signal is below Supervision low limit - (0.5 * hysteresis). The status is unchanged when signal value is in between Supervision high limit + (0.5 * hysteresis) and 'Supervision Low' limit - (0.5 * hysteresis)	7
	Low falling	Action is taken whenever the signal falls from a value higher than the Supervision low limit + (0.5 * hysteresis) to a value which is lower than Supervision low limit - (0.5 * hysteresis). Action is deactivated when the signal rises to a higher value than Supervision low limit + (0.5*hysteresis).	8
	High rising	Action is taken whenever the signal rises from a value lower than Supervision high limit - (0.5 * hysteresis) to a value which is higher than Supervision high' limit + (0.5 * hysteresis). Action is deactivated when the signal falls to a value lower than Supervision high limit - (0.5*hysteresis).	9
32.46	Supervision 5 action	Selects whether the drive generates a fault, warning or neither when the value monitored by signal supervision 5 exceeds its limits. **Note:** This parameter does not affect the status indicated by 32.01 Supervision status.	No action
	No action	No warning or fault generated.	0
	Warning	Warning A8B4 Signal supervision 5 is generated.	1
	Fault	Drive trips on fault 80B4 Signal supervision 5.	2
	Fault if running	Drive trips on fault 80B0 Signal supervision 1 if the motor is running.	3
32.47	Supervision 5 signal	Selects the signal to be monitored by signal supervision function 5. For the available selections, see parameter 32.07 Supervision 1 signal.	Zero
32.48	Supervision 5 filter time	Defines a filter time constant for the signal monitored by signal supervision 5.	0.000 s
	0.000 … 30.000 s	Signal filter time.	1000 = 1 s

No.	Name/Value	Description	Def/ FbEq16
32.49	Supervision 5 low	Defines the lower limit for signal supervision 5.	0.00
	-21474836.00… 21474836.00	Low limit.	-
32.50	Supervision 5 high	Defines the upper limit for signal supervision 5.	0.00
	-21474836.00… 21474836.00	Upper limit.	-
32.51	Supervision 5 hysteresis	Defines the hysteresis for the signal monitored by signal supervision 5.	0.00
	0.00… 100000.00	Hysteresis.	-
32.55	Supervision 6 function	Selects the mode of signal supervision function 6. Determines how the monitored signal (see parameter 32.57) is compared to its lower and upper limits (32.59 and 32.50 respectively). The action to be taken when the condition is fulfilled is selected by 32.56.	Disabled
	Disabled	Signal supervision 6 not in use.	0
	Low	Action is taken whenever signal is below Supervision low limit - (0.5 * hysteresis). Action is deactivated whenever signal is above Supervision low limit + (0.5 * hysteresis).	1
	High	Action is taken whenever signal is above Supervision high limit + (0.5 * hysteresis). Action is deactivated whenever signal is below Supervision high limit - (0.5 * hysteresis).	2
	Abs low	Action is taken whenever absolute value of signal is below absolute value of Supervision low limit - (0.5 * hysteresis). Action is deactivated whenever absolute value of signal is above absolute value of Supervision low limit + (0.5 * hysteresis).	3
	Abs high	Action is taken whenever absolute value of signal is above absolute value of Supervision high limit + (0.5 * hysteresis). Action is deactivated whenever absolute value of signal is below absolute value of Supervision high limit - (0.5 * hysteresis)	4

No.	Name/Value	Description	Def/ FbEq16
	Both	Action is taken whenever signal is above Supervision high limit + (0.5 * hysteresis) or below Supervision low limit - (0.5*hysteresis). Action is deactivated whenever signal is in between Supervision high limit - (0.5 * hysteresis) and Supervision low limit + (0.5*hysteresis).	5
	Abs both	Action is taken whenever absolute value of signal is above absolute value of Supervision high limit + (0.5 * hysteresis) or below absolute value of Supervision low limit - (0.5*hysteresis). Action is deactivated whenever absolute value of signal is in between absolute value of Supervision high limit - (0.5 * hysteresis) and absolute value of Supervision low limit + (0.5*hysteresis).	6
	Hysteresis	Action is taken whenever signal is above Supervision high limit + 0.5 * hysteresis. Action is deactivated whenever signal is below Supervision low limit - (0.5 * hysteresis). The status is unchanged when signal value is in between Supervision high limit + (0.5 * hysteresis) and 'Supervision Low' limit - (0.5 * hysteresis)	7
	Low falling	Action is taken whenever the signal falls from a value higher than the Supervision low limit + (0.5 * hysteresis) to a value which is lower than Supervision low limit - (0.5 * hysteresis). Action is deactivated when the signal rises to a higher value than Supervision low limit + (0.5*hysteresis).	8
	High rising	Action is taken whenever the signal rises from a value lower than Supervision high limit - (0.5 * hysteresis) to a value which is higher than Supervision high' limit + (0.5 * hysteresis). Action is deactivated when the signal falls to a value lower than Supervision high limit - (0.5*hysteresis).	9
32.56	Supervision 6 action	Selects whether the drive generates a fault, warning or neither when the value monitored by signal supervision 6 exceeds its limits. **Note:** This parameter does not affect the status indicated by 32.01 Supervision status.	No action
	No action	No warning or fault generated.	0
	Warning	Warning A8B5 Signal supervision 6 is generated.	1
	Fault	Drive trips on fault 80B5 Signal supervision 6.	2

No.	Name/Value	Description	Def/ FbEq16
	Fault if running	Drive trips on fault 80B0 Signal supervision 1 if the motor is running.	3
32.57	Supervision 6 signal	Selects the signal to be monitored by signal supervision function 6. For the available selections, see parameter 32.07 Supervision 1 signal.	Zero
32.58	Supervision 6 filter time	Defines a filter time constant for the signal monitored by signal supervision 6.	0.000 s
	0.000 … 30.000 s	Signal filter time.	1000 = 1 s
32.59	Supervision 6 low	Defines the lower limit for signal supervision 6.	0.00
	-21474836.00… 21474836.00	Low limit.	-
32.60	Supervision 6 high	Defines the upper limit for signal supervision 6.	0.00
	-21474836.00… 21474836.00	Upper limit.	-
32.61	Supervision 6 hysteresis	Defines the hysteresis for the signal monitored by signal supervision 6.	0.00
	0.00… 100000.00	Hysteresis.	-

34 Timed functions		Configuration of the timed functions. See section In the Manual In1P Start; In2 stop mode, the drive starts with the pulse command from the DI selected in the parameter 79.11 Manual input source 1 and stops with the DI selected in the parameter 79.12 Manual input source 2. This mode can be used to start and stop the pump with two separate push buttons. on page 45.	
34.01	Timed functions status	Status of the combined timers. The status of a combined timer is the logical OR of all timers connected to it. This parameter is read-only.	-

Bit	Name	Description
0	Timed function 1	1 = Active.
1	Timed function 2	1 = Active.
2	Timed function 3	1 = Active.
3…15	Reserved	

	0000h…FFFFh	Status of combined timers 1…3.	1 = 1

No.	Name/Value	Description	Def/ FbEq16
34.02	Timer status	Status of timers 1…12. This parameter is read-only.	-

Bit	Name	Description
0	Timer 1	1 = Active.
1	Timer 2	1 = Active.
2	Timer 3	1 = Active.
3	Timer 4	1 = Active.
4	Timer 5	1 = Active.
5	Timer 6	1 = Active.
6	Timer 7	1 = Active.
7	Timer 8	1 = Active.
8	Timer 9	1 = Active.
9	Timer 10	1 = Active.
10	Timer 11	1 = Active.
11	Timer 12	1 = Active.
12…15	Reserved	

	0000h…FFFFh	Timer status.	1 = 1
34.04	Season/exception day status	Status of seasons 1…4, exception weekday and exception holiday. Only one season can be active at a time. A day can be a workday and a holiday at the same time. This parameter is read-only.	-

Bit	Name	Description
0	Season 1	1 = Active.
1	Season 2	1 = Active.
2	Season 3	1 = Active.
3	Season 4	1 = Active.
4…9	Reserved	
10	Exception workday	1 = Active.
11	Exception holiday	1 = Active.
12…15	Reserved	

	0000h…FFFFh	Status of the seasons and exception weekday and holiday.	1 = 1
34.10	Timed functions enable	Selects the source for the timed functions enable signal. 0 = Disabled. 1 = Enabled.	Disabled
	Disabled	0.	0
	Enabled	1.	1
	DI1	Digital input DI1 (10.02 DI delayed status, bit 0).	2
	DI2	Digital input DI2 (10.02 DI delayed status, bit 1).	3
	DI3	Digital input DI3 (10.02 DI delayed status, bit 2).	4

No.	Name/Value	Description	Def/ FbEq16
	DI4	Digital input DI4 (10.02 DI delayed status, bit 3).	5
	DI5	Digital input DI5 (10.02 DI delayed status, bit 4).	6
	DI6	Digital input DI6 (10.02 DI delayed status, bit 5).	7
	Other [bit]	Source selection (see Terms and abbreviations on page 80).	-

No.	Name/Value	Description	Def/ FbEq16
34.11	Timer 1 configuration	Defines when timer 1 is active.	0000 0111 1000 0000b

Bit	Name	Description
0	Monday	1 = Monday is an active start day.
1	Tuesday	1 = Tuesday is an active start day.
2	Wednesday	1 = Wednesday is an active start day.
3	Thursday	1 = Thursday is an active start day.
4	Friday	1 = Friday is an active start day.
5	Saturday	1 = Saturday is an active start day.
6	Sunday	1 = Sunday is an active start day.
7	Season 1	1 = Timer is active in season 1.
8	Season 2	1 = Timer is active in season 2.
9	Season 3	1 = Timer is active in season 3.
10	Season 4	1 = Timer is active in season 4.
11	Exceptions	0 = Exceptions days are disabled. The timer follows only weekday and season settings (bits 0…10 in the timer configuration) and the start time and duration of the timer (see 34.12 and 34.13). Exception day settings, parameters 34.70…34.90, do not have any effect on this timer. 1 = Exception days are enabled. The timer is active during the weekdays and seasons defined with bits 0…10 and the times defined by 34.12 and 34.13. In addition, the timer is active during the exception days defined with bit 12, bit 13 and parameters 34.70…34.90. If bit 12 and bit 13 are both zero, the timer is inactive during the exception days.
12	Holidays	This bit has no effect unless bit 11 = 1 (Exceptions days are enabled). When bits 11 and 12 are both 1, the timer is active during the weekdays and seasons defined with bits 0…10 and times defined by parameters 34.12 and 34.13. In addition, the timer is active when the ongoing day is defined as Exception day Holiday by parameters 34.70…34.90 and the current time matches with the time range defined by 34.12 and 34.13. During Exception days, weekday and season bits are ignored.
13	Workdays	This bit has no effect unless bit 11 = 1 (Exceptions enabled). When bits 11 and 13 are both 1, the Timer is active during the weekdays and seasons defined with bits 0…10 and the times defined by parameters 34.12 and 34.13. In addition, the timer is active when the ongoing day is defined as Exception day Workday by parameters 34.70…34.90 and the current time matches with the time range defined by 34.12 and 34.13. During Exception days, weekday and season bits are ignored.
14…15	Reserved	

No.	Name/Value	Description	Def/ FbEq16

Examples of how the timer configuration defines when the Timer is active are shown below.

Bits of parameter 34.11 Timer 1 configuration														
Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Season1	Season2	Season3	Season4	Exceptions	Holidays	Workdays	
1	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	0	0	0	**Example 1:** Timer is active during the times of the day defined by other parameters every Weekday and every Season. Exception day settings (34.70…34.90) do not have any effect on the Timer.
1	**1**	**1**	**1**	**1**	0	0	1	1	1	1	0	0	0	**Example 2:** Timer is active during the times of the day defined by other parameters from Mon to Fri, every Season. Exception day settings (34.70…34.90) do not have any effect on the Timer.
1	1	1	1	1	0	0	0	0	**1**	0	0	0	0	**Example 3:** Timer is active during the times of the day defined by other parameters from Mon to Fri, only during Season 3 (can be configured as, eg, summer). Exception day settings (34.70…34.90) do not have any effect on the Timer.
1	1	1	1	1	0	0	1	1	1	1	**1**	**1**	0	**Example 4:** Timer is active during the times of the day defined by other parameters from Mon to Fri, every Season. In addition, the Timer is active every Exception day Holidays, regardless what is the day or season.
1	0	1	0	1	0	1	1	1	0	0	**1**	0	**1**	**Example 5:** Timer is active during the times of the day defined by other parameters on Mon, Wed, Fri and Sun, during Season1 and Season 2. In addition, the Timer is active every Exception day Workdays, regardless what is the day or season.
1	1	1	1	1	1	1	1	1	1	1	**1**	**0**	**0**	**Example 6:** Timer is active during the times of the day defined by other parameters every Weekday and every Season. The Timer is inactive during all Exception days.

	0000h…FFFFh	Configuration of timer 1.	1 = 1

No.	Name/Value	Description	Def/ FbEq16
34.12	Timer 1 start time	Defines the daily start time of timer 1. The time can be changed in second steps. The timer can be started at an other time than the start time. For example, if the timer's duration is more than one day and the active session starts during the time, the timer is started at 00:00 and stopped when there is no duration left.	00:00:00
	00:00:00… 23:59:59	Daily start time of the timer.	
34.13	Timer 1 duration	Defines the duration of timer 1. The duration can be changed in minute steps. The duration can extend over the change of the day but if an exception day becomes active, the period is interrupted at midnight. In the same way the period started on an exception day stays active only until the end of the day, even if the duration is longer. The timer will continue after a break if there is duration left.	00 00:00
	00 00:00… 07 00:00	Timer duration.	1 = 1 min
34.14	Timer 2 configuration	See 34.11 Timer 1 configuration.	0000 0111 1000 0000b
34.15	Timer 2 start time	See 34.12 Timer 1 start time.	00:00:00
34.16	Timer 2 duration	See 34.13 Timer 1 duration.	00 00:00
34.17	Timer 3 configuration	See 34.11 Timer 1 configuration.	0000 0111 1000 0000b
34.18	Timer 3 start time	See 34.12 Timer 1 start time.	00:00:00
34.19	Timer 3 duration	See 34.13 Timer 1 duration.	00 00:00
34.20	Timer 4 configuration	See 34.11 Timer 1 configuration.	0000 0111 1000 0000b
34.21	Timer 4 start time	See 34.12 Timer 1 start time.	00:00:00
34.22	Timer 4 duration	See 34.13 Timer 1 duration.	00 00:00
34.23	Timer 5 configuration	See 34.11 Timer 1 configuration.	0000 0111 1000 0000b
34.24	Timer 5 start time	See 34.12 Timer 1 start time.	00:00:00
34.25	Timer 5 duration	See 34.13 Timer 1 duration.	00 00:00

No.	Name/Value	Description	Def/ FbEq16
34.26	Timer 6 configuration	See 34.11 Timer 1 configuration.	0000 0111 1000 0000b
34.27	Timer 6 start time	See 34.12 Timer 1 start time.	00:00:00
34.28	Timer 6 duration	See 34.13 Timer 1 duration.	00 00:00
34.29	Timer 7 configuration	See 34.11 Timer 1 configuration.	0000 0111 1000 0000b
34.30	Timer 7 start time	See 34.12 Timer 1 start time.	00:00:00
34.31	Timer 7 duration	See 34.13 Timer 1 duration.	00 00:00
34.32	Timer 8 configuration	See 34.11 Timer 1 configuration.	0000 0111 1000 0000b
34.33	Timer 8 start time	See 34.12 Timer 1 start time.	00:00:00
34.34	Timer 8 duration	See 34.13 Timer 1 duration.	00 00:00
34.35	Timer 9 configuration	See 34.11 Timer 1 configuration.	0000 0111 1000 0000b
34.36	Timer 9 start time	See 34.12 Timer 1 start time.	00:00:00
34.37	Timer 9 duration	See 34.13 Timer 1 duration.	00 00:00
34.38	Timer 10 configuration	See 34.11 Timer 1 configuration	0000 0111 1000 0000b
34.39	Timer 10 start time	See 34.12 Timer 1 start time .	00:00:00
34.40	Timer 10 duration	See 34.13 Timer 1 duration	00 00:00
34.41	Timer 11 configuration	See 34.11 Timer 1 configuration	0000 0111 1000 0000b
34.41	Timer 11 configuration	See 34.12 Timer 1 start time.	00:00:00
34.42	Timer 11 start time	See 34.13 Timer 1 duration.	00 00:00
34.43	Timer 11 duration	See 34.11 Timer 1 configuration.	0000 0111 1000 0000b
34.44	Timer 12 configuration	See 34.12 Timer 1 start time.	00:00:00
34.45	Timer 12 start time	See 34.13 Timer 1 duration.	00 00:00

No.	Name/Value	Description	Def/ FbEq16
34.60	Season 1 start date	Defines the start date of season 1 in format dd.mm, where dd is the number of the day and mm is the number of the month. The season changes at midnight. One season can be active at a time. Timers are started on exception days even if they are not inside the active season. The season start dates (1…4) must be given in increasing order to use all seasons. The default value is interpreted that the season is not configured. If the season start dates are not in increasing order and the value is something else than the default value, a season configuration warning is given.	01.01.
	01.01…31.12	Season start date.	-
34.61	Season 2 start date	Defines the start date of season 2. See 34.60 Season 1 start date.	01.01.
34.62	Season 3 start date	Defines the start date of season 3. See 34.60 Season 1 start date.	01.01.
34.63	Season 4 start date	Defines the start date of season 4. See 34.60 Season 1 start date.	01.01.
34.70	Number of active exceptions	Defines how many of the exceptions are active by specifying the last active one. All preceding exceptions are active. Exceptions 1…3 are periods (duration can be defined) and exceptions 4…16 are days (duration is always 24 hours). **Example:** If the value is 4, exceptions 1…4 are active, and exceptions 5…16 are not active.	3
	0…16	Number of active exception periods or days.	1 = 1

No.	Name/Value	Description	Def/ FbEq16
34.71	Exception types	Defines the types of exceptions 1…16 as workday or holiday. Exceptions 1…3 are periods (duration can be defined) and exceptions 4…16 are days (duration is always 24 hours).	0000 0000 0000 0000b

Bit	Name	Description
0	Exception 1	0 = Workday. 1 = Holiday
1	Exception 2	0 = Workday. 1 = Holiday
2	Exception 3	0 = Workday. 1 = Holiday
3	Exception 4	0 = Workday. 1 = Holiday
4	Exception 5	0 = Workday. 1 = Holiday
5	Exception 6	0 = Workday. 1 = Holiday
6	Exception 7	0 = Workday. 1 = Holiday
7	Exception 8	0 = Workday. 1 = Holiday
8	Exception 9	0 = Workday. 1 = Holiday
9	Exception 10	0 = Workday. 1 = Holiday
10	Exception 11	0 = Workday. 1 = Holiday
11	Exception 12	0 = Workday. 1 = Holiday
12	Exception 13	0 = Workday. 1 = Holiday
13	Exception 14	0 = Workday. 1 = Holiday
14	Exception 15	0 = Workday. 1 = Holiday
15	Exception 16	0 = Workday. 1 = Holiday

No.	Name/Value	Description	Def/ FbEq16
	0000h…FFFFh	Types of exception period or days.	1 = 1
34.72	Exception 1 start	Defines the start date of the exception period in format dd.mm, where dd is the number of the day and mm is the number of the month. The timer started on an exception day is always stopped at 23:59:59 even if it has duration left. The same date can be configured to be holiday and workday. The date is active if any of exception days are active.	01.01.
	01.01.…31.12.	Start date of exception period 1.	-
34.73	Exception 1 length	Defines the length of the exception period in days. Exception period is handled the same as a number of consecutive exception days.	0 d
	0…60 d	Length of exception period 1.	1 = 1 d
34.74	Exception 2 start	See 34.72 Exception 1 start.	01.01.
34.75	Exception 2 length	See 34.73 Exception 1 length.	0 d
34.76	Exception 3 start	See 34.72 Exception 1 start.	01.01.
34.77	Exception 3 length	See 34.73 Exception 1 length.	0 d

No.	Name/Value	Description	Def/ FbEq16
34.78	Exception day 4	Defines the date of exception day 4.	01.01.
	01.01.…31.12.	Start date of exception day 4. The timer started on an exception day is always stopped at 23:59:59 even if it has duration left.	-
34.79	Exception day 5	See 34.79 Exception day 4.	01.01
34.80	Exception day 6	See 34.79 Exception day 4.	01.01
34.81	Exception day 7	See 34.79 Exception day 4	01.01
34.82	Exception day 8	See 34.79 Exception day 4.	01.01
34.83	Exception day 9	See 34.79 Exception day 4.	01.01
34.84	Exception day 10	See 34.79 Exception day 4.	01.01
34.85	Exception day 11	See 34.79 Exception day 4.	01.01
34.86	Exception day 12	See 34.79 Exception day 4.	01.01
34.87	Exception day 13	See 34.79 Exception day 4.	01.01
34.88	Exception day 14	See 34.79 Exception day 4.	01.01
34.89	Exception day 15	See 34.79 Exception day 4.	01.01
34.90	Exception day 16	See 34.79 Exception day 4.	01.01
34.100	Timed function 1	Defines which timers are connected to combined timer 1. 0 = Not connected. 1 = Connected. See 34.01 Timed functions status.	0000 0000 0000 0000b

Bit	Name	Description
0	Timer 1	0 = Inactive. 1 = Active.
1	Timer 2	0 = Inactive. 1 = Active.
2	Timer 3	0 = Inactive. 1 = Active.
3	Timer 4	0 = Inactive. 1 = Active.
4	Timer 5	0 = Inactive. 1 = Active.
5	Timer 6	0 = Inactive. 1 = Active.
6	Timer 7	0 = Inactive. 1 = Active.
7	Timer 8	0 = Inactive. 1 = Active.
8	Timer 9	0 = Inactive. 1 = Active.
9	Timer 10	0 = Inactive. 1 = Active.
10	Timer 11	0 = Inactive. 1 = Active.
11	Timer 12	0 = Inactive. 1 = Active.
12…15	Reserved	

No.	Name/Value	Description	Def/ FbEq16
	0000h…FFFFh	Timers connected to combined timer 1.	1 = 1
34.101	Timed function 2	Defines which timers are connected to combined timer 2. See 34.01 Timed functions status.	0000 0000 0000 0000b

No.	Name/Value	Description	Def/ FbEq16
34.102	Timed function 3	Defines which timers are connected to combined timer 3. See 34.01 Timed functions status.	0000 0000 0000 0000b
34.110	Boost time function	Defines which combined timers (that is, timers that are connected to the combined timers) are activated with the extra time function.	0000 0000 0000 0000b

Bit	Name	Description
0	Timed function 1	0 = Inactive. 1 = Active.
1	Timed function 2	0 = Inactive. 1 = Active.
2	Timed function 3	0 = Inactive. 1 = Active.
3…15	Reserved	

No.	Name/Value	Description	Def/ FbEq16
	0000h…FFFFh	Combined timers including the extra timer.	1 = 1
34.111	Boost time activation source	Selects the source of extra time activation signal. 0 = Disabled. 1 = Enabled.	Off
	Off	0.	0
	On	1.	1
	DI1	Digital input DI1 (10.02 DI delayed status, bit 0).	2
	DI2	Digital input DI2 (10.02 DI delayed status, bit 1).	3
	DI3	Digital input DI3 (10.02 DI delayed status, bit 2).	4
	DI4	Digital input DI4 (10.02 DI delayed status, bit 3).	5
	DI5	Digital input DI5 (10.02 DI delayed status, bit 4).	6
	DI6	Digital input DI6 (10.02 DI delayed status, bit 5).	7
	Other [bit]	Source selection (see Terms and abbreviations on page 80).	-
34.112	Boost time duration	Defines the time inside which the extra time is deactivated after extra time activation signal is switched off. **Example:** If parameter 34.111 Boost time activation source is set to DI1 and 34.112 Boost time duration is set to 00 01:30, the extra time is active for 1 hour and 30 minutes after digital input DI is deactivated.	00 00:00
	00 00:00… 07 00:00	Extra time duration.	1 = 1 min

No.	Name/Value	Description	Def/ FbEq16
35 Motor thermal protection		Motor thermal protection settings such as temperature measurement configuration, load curve definition and motor fan control configuration. See also section Motor thermal protection (page 58).	
35.01	Motor estimated temperature	Shows motor temperature as estimated by the internal motor thermal protection model (see parameters 35.50…35.55). The unit is selected by parameter 96.16 Unit selection. This parameter is read-only.	0
	-60…1000 °C or -76…1832 °F	Estimated motor temperature.	1 = 1°C
35.02	Measured temperature 1	Shows temperature received through the source defined by parameter 35.11 Temperature 1 source. The unit is selected by parameter 96.16 Unit selection. **Note:** With a PTC sensor, the value shown is not a valid measurement. Either 0 ohm (normal temperature) or the value of parameter 35.22 Temperature 2 fault limit (excessive temperature) is shown. This parameter is read-only.	0
	-60…5000 °C or -76…9032 °F	Measured temperature 1.	1 = 1 unit
35.03	Measured temperature 2	Shows temperature received through the source defined by parameter 35.21 Temperature 2 source. The unit is selected by parameter 96.16 Unit selection. **Note:** With a PTC sensor, the value shown is not a valid measurement. Either 0 ohm (normal temperature) or the value of parameter 35.22 Temperature 2 fault limit (excessive temperature) is shown. This parameter is read-only.	0
	-60…5000 °C or -76…9032 °F	Measured temperature 2.	1 = 1 unit
35.05	Motor overload level	Motor overload level as a percentage of the fault limit.	0.0
	0.0...300.0 %	Motor overload level	1 = 1unit

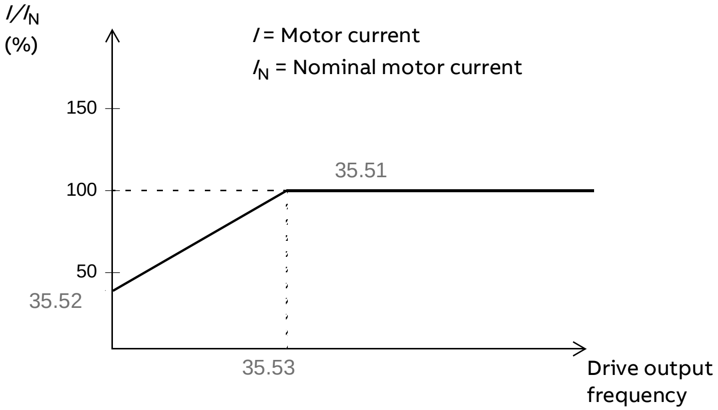
No.	Name/Value	Description	Def/ FbEq16
35.11	Temperature 1 source	Selects the source from which measured temperature 1 is read. Usually this source is from a sensor connected to the motor controlled by the drive, but it could be used to measure and monitor a temperature from other parts of the process as long as a suitable sensor is used as per the selection list.	Estimated temperature
	Disabled	None. Temperature monitoring function 1 is disabled.	0
	Estimated temperature	Estimated motor temperature (see parameter 35.01 Motor estimated temperature). The temperature is estimated from an internal drive calculation. It is important to set up the ambient temperature of the motor in 35.50 Motor ambient temperature.	1
	KTY84 analog I/O	KTY84 sensor connected to the analog input selected by parameter 35.14 Temperature 1 AI source and an analog output. The analog input can be from the standard I/O or from an extension module The following settings are required: • Set the hardware jumper or switch related to the analog input to ***U*** (voltage). Any change must be validated by a control unit reboot. • Set the appropriate analog input unit selection parameter in group 12 Standard AI to V (volt). • In parameter group 13 Standard AO, set the source selection parameter of the analog output to Temp sensor 1 excitation. The analog output feeds a constant current through the sensor. As the resistance of the sensor increases along with its temperature, the voltage over the sensor increases. The voltage is read by the analog input and converted into degrees.	2

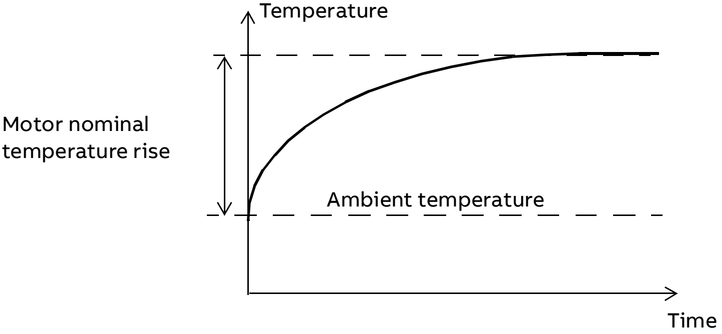
No.	Name/Value	Description	Def/ FbEq16
	1 × Pt100 analog I/O	Pt100 sensor connected to a standard analog input selected by parameter 35.14 Temperature 1 AI source and an analog output. The following settings are required: • Set the hardware jumper or switch related to the analog input to ***U*** (voltage). Any change must be validated by a control unit reboot. • Set the appropriate analog input unit selection parameter in group 12 Standard AI to V (volt). • In parameter group 13 Standard AO, set the source selection parameter of the analog output to Temp sensor 1 excitation. The analog output feeds a constant current through the sensor. As the resistance of the sensor increases along with its temperature, the voltage over the sensor increases. The voltage is read by the analog input and converted into degrees.	5
	2 × Pt100 analog I/O	As selection 1 × Pt100 analog I/O, but with two sensors connected in series. Using multiple sensors improves measurement accuracy significantly.	6
	3 × Pt100 analog I/O	As selection 1 × Pt100 analog I/O, but with three sensors connected in series. Using multiple sensors improves measurement accuracy significantly.	7
	Direct temperature	The temperature is taken from the source selected by parameter 35.14 Temperature 1 AI source. The value of the source is assumed to be degrees Celsius.	11
35.12	Temperature 1 fault limit	Defines the fault limit for temperature supervision function 1. When measured temperature 1 exceeds the limit, the drive trips on fault 4981 External temperature 1. The unit is selected by parameter 96.16 Unit selection.	130 °C or 266 °F
	-60…5000 °C or -76…9032 °F	Fault limit for temperature monitoring function 1.	1 = 1 unit

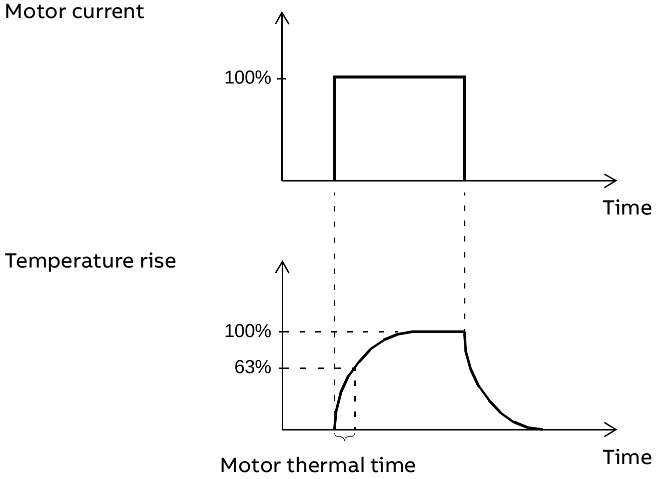
No.	Name/Value	Description	Def/ FbEq16
35.13	Temperature 1 warning limit	Defines the warning limit for temperature supervision function 1. When measured temperature 1 exceeds the limit, warning A491 External temperature 1 is generated. The unit is selected by parameter 96.16 Unit selection.	110 °C or 230 °F
	-60…5000 °C or -76…9032 °F	Warning limit for temperature monitoring function 1.	1 = 1 unit
35.14	Temperature 1 AI source	Specifies the analog input when the setting of 35.11 Temperature 1 source requires measurement through an analog input.	Not selected
	Not selected	None.	0
	AI1 actual value	Analog input AI1 on the control unit.	1
	AI2 actual value	Analog input AI2 on the control unit.	2
	Other	Source selection (see Terms and abbreviations on page 80).	-
35.21	Temperature 2 source	Selects the source from which measured temperature 2 is read. Usually this source is from a sensor connected to the motor controlled by the drive, but it could be used to measure and monitor a temperature from other parts of the process as long as a suitable sensor is used as per the selection list.	Disabled
	Disabled	None. Temperature monitoring function 2 is disabled.	0
	Estimated temperature	Estimated motor temperature (see parameter 35.01 Motor estimated temperature). The temperature is estimated from an internal drive calculation. It is important to set up the ambient temperature of the motor in 35.50 Motor ambient temperature.	1

No.	Name/Value	Description	Def/ FbEq16
	1 × Pt100 analog I/O	Pt100 sensor connected to a standard analog input selected by parameter 35.24 Temperature 2 AI source and an analog output. The following settings are required: • Set the hardware jumper or switch related to the analog input to ***U*** (voltage). Any change must be validated by a control unit reboot. • Set the appropriate analog input unit selection parameter in group 12 Standard AI to V (volt). • In parameter group 13 Standard AO, set the source selection parameter of the analog output to Temp sensor 2 excitation. The analog output feeds a constant current through the sensor. As the resistance of the sensor increases along with its temperature, the voltage over the sensor increases. The voltage is read by the analog input and converted into degrees.	5
	2 × Pt100 analog I/O	As selection 1 × Pt100 analog I/O, but with two sensors connected in series. Using multiple sensors improves measurement accuracy significantly.	6
	3 × Pt100 analog I/O	As selection 1 × Pt100 analog I/O, but with three sensors connected in series. Using multiple sensors improves measurement accuracy significantly.	7
	Direct temperature	The temperature is taken from the source selected by parameter 35.24 Temperature 2 AI source. The value of the source is assumed to be degrees Celsius.	11
35.22	Temperature 2 fault limit	Defines the fault limit for temperature supervision function 2. When measured temperature 1 exceeds the limit, the drive trips on fault 4982 External temperature 2. The unit is selected by parameter 96.16 Unit selection.	130 °C or 266 °F
	-60…5000 °C or -76…9032 °F	Fault limit for temperature monitoring function 2.	1 = 1 unit

No.	Name/Value	Description	Def/ FbEq16
35.23	Temperature 2 warning limit	Defines the warning limit for temperature supervision function 2. When measured temperature 1 exceeds the limit, warning A492 External temperature 2 is generated. The unit is selected by parameter 96.16 Unit selection.	110 °C or 230 °F
	-60…5000 °C or -76…9032 °F	Warning limit for temperature monitoring function 2.	1 = 1 unit
35.24	Temperature 2 AI source	Specifies the analog input when the setting of 35.11 Temperature 1 source requires measurement through an analog input.	Not selected
	Not selected	None.	0
	AI1 actual value	Analog input AI1 on the control unit.	1
	AI2 actual value	Analog input AI2 on the control unit.	2
	Other	Source selection (see Terms and abbreviations on page 80).	-
35.50	Motor ambient temperature	Defines the ambient temperature of the motor for the motor thermal protection model. The unit is selected by parameter96.16 Unit selection. The motor thermal protection model estimates the motor temperature on the basis of parameters 35.50…35.55. The motor temperature increases if it operates in the region above the load curve, and decreases if it operates in the region below the load curve. ⚠ **WARNING!** The model cannot protect the motor if the motor does not cool properly because of dust, dirt, etc.	20 °C or 68 °F
	-60…100 °C or -76 … 212 °F	Ambient temperature.	1 = 1°

No.	Name/Value	Description	Def/ FbEq16
35.51	Motor load curve	Defines the motor load curve together with parameters 35.52 Zero speed load and 35.53 Break point. The load curve is used by the motor thermal protection model to estimate the motor temperature. When the parameter is set to 100%, the maximum load is taken as the value of parameter 99.06 Motor nominal current (higher loads heat up the motor). The load curve level should be adjusted if the ambient temperature differs from the nominal value set in 35.50 Motor ambient temperature.	100%
			
	50…150%	Maximum load for the motor load curve.	1 = 1%
35.52	Zero speed load	Defines the motor load curve together with parameters 35.51 Motor load curve and 35.53 Break point. Defines the maximum motor load at zero speed of the load curve. A higher value can be used if the motor has an external motor fan to boost the cooling. See the motor manufacturer's recommendations. See parameter 35.51 Motor load curve.	100%
	50…150%	Zero speed load for the motor load curve.	1 = 1%

No.	Name/Value	Description	Def/ FbEq16
35.53	Break point	Defines the motor load curve together with parameters 35.51 Motor load curve and 35.52 Zero speed load. Defines the break point frequency of the load curve ie. the point at which the motor load curve begins to decrease from the value of parameter 35.51 Motor load curve towards the value of parameter 35.52 Zero speed load. See parameter 35.51 Motor load curve.	45.00 Hz
	1.00…500.00 Hz	Break point for the motor load curve.	10 = 1 Hz
35.54	Motor nominal temperature rise	Defines the temperature rise of the motor above ambient when the motor is loaded with nominal current. See the motor manufacturer's recommendations. The unit is selected by parameter 96.16 Unit selection.	80 °C or 176 °F
			
	0…300 °C or 32…572 °F	Temperature rise.	1 = 1°

No.	Name/Value	Description	Def/ FbEq16
35.55	Motor thermal time const	Defines the thermal time constant for use with the motor thermal protection model, defined as the time to reach 63% of the nominal motor temperature. See the motor manufacturer's recommendations.	256 s
			
	100…10000 s	Motor thermal time constant.	1 = 1 s
35.56	Motor overload action	Selects how the drive reacts when the motor reaches overload condition.	Warning and fault
	No action	None.	0
	Warning only	The drive generates an A783 Motor overload warning.	1
	Warning and fault	The drive generates an A783 Motor overload warning and 7122 Motor overload.	2
35.57	Motor overload class	Selects the motor overload class to be used.	Class 20
	Class 5	Class 5 relay trip class	0
	Class 10	Class 10 relay trip class	1
	Class 20	Class 20 relay trip class	2
	Class 30	Class 30 relay trip class	3
	Class 40	Class 40 relay trip class	4

No.	Name/Value	Description	Def/ FbEq16
36 Load analyzer		Peak value and amplitude logger settings. See also section Load analyzer (page 66).	
36.01	PVL signal source	Selects the signal to be monitored by the peak value logger. The signal is filtered using the filtering time specified by parameter 36.02 PVL filter time. The peak value is stored, along with other pre-selected signals at the time, into parameters 36.10 … 36.15. The peak value logger can be reset using parameter 36.09 Reset loggers. The date and time of the last reset are stored into parameters 36.16 and 36.17 respectively.	Output power
	Not selected	None (peak value logger disabled).	0
	Motor speed used	01.01 Motor speed used.	1
	Output frequency	01.06 Output frequency.	3
	Motor current	01.07 Motor current.	4
	Motor torque	01.10 Motor torque.	6
	DC voltage	01.11 DC voltage.	7
	Output power	01.14 Output power.	8
	Speed ref ramp in	23.01 Speed ref ramp input.	10
	Speed ref ramp out	23.02 Speed ref ramp output.	11
	Speed ref used	24.01 Used speed reference.	12
	Torque ref used	Not applicable	
	Freq ref used	28.02 Frequency ref ramp output.	14
	Process PID out	40.01 Process PID output actual.	16
	Other	Source selection (see Terms and abbreviations).	-
36.02	PVL filter time	Peak value logger filtering time. See parameter 36.01 PVL signal source.	2.00 s
	0.00…120.00 s	Peak value logger filtering time.	100 = 1 s

No.	Name/Value	Description	Def/ FbEq16
36.06	AL2 signal source	Selects the signal to be monitored by amplitude logger 2. The signal is sampled at 200 ms intervals. The results are displayed by parameters 36.40 … 36.49. Each parameter represents an amplitude range, and shows what portion of the samples fall within that range. The signal value corresponding to 100% is defined by parameter 36.07 AL2 signal scaling. Amplitude logger 2 can be reset using parameter 36.09 Reset loggers. The date and time of the last reset are stored into parameters 36.50 and 36.51 respectively. For the selections, see parameter 36.01 PVL signal source.	Motor torque
		See parameter 36.01 for the selections.	
36.07	AL2 signal scaling	Defines the monitored signal value for the amplitude logger AL2 that corresponds to 100% sample value.	100.00
	0.00…32767.00	Signal value corresponding to 100%.	1 = 1
36.09	Reset loggers	Resets the peak value logger and/or amplitude logger 2. (Amplitude logger 1 cannot be reset.)	Done
	Done	Reset completed or not requested (normal operation).	0
	All	Reset both the peak value logger and amplitude logger 2.	1
	PVL	Reset the peak value logger.	2
	AL2	Reset amplitude logger 2.	3
36.10	PVL peak value	Shows the peak value recorded by the peak value logger.	0.00
	-32768.00… 32767.00	Peak value.	1 = 1
36.11	PVL peak date	Shows the date when the peak value was recorded.	01/01/ 1980
	1/1/1980… 6/5/2159	Peak occurrence date.	-
36.12	PVL peak time	Shows the time when the peak value was recorded.	00:00:00
	-	Peak occurrence time.	-

No.	Name/Value	Description	Def/ FbEq16
36.13	PVL current at peak	Shows the Motor current at the moment the peak value was recorded.	0.00 A
	-32768.00… 32767.00 A	Motor current at peak.	1 = 1 A
36.14	PVL DC voltage at peak	Shows the voltage in the intermediate DC circuit of the drive at the moment the peak value was recorded.	0.00 V
	0.00… 2000.00 V	DC voltage at peak.	10 = 1 V
36.15	PVL speed at peak	Shows the Motor speed at the moment the peak value was recorded.	0.00 rpm
	-30000… 30000 rpm	Motor speed at peak.	See par. 46.01
36.16	PVL reset date	Shows the date on which the peak value logger was last reset.	01/01/ 1980
	1/1/1980...6/5/ 2159	Last reset date of the peak value logger.	-
36.17	PVL reset time	Shows the time when the peak value logger was last reset.	00:00:00
	-	Last reset time of the peak value logger.	-
36.20	AL1 0 to 10%	Shows the percentage of samples recorded by amplitude logger 1 that fall between 0 and 10%. 100% corresponds to the I_{max} value given in the ratings table in chapter Technical data in the hardware manual.	0.00%
	0.00…100.00%	Amplitude logger 1 samples between 0 and 10%.	1 = 1%
36.21	AL1 10 to 20%	Shows the percentage of samples recorded by amplitude logger 1 that fall between 10 and 20%.	0.00%
	0.00…100.00%	Amplitude logger 1 samples between 10 and 20%.	1 = 1%
36.22	AL1 20 to 30%	Shows the percentage of samples recorded by amplitude logger 1 that fall between 20 and 30%.	0.00%
	0.00…100.00%	Amplitude logger 1 samples between 20 and 30%.	1 = 1%
36.23	AL1 30 to 40%	Shows the percentage of samples recorded by amplitude logger 1 that fall between 30 and 40%.	0.00%
	0.00…100.00%	Amplitude logger 1 samples between 30 and 40%.	1 = 1%
36.24	AL1 40 to 50%	Shows the percentage of samples recorded by amplitude logger 1 that fall between 40 and 50%.	0.00%
	0.00…100.00%	Amplitude logger 1 samples between 40 and 50%.	1 = 1%

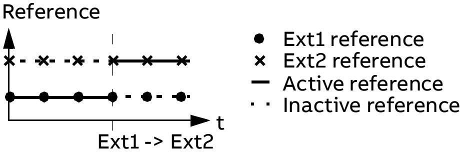
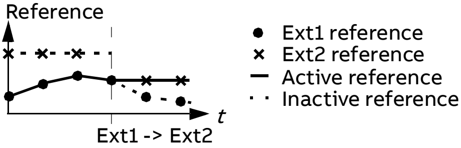
No.	Name/Value	Description	Def/ FbEq16
36.25	AL1 50 to 60%	Percentage of samples recorded by amplitude logger 1 that fall between 50 and 60%.	0.00%
	0.00…100.00%	Amplitude logger 1 samples between 50 and 60%.	1 = 1%
36.26	AL1 60 to 70%	Percentage of samples recorded by amplitude logger 1 that fall between 60 and 70%.	0.00%
	0.00…100.00%	Amplitude logger 1 samples between 60 and 70%.	1 = 1%
36.27	AL1 70 to 80%	Percentage of samples recorded by amplitude logger 1 that fall between 70 and 80%.	0.00%
	0.00…100.00%	Amplitude logger 1 samples between 70 and 80%.	1 = 1%
36.28	AL1 80 to 90%	Percentage of samples recorded by amplitude logger 1 that fall between 80 and 90%.	0.00%
	0.00…100.00%	Amplitude logger 1 samples between 80 and 90%.	1 = 1%
36.29	AL1 over 90%	Percentage of samples recorded by amplitude logger 1 that exceed 90%.	0.00%
	0.00…100.00%	Amplitude logger 1 samples over 90%.	1 = 1%
36.40	AL2 0 to 10%	Percentage of samples recorded by amplitude logger 2 that fall between 0 and 10%.	0.00%
	0.00…100.00%	Amplitude logger 2 samples between 0 and 10%.	1 = 1%
36.41	AL2 10 to 20%	Percentage of samples recorded by amplitude logger 2 that fall between 10 and 20%.	0.00%
	0.00…100.00%	Amplitude logger 2 samples between 10 and 20%.	1 = 1%
36.42	AL2 20 to 30%	Percentage of samples recorded by amplitude logger 2 that fall between 20 and 30%.	0.00%
	0.00…100.00%	Amplitude logger 2 samples between 20 and 30%.	1 = 1%
36.43	AL2 30 to 40%	Percentage of samples recorded by amplitude logger 2 that fall between 30 and 40%.	0.00%
	0.00…100.00%	Amplitude logger 2 samples between 30 and 40%.	1 = 1%
36.44	AL2 40 to 50%	Percentage of samples recorded by amplitude logger 2 that fall between 40 and 50%.	0.00%
	0.00…100.00%	Amplitude logger 2 samples between 40 and 50%.	1 = 1%
36.45	AL2 50 to 60%	Percentage of samples recorded by amplitude logger 2 that fall between 50 and 60%.	0.00%
	0.00…100.00%	Amplitude logger 2 samples between 50 and 60%.	1 = 1%

No.	Name/Value	Description	Def/ FbEq16
36.46	AL2 60 to 70%	Percentage of samples recorded by amplitude logger 2 that fall between 60 and 70%.	0.00%
	0.00…100.00%	Amplitude logger 2 samples between 60 and 70%.	1 = 1%
36.47	AL2 70 to 80%	Percentage of samples recorded by amplitude logger 2 that fall between 70 and 80%.	0.00%
	0.00…100.00%	Amplitude logger 2 samples between 70 and 80%.	1 = 1%
36.48	AL2 80 to 90%	Percentage of samples recorded by amplitude logger 2 that fall between 80 and 90%.	0.00%
	0.00…100.00%	Amplitude logger 2 samples between 80 and 90%.	1 = 1%
36.49	AL2 over 90%	Percentage of samples recorded by amplitude logger 2 that exceed 90%.	0.00%
	0.00…100.00%	Amplitude logger 2 samples over 90%.	1 = 1%
36.50	AL2 reset date	The date on which amplitude logger 2 was last reset.	01/01/1980
	1/1/1980...6/5/ 2159	Last reset date of amplitude logger 2.	-
36.51	AL2 reset time	The time at which amplitude logger 2 was last reset.	00:00:00
	-	Last reset time of amplitude logger 2.	-

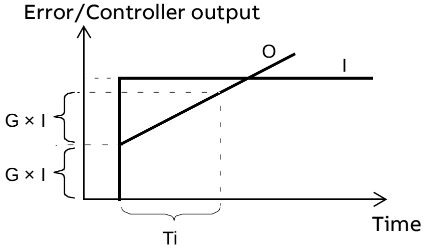
40 Process PID set 1		Parameter values for process PID control. The drive output can be controlled by the process PID. When the process PID control is enabled, the drive controls the process feedback to the reference value.	
40.01	Process PID output actual	Shows output of the process PID controller. This parameter is read-only.	-
	-200000.00... 200000.00	Process PID controller output.	1 = 1
40.02	Process PID feedback actual	Shows value of process feedback after source selection, mathematical function and filtering. This parameter is read-only.	-
	-200000.00... 200000.00	Process feedback.	1 = 1

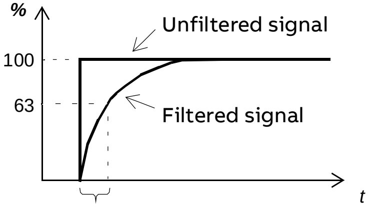
<table>
<tr><th>No.</th><th>Name/Value</th><th>Description</th><th>Def/
FbEq16</th></tr>
<tr><td>40.03</td><td>Process PID setpoint actual</td><td>Shows value of process PID setpoint after source selection, mathematical function limitation and ramping.
This parameter is read-only.</td><td>-</td></tr>
<tr><td></td><td>-200000.00...
200000.00</td><td>Setpoint for process PID controller.</td><td>1 = 1</td></tr>
<tr><td>40.04</td><td>Process PID deviation actual</td><td>Shows process PID deviation. By default, this value equals setpoint - feedback, but deviation can be inverted by parameter 40.31 Set 1 deviation inversion.
This parameter is read-only.</td><td>-</td></tr>
<tr><td></td><td>-200000.00...
200000.00</td><td>PID deviation.</td><td>1 = 1</td></tr>
<tr><td>40.06</td><td>Process PID status word</td><td>Shows status information on process PID control.
This parameter is read-only.</td><td>0b0000</td></tr>
<tr><td colspan="4">
<table>
<tr><th>Bit</th><th>Name</th><th>Value</th></tr>
<tr><td>0</td><td>PID active</td><td>1 = Process PID control active.</td></tr>
<tr><td>1</td><td>Setpoint frozen</td><td>1 = Process PID setpoint frozen.</td></tr>
<tr><td>2</td><td>Output frozen</td><td>1 = Process PID controller output frozen.</td></tr>
<tr><td>3</td><td>PID sleep mode</td><td>1 = Sleep mode active.</td></tr>
<tr><td>4</td><td>Sleep boost</td><td>1 = Sleep boost active.</td></tr>
<tr><td>5</td><td colspan="2">Reserved</td></tr>
<tr><td>6</td><td>Tracking mode</td><td>1 = Tracking function active.</td></tr>
<tr><td>7</td><td>Output limit high</td><td>1 = PID output is being limited by par. 40.37.</td></tr>
<tr><td>8</td><td>Output limit low</td><td>1 = PID output is being limited by par. 40.36.</td></tr>
<tr><td>9</td><td colspan="2">Reserved</td></tr>
<tr><td>10</td><td>PID set</td><td>0 = Parameter set 1 in use. 1 = Parameter set 2 in use.</td></tr>
<tr><td>11</td><td colspan="2">Reserved</td></tr>
<tr><td>12</td><td>Internal setpoint active</td><td>1 = Internal setpoint active (see par. 40.16…40.16)</td></tr>
<tr><td>13…15</td><td colspan="2">Reserved</td></tr>
</table>
</td></tr>
<tr><td></td><td>0b0000…
0b1111</td><td>Process PID control status word.</td><td>1 = 1</td></tr>
<tr><td>40.07</td><td>Process PID operation mode</td><td>Activates/deactivates process PID control.
Note: Process PID control is only available in external control; see section Local control vs. external control (page 35).</td><td>Off</td></tr>
<tr><td></td><td>Off</td><td>Process PID control inactive.</td><td>0</td></tr>
<tr><td></td><td>On</td><td>Process PID control active.</td><td>1</td></tr>
</table>

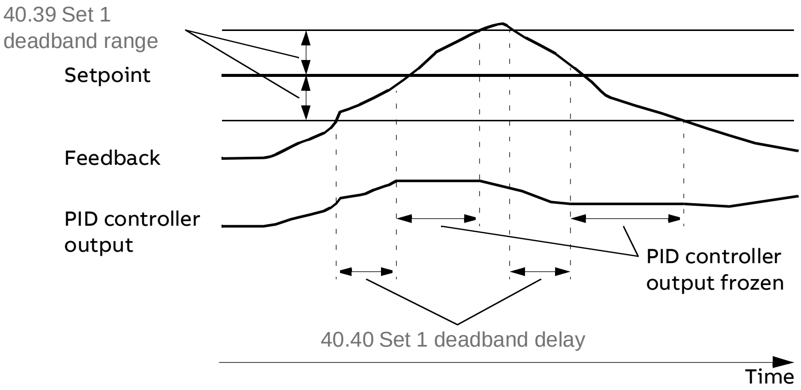
No.	Name/Value	Description	Def/ FbEq16
	On when drive running	Process PID control is active when the drive is running.	2
40.08	Set 1 feedback 1 source	Selects the primary source of process feedback.	AI2 percent
	Not selected	None.	0
	AI1 scaled	12.12 AI1 scaled value (see page 110).	1
	AI2 scaled	12.22 AI2 scaled value (see page 112).	2
	Freq in scaled	11.39 Freq in 1 scaled value (see page 107).	3
	AI1 percent	12.101 AI1 percent value (see page 114)	8
	AI2 percent	12.102 AI2 percent value (see page 114)	9
	Feedback data storage	40.91 Feedback data storage (see page 204),	10
	Actual flow	80.01 Calculated flow (see page 231),	11
	Other	Source selection (see Terms and abbreviations on page 80).	-
40.11	Set 1 feedback filter time	Defines the filter time constant for process feedback.	0.000 s
	0.000… 30.000 s	Feedback filter time.	1 = 1 s
40.14	Set 1 setpoint scaling	Defines a general scaling factor for the external PID control chain. The scaling can be utilized when, for example, the process setpoint is input in Hz, and the output of the PID controller is used as an rpm value in speed control. In this case, this parameter might be set to 50.	100.00
	-200000.00... 200000.00	Process setpoint base.	1=1
40.16	Set 1 setpoint 1 source	Selects the primary source of process PID setpoint.	AI1 percent
	Not selected	None.	0
	Internal setpoint	Internal setpoint. See parameter 40.24 Set 1 internal setpoint 0.	2
	AI1 scaled	12.12 AI1 scaled value (see page 110).	3
	AI2 scaled	12.22 AI2 scaled value (see page 112).	4
	Motor potentiometer	Not applicable.	
	Freq in scaled	11.39 Freq in 1 scaled value (see page 107).	10
	AI1 percent	12.101 AI1 percent value (see page 114)	11
	AI2 percent	12.102 AI2 percent value (see page 114)	12

No.	Name/Value	Description	Def/ FbEq16
	Control panel (ref saved)	Panel reference (03.01 Panel reference, see page 88) saved by the control system for the location where the control returns is used as the reference. 	13
	Control panel (ref copied)	Panel reference (03.01 Panel reference, see page 88) for the previous control location is used as the reference when the control location changes if the references for the two locations are of the same type (eg frequency/speed/torque/PID); otherwise, the actual signal is used as the new reference. 	14
	FB A ref1	03.05 FB A reference 1 (see page 88).	15
	FB A ref2	03.06 FB A reference 2 (see page 88).	16
	EFB ref1	03.09 EFB reference 1 (see page 88).	19
	EFB ref2	03.10 EFB reference 2 (see page 88).	20
	Setpoint data storage	40.92 Setpoint data storage (see page 204)	24
	Other	Source selection (see Terms and abbreviations on page 80).	-
40.24	Set 1 internal setpoint 0	Internal process setpoint 1. See parameter 40.16 Set 1 setpoint 1 source.	0.00
	-200000.00… 200000.00	Internal process setpoint 1.	1 = 1
40.26	Set 1 setpoint min	Defines a minimum limit for the process PID controller setpoint.	0.00
	-200000.00… 200000.00	Minimum limit for process PID controller setpoint.	1 = 1
40.27	Set 1 setpoint max	Defines a maximum limit for the process PID controller setpoint.	200000.00
	-200000.00… 200000.00	Maximum limit for process PID controller setpoint.	1 = 1

No.	Name/Value	Description	Def/ FbEq16
40.28	Set 1 setpoint increase time	Defines the minimum time it takes for the setpoint to increase from 0% to 100%.	0.0 s
	0.0…1800.0 s	Setpoint increase time.	1 = 1
40.29	Set 1 setpoint decrease time	Defines the minimum time it takes for the setpoint to decrease from 100% to 0%.	0.0 s
	0.0…1800.0 s	Setpoint decrease time.	1 = 1
40.30	Set 1 setpoint freeze enable	Freezes, or defines a source that can be used to freeze, the setpoint of the process PID controller. This feature is useful when the reference is based on a process feedback connected to an analog input, and the sensor must be serviced without stopping the process. 1 = Process PID controller setpoint frozen See also parameter 40.38 Set 1 output freeze enable.	Not selected
	Not selected	Process PID controller setpoint not frozen.	0
	Selected	Process PID controller setpoint frozen.	1
	DI1	Digital input DI1 (10.02 DI delayed status, bit 0).	2
	DI2	Digital input DI2 (10.02 DI delayed status, bit 1).	3
	DI3	Digital input DI3 (10.02 DI delayed status, bit 2).	4
	DI4	Digital input DI4 (10.02 DI delayed status, bit 3).	5
	DI5	Digital input DI5 (10.02 DI delayed status, bit 4).	6
	DI6	Digital input DI6 (10.02 DI delayed status, bit 5).	7
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 152).	21
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 152).	22
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 152).	23
	Other [bit]	Source selection (see Terms and abbreviations on page 80).	-
40.31	Set 1 deviation inversion	Inverts the input of the process PID controller. 0 = Deviation not inverted (Deviation = Setpoint - Feedback) 1 = Deviation inverted (Deviation = Feedback - Setpoint) See also section Tracking (page 54).	Not inverted (Ref - Fbk)
	Not inverted (Ref - Fbk)	0.	0
	Inverted (Fbk - Ref)	1.	1
	Other [bit]	Source selection (see Terms and abbreviations on page 80).	-

No.	Name/Value	Description	Def/ FbEq16
40.32	Set 1 gain	Defines the gain for the process PID controller. See parameter 40.33 Set 1 integration time.	1.00
	0.01…100.00	Gain for PID controller.	100 = 1
40.33	Set 1 integration time	Defines the integration time for the process PID controller. This time needs to be set to the same order of magnitude as the reaction time of the process being controlled, otherwise instability will result.  I = controller input (error) O = controller output G = gain Ti = integration time **Note:** Setting this value to 0 disables the “I” part, turning the PID controller into a PD controller.	60.0 s
	0.0…9999.0 s	Integration time.	1 = 1 s
40.34	Set 1 derivation time	Defines the derivation time of the process PID controller. The derivative component at the controller output is calculated on basis of two consecutive error values (E_{K-1} and E_K) according to the following formula: PID DERIV TIME × (E_K - E_{K-1})/ T_S, in which T_S = 2 ms sample time E = Error = Process reference - process feedback.	0.000 s
	0.000…10.000 s	Derivation time.	1000 = 1 s

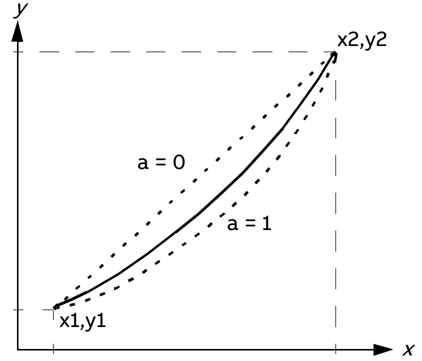
No.	Name/Value	Description	Def/ FbEq16
40.35	Set 1 derivation filter time	Defines the time constant of the 1-pole filter used to smooth the derivative component of the process PID controller.  $O = I \times (1 - e^{-t/T})$ I = filter input (step) O = filter output *t* = time T = filter time constant	0.0 s
	0.0…10.0 s	Filter time constant.	10 = 1 s
40.36	Set 1 output min	Defines the minimum limit for the process PID controller output. Using the minimum and maximum limits, it is possible to restrict the operation range.	0.00
	-100.00...100.00	Minimum limit for process PID controller output.	1 = 1
40.37	Set 1 output max	Defines the maximum limit for the process PID controller output. See parameter 40.36 Set 1 output min.	100.00
	-100.00...100.00	Maximum limit for process PID controller output.	1 = 1
40.38	Set 1 output freeze enable	Freezes (or defines a source that can be used to freeze) the output of the process PID controller, keeping the output at the value it was before freeze was enabled. This feature can be used when, for example, a sensor providing process feedback must to be serviced without stopping the process. 1 = Process PID controller output frozen See also parameter 40.30 Set 1 setpoint freeze enable.	Not selected
	Not selected	Process PID controller output not frozen.	0
	Selected	Process PID controller output frozen.	1
	DI1	Digital input DI1 (10.02 DI delayed status, bit 0).	2
	DI2	Digital input DI2 (10.02 DI delayed status, bit 1).	3
	DI3	Digital input DI3 (10.02 DI delayed status, bit 2).	4

No.	Name/Value	Description	Def/ FbEq16
	DI4	Digital input DI4 (10.02 DI delayed status, bit 3).	5
	DI5	Digital input DI5 (10.02 DI delayed status, bit 4).	6
	DI6	Digital input DI6 (10.02 DI delayed status, bit 5).	7
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 152).	21
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 152).	22
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 152).	23
	Other [bit]	Source selection (see Terms and abbreviations on page 80).	-
40.39	Set 1 deadband range	Defines a deadband around the setpoint. Whenever process feedback enters the deadband, a delay timer starts. If the feedback remains within the deadband longer than the delay (40.40 Set 1 deadband delay), the PID controller output is frozen. Normal operation resumes after the feedback value leaves the deadband.	0.00
			
	0.00…… 200000.00	Deadband range.	1 = 1
40.40	Set 1 deadband delay	Delay for the deadband. See parameter 40.39 Set 1 deadband range.	0.0 s
	0.0 … 3600.0 s	Delay for deadband area.	1 = 1 s

No.	Name/Value	Description	Def/ FbEq16
40.43	Set 1 sleep level	Defines the start limit for the sleep function. If the value is 0.0, set 1 sleep mode is disabled. The sleep function compares PID output (parameter 40.01 Process PID output actual) to the value of this parameter. If PID output remains below this value longer than the sleep delay defined by 40.44 Set 1 sleep delay, the drive enters the sleep mode and stops the motor.	0.0
	0.0...200000.00	Sleep start level.	1 = 1
40.44	Set 1 sleep delay	Defines a delay before the sleep function actually becomes enabled, to prevent nuisance sleeping. The delay timer starts when the sleep mode is enabled by parameter 40.43 Set 1 sleep level, and resets when the sleep mode is disabled.	60.0
	0.0…3600.0 s	Sleep start delay.	1 = 1
40.45	Set 1 sleep boost time	Defines a boost time for the sleep boost step. See parameter 40.46 Set 1 sleep boost step.	0.0
	0.0...200000.00	Sleep boost time.	1 = 1
40.46	Set 1 sleep boost step	When the drive is entering sleep mode, the process setpoint is increased by this value for the time defined by parameter 40.45 Set 1 sleep boost time. If active, sleep boost is aborted when the drive wakes up.	0.00
	0.00… 32767.00%	Sleep boost step.	1 = 1
40.47	Set 1 wake-up deviation	Defines the wake-up level as deviation between process setpoint and feedback. When the deviation exceeds the value of this parameter, and remains there for the duration of the wake-up delay (40.48 Set 1 wake-up delay), the drive wakes up. See also parameter 40.31 Set 1 deviation inversion.	0.00
	-200000.00... 200000.00	Wake-up level (as deviation between process setpoint and feedback).	1 = 1
40.48	Set 1 wake-up delay	Defines a wake-up delay for the sleep function to prevent nuisance wake-ups. See parameter 40.47 Set 1 wake-up deviation. The delay timer starts when the deviation exceeds the wake-up level (40.47 Set 1 wake-up deviation), and resets if the deviation falls below the wake-up level.	0.50
	0.00…60.00 s	Wake-up delay.	1 = 1

No.	Name/Value	Description	Def/ FbEq16
40.49	Set 1 tracking mode	Activates (or selects a source that activates) tracking mode. In tracking mode, the value selected by parameter 40.50 Set 1 tracking ref selection is substituted for the PID controller output. See also section Tracking (page 54). 1 = Tracking mode enabled	Not selected
	Not selected	0.	0
	Selected	1.	1
	DI1	Digital input DI1 (10.02 DI delayed status, bit 0).	2
	DI2	Digital input DI2 (10.02 DI delayed status, bit 1).	3
	DI3	Digital input DI3 (10.02 DI delayed status, bit 2).	4
	DI4	Digital input DI4 (10.02 DI delayed status, bit 3).	5
	DI5	Digital input DI5 (10.02 DI delayed status, bit 4).	6
	DI6	Digital input DI6 (10.02 DI delayed status, bit 5).	7
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 152).	21
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 152).	22
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 152).	23
	Other [bit]	Source selection (see Terms and abbreviations on page 80).	-
40.50	Set 1 tracking ref selection	Selects the value source for tracking mode. See parameter 40.49 Set 1 tracking mode.	Not selected
	Not selected	None.	0
	AI1 scaled	12.12 AI1 scaled value (see page 110).	1
	AI2 scaled	12.22 AI2 scaled value (see page 112).	2
	FB A ref1	03.05 FB A reference 1 (see page 88).	3
	FB A ref2	03.06 FB A reference 2 (see page 88).	4
	Other	Source selection (see Terms and abbreviations on page 80).	-
40.58	Set 1 increase prevention	Activates increase prevention of PID integration term for PID set 1.	No
	No	Increase prevention not in use.	0
	Limiting	The PID integration term is not increased.	1
	Other [bit]	Source selection (see Terms and abbreviations on page 80).	-
40.59	Set 1 decrease prevention	Activates decrease prevention of PID integration term for PID set 1.	No
	No	Decrease prevention not in use.	0
	Limiting	The PID integration term is not decreased.	1
	Other [bit]	Source selection (see Terms and abbreviations on page 80).	-

No.	Name/Value	Description	Def/ FbEq16
40.60	Set 1 PID activation source	Selects the source of process PID set 1 activation.	On
	Off	Set 1 PID activation source is Off.	0
	On	Set 1 PID activation source is On.	1
	DI1	Digital input DI1 (10.02 DI delayed status, bit 0).	3
	DI2	Digital input DI2 (10.02 DI delayed status, bit 1).	4
	DI3	Digital input DI3 (10.02 DI delayed status, bit 2).	5
	DI4	Digital input DI4 (10.02 DI delayed status, bit 3).	6
	DI5	Digital input DI5 (10.02 DI delayed status, bit 4).	7
	DI6	Digital input DI6 (10.02 DI delayed status, bit 5).	8
	DIO1	Digital input/output DIO1.	9
	DIO2	Digital input/output DIO2.	10
	Other [bit]	Source selection (see Terms and abbreviations on page 80).	-
40.61	Setpoint scaling actual	Actual setpoint scaling. See parameter 40.14 Set 1 setpoint scaling.	0.00
	-200000.00… 200000.00 PID customer units	Scaling.	1 = 1 PID customer unit
40.62	PID internal setpoint actual	Shows value of the internal setpoint. This parameter is read-only.	-
	-200000.00… 200000.00	Process PID internal setpoint.	1 = 1

No.	Name/Value	Description	Def/ FbEq16
40.70	Compensated setpoint	Compensated setpoint determined for the input specified by parameter 40.71 Set 1 compensation input source. The determination of the compensated setpoint is based on the curve specified by points (x1, y1), (x2, y2) and the non-linearity of the curve specified with parameters 40.71…40.76. The compensated setpoint curve will be a mixture of a straight line between the points and a squared line between the points:  *x* = value from 40.71 Set 1 compensation input source *y* = 40.70 Compensated setpoint *a* = 40.76 Set 1 compensation non-linearity Compensated setpoint curve = a * squared	-
	-21474836.48… 21474835.20 PID unit 1bar	Compensated setpoint value.	1 = 1 PID unit 1bar
40.71	Set 1 compensation input source	Selects the source for set 1 compensation input.	Not selected
	Not selected	None.	0
	Reserved		1
	Internal setpoint	Internal setpoint.	2
	AI1 scaled	12.12 AI1 scaled value (see page 110).	3
	AI2 scaled	12.22 AI2 scaled value (see page 112).	4
	Reserved		5…9
	Freq in scaled	11.39 Freq in 1 scaled value (see page 107).	10
	AI1 percent	12.101 AI1 percent value (see page 114).	11

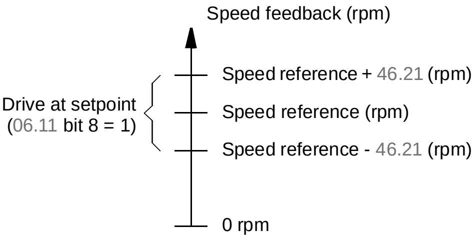
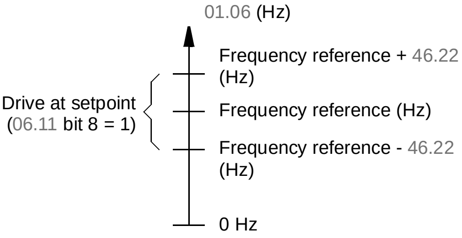
No.	Name/Value	Description	Def/ FbEq16
	AI2 percent	12.102 AI2 percent value (see page 114).	12
	Reserved		13…14
	FB A ref1	03.05 FB A reference 1 (see page 88).	15
	FB A ref2	03.06 FB A reference 2 (see page 88).	16
	Reserved		17…18
	EFB ref1	03.09 EFB reference 1 (see page 88).	19
	EFB ref2	03.10 EFB reference 2 (see page 88).	20
	Reserved		21…23
	Setpoint data storage	40.92 Setpoint data storage (see page 204).	24
	Other	Source selection (see Terms and abbreviations on page 80).	-
40.72	Set 1 compensation input 1	Point x1 on the setpoint compensation curve, see parameter 40.71 Compensated setpoint.	0.00
	-200000.00… 200000.00	Setpoint value.	1 = 1
40.73	Set 1 compensated output 1	Point y1 (= the compensated output of parameter 40.72 Set 1 compensation input 1) on the setpoint compensation curve, see parameter 40.70 Compensated setpoint.	0.00 PID unit 1bar
	-200000.00… 200000.00 PID unit 1bar	Compensated setpoint value.	1 = 1 PID unit 1bar
40.74	Set 1 compensation input 2	Point x2 on the setpoint compensation curve, see parameter 40.71 Compensated setpoint.	0.00
	-200000.00… 200000.00	Setpoint value.	1 = 1
40.75	Set 1 compensated output 2	Point y2 (= the compensated output of parameter 40.74 Set 1 compensation input 2) on the setpoint compensation curve, see parameter 40.70 Compensated setpoint.	0.00 PID unit 1bar
	-200000.00… 200000.00 PID unit 1bar	Compensated setpoint value.	1 = 1 PID unit 1bar
40.76	Set 1 compensation non-linearity	Describes the non-linearity of the setpoint compensation curve, see parameter 40.70 Compensated setpoint.	0%
	0…100%	Percentage.	1 = 1%

No.	Name/Value	Description	Def/ FbEq16
40.79	Set 1 units	Selects the unit for process PID setpoint, feedback and deviation.	°C
	User text	User text	0
	%	%	1
	bar	bar	2
	kPa	kPa	3
	Pa	Pa	4
	psi	psi	5
	CFM	CFM	6
	inH$_2$O	inH$_2$O	7
	°C	°C	8
	°F	°F	9
	mbar	mbar	10
	m^3/h	m^3/h	11
	dm^3/h	dm^3/h	12
	l/s	l/s	13
	l/min	l/min	14
	l/h	l/h	15
	m^3/s	m^3/s	16
	m^3/m	m^3/m	17
	km^3/h	km^3/h	18
	gal/s	gal/s	19
	ft^3/s	ft^3/s	20
	ft^3/m	ft^3/m	21
	ft^3/h	ft^3/h	22
	ppm	ppm	23
	inHg	inHg	24
	kCFM	kCFM	25
	inWC	inWC	26
	GPM	GPM	27
	gal/m	gal/m	28
	in wg	in wg	29
	MPa	MPa	30
	ftWC	ftWC	31
40.89	Set 1 setpoint multiplier	Defines the multiplier with the result of parameter 40.16 Set 1 setpoint 1 source.	1.00
	-200000.00… 200000.00	Multiplier.	-

No.	Name/Value	Description	Def/ FbEq16
40.90	Set 1 feedback multiplier	Defines the multiplier with the result of parameter 40.08 Set 1 feedback 1 source.	1.00
	-200000.00… 200000.00	Multiplier.	1 = 1
40.91	Feedback data storage	Storage parameter for receiving a process feedback value eg. through the embedded fieldbus interface. The value can be sent to the drive as Modbus I/O data. Set the target selection parameter of that particular data (58.101…58.114) to Feedback data storage. In 40.08 Set 1 feedback 1 source, select Feedback data storage.	0.00
	-327.68…327.67	Storage parameter for process feedback.	100 = 1
40.92	Setpoint data storage	Storage parameter for receiving a process setpoint value eg. through the embedded fieldbus interface. The value can be sent to the drive as Modbus I/O data. Set the target selection parameter of that particular data (58.101…58.114)) to Setpoint data storage. In 40.16 Set 1 setpoint 1 source, select Setpoint data storage.	0.00
	-327.68…327.67	Storage parameter for process setpoint.	100 = 1
40.96	Process PID output%	Percentage scaled signal of parameter 40.01 Process PID feedback actual. Correct later.	0.00
	-100.00... 100.00%	Percentage.	1=1
40.97	Process PID feedback%	Percentage scaled signal of parameter 40.02 Process PID feedback actual. Correct later.	0.00
	-100.00... 100.00%	Percentage.	1=1
40.98	Process PID setpoint%	Percentage scaled signal of parameter 40.03 Process PID setpoint actual.Correct later.	0.00
	-100.00... 100.00%	Percentage.	1=1
40.99	Process PID deviation%	Percentage scaled signal of parameter 40.04 Process PID deviation actual.Correct later.	0.00
	-100.00... 100.00%	Percentage.	1=1

No.	Name/Value	Description	Def/ FbEq16
46 Monitoring/scaling settings		Speed supervision settings; actual signal filtering; general scaling settings.	
46.01	Speed scaling	Defines the maximum speed value used to define the acceleration ramp rate and the initial speed value used to define the deceleration ramp rate (see parameter group 23 Speed reference ramp). The speed acceleration and deceleration ramp times are therefore related to this value (**not** to parameter 30.12 Maximum speed). Also defines the 16-bit scaling of speed-related parameters. The value of this parameter corresponds to 20000 in eg. fieldbus communication.	1500.00 rpm
	0.10… 30000.00 rpm	Acceleration/deceleration terminal/initial speed.	1 = 1 rpm
46.02	Frequency scaling	Defines the maximum frequency value used to define the acceleration ramp rate and the initial frequency value used to define deceleration ramp rate (see parameter group 28 Frequency reference chain). The frequency acceleration and deceleration ramp times are therefore related to this value (**not** to parameter 30.14 Maximum frequency. Also defines the 16-bit scaling of frequency-related parameters. The value of this parameter corresponds to 20000 in eg. fieldbus communication.	50.00 Hz
	0.10… 1000.00 Hz	Acceleration/deceleration terminal/initial frequency.	10 = 1 Hz
46.03	Torque scaling	Defines the 16-bit scaling of torque parameters. The value of this parameter (in percent of nominal motor torque) corresponds to 10000 in eg. fieldbus communication.	100.0%
	0.1…1000.0%	Torque corresponding to 10000 on fieldbus.	10 = 1%
46.04	Power scaling	Defines the output power value that corresponds to 10000 in eg. fieldbus communication. The unit is selected by parameter 96.16 Unit selection.	1000.00 kW or hp
	0.10 … 30000.00 kW or 0.10 … 40200.00 hp	Power corresponding to 10000 on fieldbus.	1 = 1 unit

No.	Name/Value	Description	Def/ FbEq16
46.05	Current scaling	Defines the 16-bit scaling of current parameters. The value of of this parameter corresponds to 10000 in fieldbus, master/follower etc. communication.	10000 A
	0…30000 A		
46.06	Speed ref zero scaling	Defines a speed corresponding to a zero reference received from fieldbus (either the embedded fieldbus interface, or interface FBA A). For example, with a setting of 500, the fieldbus reference range of 0…20000 would correspond to a speed of 500…[99.09] rpm. **Note:** This parameter is effective only with the ABB Drives communication profile.	0.00 rpm
	0.00 … 30000.00 rpm	Speed corresponding to minimum fieldbus reference.	1 = 1 rpm
46.07	Frequency ref zero scaling	Defines a frequency corresponding to a zero reference received from fieldbus (either the embedded fieldbus interface, or interface FBA A or FBA B). For example, with a setting of 30, the fieldbus reference range of 0…20000 would correspond to a speed of 30…[46.02] Hz. **Note:** This parameter is effective only with the ABB Drives communication profile.	0.00 Hz
	0.00 … 1000.00 Hz	Speed corresponding to minimum fieldbus reference.	10 = 1 Hz
46.11	Filter time motor speed	Defines a filter time for signals 01.01 Motor speed used and 01.02 Motor speed estimated.	500 ms
	2…20000 ms	Motor speed signal filter time.	1 = 1 ms
46.12	Filter time output frequency	Defines a filter time for signal 01.06 Output frequency.	500 ms
	2…20000 ms	Output frequency signal filter time.	1 = 1 ms
46.13	Filter time motor torque	Defines a filter time for signal 01.10 Motor torque.	100 ms
	2…20000 ms	Motor torque signal filter time.	1 = 1 ms
46.14	Filter time power	Defines a filter time for signal 01.14 Output power.	100 ms
	2…20000 ms	Output power signal filter time.	1 = 1 ms

No.	Name/Value	Description	Def/ FbEq16
46.21	At speed hysteresis	Defines the "at setpoint" limits for speed control of the drive. When the difference between speed reference and the speed feedback is smaller than 46.21 At speed hysteresis, the drive is considered to be "at setpoint". This is indicated by bit 8 of 06.11 Main status word. 	50.00 rpm
	0.00… 30000.00 rpm	Limit for "at setpoint" indication in speed control.	1 = 1
46.22	At frequency hysteresis	Defines the "at setpoint" limits for frequency control of the drive. When the absolute difference between frequency reference and actual frequency (01.06 Output frequency) is smaller than 46.22 At frequency hysteresis, the drive is considered to be "at setpoint". This is indicated by bit 8 of 06.11 Main status word. 	2.00 Hz
	0.00… 1000.00 Hz	Limit for "at setpoint" indication in frequency control.	10 = 1
46.31	Above speed limit	Defines the trigger level for "above limit" indication in speed control. When actual speed exceeds the limit, bit 10 of 06.17 Drive status word 2 is set.	1500.00 rpm
	0.00… 30000.00 rpm	"Above limit" indication trigger level for speed control.	1 = 1

No.	Name/Value	Description	Def/ FbEq16
46.32	Above frequency limit	Defines the trigger level for “above limit” indication in frequency control. When actual frequency exceeds the limit, bit 10 of 06.17 Drive status word 2 is set.	50.00 Hz
	0.00… 1000.00 Hz	“Above limit” indication trigger level for frequency control.	10 = 1
46.41	kWh pulse scaling	Defines the trigger level for the “kWh pulse” on for 50 ms. The output of the pulse is bit 9 of 05.22 Diagnostic word 3.	1.000 kWh
	0.001… 1000.000 kWh	“kWh pulse” on trigger level.	1 = 1 kWh
46.43	Power decimals	Defines the number of decimal places of power-related parameters.	2
	0...3	Number of decimal places of power parameters.	1 = 1
46.44	Current decimals	Defines the number of decimal places of current-related parameters.	1
	0...3	Number of decimal places of current parameters.	1 = 1

49 Panel port communication		Communication settings for the control panel port on the drive.	
49.01	Node ID number	Defines the node ID of the drive. All devices connected to the network must have a unique node ID. Note: For networked drives, it is advisable to reserve ID 1 for spare/replacement drives.	1
	1…32	Node ID.	1 = 1
49.03	Baud rate	Defines the transfer rate of the link.	115.2 kbps
	38.4 kbps	38.4 kbit/s.	1
	57.6 kbps	57.6 kbit/s.	2
	86.4 kbps	86.4 kbit/s.	3
	115.2 kbps	115.2 kbit/s.	4
	230.4 kbps	230.4 kbit/s.	5
49.04	Communication loss time	Sets a timeout for control panel (or PC tool) communication. If a communication break lasts longer than the timeout, the action specified by parameter 49.05 Communication loss action is taken.	10.0 s
	0.3…3000.0 s	Panel/PC tool communication timeout.	10 = 1 s

No.	Name/Value	Description	Def/ FbEq16
49.05	Communication loss action	Selects how the drive reacts to a control panel (or PC tool) communication break.	Fault
	No action	No action taken.	0
	Fault	Drive trips on 7081 Control panel loss.	1
49.06	Refresh settings	Applies the settings of parameters 49.01…49.05. **Note:** Refreshing may cause a communication break, so reconnecting the drive may be required.	Done
	Done	Refresh done or not requested.	0
	Configure	Refresh parameters 49.01…49.05. The value reverts automatically to Done.	1

50 Fieldbus adapter (FBA)		Fieldbus communication configuration. See also chapter Fieldbus control through a fieldbus adapter (page 369).	
50.01	FBA A enable	Enables/disables communication between the drive and fieldbus adapter A, and specifies the slot the adapter is installed into.	Disable
	Disable	Communication between drive and fieldbus adapter A disabled.	0
	Enable	Communication between drive and fieldbus adapter A enabled. The adapter is in slot 1.	1
50.02	FBA A comm loss func	Selects how the drive reacts upon a fieldbus communication break. The time delay is defined by parameter 50.03 FBA A comm loss t out.	No action
	No action	No action taken.	0
	Fault	Communication break detection active. Upon a communication break, the drive trips on a 7510 FBA A communication fault and coasts to a stop.	1
	Fault always	Drive trips on 7510 FBA A communication. This occurs even though no control is expected from the fieldbus.	4
	Warning	Drive generates an A7C1 FBA A communication warning. This occurs even though no control is expected from the fieldbus. ⚠ **WARNING!** Make sure that it is safe to continue operation in case of a communication break.	5

<table>
<tr><th>No.</th><th>Name/Value</th><th>Description</th><th>Def/
FbEq16</th></tr>
<tr><td>50.03</td><td>FBA A comm loss t out</td><td>Defines the time delay before the action defined by parameter 50.02 FBA A comm loss func is taken. Time count starts when the communication link fails to update the message.
Notes:
• There is a 60 second boot-up delay immediately after power-up. During the delay, communication break monitoring is disabled (but communication itself can be active).
• This timer starts when parameter 51.31 D2FBA A comm status = Off-line.
• This timer only delays the function selected in 50.02 FBA A comm loss func.</td><td>0.3 s</td></tr>
<tr><td></td><td>0.3…6553.5 s</td><td>Time delay.</td><td>1 = 1 s</td></tr>
<tr><td>50.04</td><td>FBA A ref1 type</td><td>Selects the type and scaling of reference 1 received from fieldbus adapter A. The scaling of the reference is defined by parameters 46.01…46.04, depending on which reference type is selected by this parameter.</td><td>Speed or frequency</td></tr>
<tr><td></td><td>Speed or frequency</td><td>Type and scaling is chosen automatically according to the currently active operation mode as follows:<table><tr><th>Operation mode</th><th>Reference 1 type</th></tr><tr><td>Speed control</td><td>Speed</td></tr><tr><td>Frequency control</td><td>Frequency</td></tr></table></td><td>0</td></tr>
<tr><td></td><td>Transparent</td><td>No scaling is applied.</td><td>1</td></tr>
<tr><td></td><td>General</td><td>Generic reference without a specific unit.</td><td>2</td></tr>
<tr><td></td><td>Torque</td><td>The scaling is defined by parameter 46.03 Torque scaling.</td><td>3</td></tr>
<tr><td></td><td>Speed</td><td>The scaling is defined by parameter 46.01 Speed scaling.</td><td>4</td></tr>
<tr><td></td><td>Frequency</td><td>The scaling is defined by parameter 46.02 Frequency scaling.</td><td>5</td></tr>
<tr><td>50.05</td><td>FBA A ref2 type</td><td colspan="2">Not applicable</td></tr>
<tr><td>50.06</td><td>FBA A SW sel</td><td>Selects the source of the Status word to be sent to the fieldbus network through fieldbus adapter A.</td><td>Auto</td></tr>
<tr><td></td><td>Auto</td><td>Source of the Status word is chosen automatically.</td><td>0</td></tr>
<tr><td></td><td>Transparent mode</td><td>The source selected by parameter 50.09 FBA A SW transparent source is transmitted as the Status word to the fieldbus network through fieldbus adapter A.</td><td>1</td></tr>
</table>

<table>
<tr><th>No.</th><th>Name/Value</th><th>Description</th><th>Def/
FbEq16</th></tr>
<tr><td>50.07</td><td>FBA A actual 1 type</td><td>Selects the type and scaling of actual value 1 transmitted to the fieldbus network through fieldbus adapter A. The scaling of the value is defined by parameters 99.09, 99.08, 46.03 and 46.04 depending on which actual value type is selected by this parameter.</td><td>Speed or frequency</td></tr>
<tr><td></td><td>Speed or frequency</td><td>Type and scaling is chosen automatically according to the currently active operation mode as follows.<table><tr><td>Motor control mode (see par. 99.04)</td><td>Actual 1 type</td></tr><tr><td>Speed control</td><td>Speed</td></tr><tr><td>Frequency control</td><td>Frequency</td></tr></table></td><td>0</td></tr>
<tr><td></td><td>Transparent</td><td>No scaling is applied.</td><td>1</td></tr>
<tr><td></td><td>General</td><td>Generic reference without a specific unit.</td><td>2</td></tr>
<tr><td></td><td>Speed</td><td>The scaling is defined by parameter 99.09 Motor nominal speed.</td><td>4</td></tr>
<tr><td></td><td>Frequency</td><td>The scaling is defined by parameter 99.08 Motor nominal frequency.</td><td>5</td></tr>
<tr><td>50.08</td><td>FBA A actual 2 type</td><td colspan="2">Not applicable</td></tr>
<tr><td>50.09</td><td>FBA A SW transparent source</td><td>Selects the source of the fieldbus status word when parameter 50.06 FBA A SW sel is set to Transparent mode.</td><td>Not selected</td></tr>
<tr><td></td><td>Not selected</td><td>No source selected.</td><td>-</td></tr>
<tr><td></td><td>Other</td><td>Source selection (see Terms and abbreviations on page 80).</td><td>-</td></tr>
<tr><td>50.10</td><td>FBA A act1 transparent source</td><td>When parameter 50.07 FBA A actual 1 type is set to Transparent, this parameter selects the source of actual value 1 transmitted to the fieldbus network through fieldbus adapter A.</td><td>Not selected</td></tr>
<tr><td></td><td>Not selected</td><td>No source selected.</td><td>-</td></tr>
<tr><td></td><td>Other</td><td>Source selection (see Terms and abbreviations on page 80).</td><td>-</td></tr>
<tr><td>50.11</td><td>FBA A act2 transparent source</td><td colspan="2">Not applicable</td></tr>
<tr><td>50.12</td><td>FBA A debug mode</td><td>This parameter enables debug mode. Shows raw (unmodified) data received from and sent to fieldbus adapter A in parameters 50.13…50.18.</td><td>Disable</td></tr>
<tr><td></td><td>Disable</td><td>Debug mode disabled.</td><td>0</td></tr>
</table>

No.	Name/Value	Description	Def/ FbEq16
	Fast	Debug mode enabled. Cyclical data update is as fast as possible which increases CPU load on the drive.	1
50.13	FBA A control word	Shows raw (unmodified) control word sent by the master (PLC) to fieldbus adapter A if debugging is enabled by parameter 50.12 FBA A debug mode. This parameter is read-only.	0.0.0.0
	0.0.0.0.0... FF.FF.FF.FF	Control word sent by master to fieldbus adapter A.	-
50.14	FBA A reference 1	Displays raw (unmodified) reference REF1 sent by the master (PLC) to fieldbus adapter A if debugging is enabled by parameter 50.12 FBA A debug mode. This parameter is read-only.	0
	-2147483648… 2147483647	Raw REF1 sent by master to fieldbus adapter A.	0
50.15	FBA A reference 2	Not applicable.	
50.16	FBA A status word	Shows raw (unmodified) status word sent by fieldbus adapter A to the master (PLC) if debugging is enabled by parameter 50.12 FBA A debug mode. This parameter is read-only.	0.0.0.0
	0.0.0.0.0... FF.FF.FF.FF	Status word sent by fieldbus adapter A to master.	-
50.17	FBA A actual value 1	Shows raw (unmodified) actual value ACT1 sent by fieldbus adapter A to the master (PLC) if debugging is enabled by parameter 50.12 FBA A debug mode. This parameter is read-only.	0
	-2147483648… 2147483647	Raw ACT1 sent by fieldbus adapter A to master.	-

No.	Name/Value	Description	Def/ FbEq16
50.18	FBA A actual value 2	Not applicable	

51 FBA A settings		Fieldbus adapter A configuration.	
51.01	FBA A type	Shows type of the connected fieldbus adapter module. **0** = Module is not found or is not properly connected, or is disabled by parameter 50.01 FBA A enable. **0** = None **1** = PROFIBUS-DP **32** = CANopen **128 =** Ethernet **132** = PROFInet IO **135** = EtherCAT **485** = RS-485 comm **502** = Modbus/TCP **2222** = Ethernet/IP This parameter is read-only.	0
51.02	FBA A Par2	Parameters 51.02…51.26 are adapter module-specific. For more information, see the documentation of the fieldbus adapter module. Note that not all of these parameters are necessarily in use.	0
	0…65535	Fieldbus adapter configuration parameter.	1 = 1
…	…	…	…
51.26	FBA A Par26	See parameter 51.02 FBA A Par2.	0
	0…65535	Fieldbus adapter configuration parameter.	1 = 1
51.27	FBA A par refresh	Validates any changed fieldbus adapter module configuration settings. After refreshing, the value reverts automatically to Done. **Note:** This parameter cannot be changed while the drive is running.	Done
	Done	Refreshing done.	0
	Configure	Refreshing.	1
51.28	FBA A par table ver	Shows parameter table revision of the fieldbus adapter module mapping file (stored in the memory of the drive). In format axyz, where ax = major table revision number; yz = minor table revision number. This parameter is read-only.	0x0000
	0x0000...0xffff	Parameter table revision of adapter module.	-

No.	Name/Value	Description	Def/ FbEq16
51.29	FBA A drive type code	Shows drive type code in the fieldbus adapter module mapping file (stored in the memory of the drive). This parameter is read-only.	-
	0…65535	Drive type code stored in the mapping file.	1 = 1
51.30	FBA A mapping file ver	Shows fieldbus adapter module mapping file revision stored in the memory of the drive in decimal format. This parameter is read-only.	-
	0…65535	Mapping file revision.	1 = 1
51.31	D2FBA A comm status	Shows status of the fieldbus adapter module communication. **Note**: After the fieldbus adapter detects a communication loss, it will wait for a time delay before changing this communication status parameter to off-line. If this time delay exists for an FBA module, then it will be in module specific section. See parameters 51.02...51.26 for more information.	Not configured
	Not configured	Adapter is not configured.	0
	Initializing	Adapter is initializing.	1
	Time out	A timeout has occurred in the communication between the adapter and the drive.	2
	Configuration error	Adapter configuration error: mapping file not found in the file system of the drive, or mapping file upload has failed more than three times.	3
	Off-line	Fieldbus communication is off-line.	4
	On-line	Fieldbus communication is on-line, or fieldbus adapter has been configured not to detect a communication break. For more information, see the documentation of the fieldbus adapter.	5
	Reset	Adapter is performing a hardware reset.	6
51.32	FBA A comm SW ver	Shows common program revision of the adapter module in format axyz, where a = major revision number, xy = minor revision number, z = correction number or letter. Example: 190A = revision 1.90A.	0x0000
	0x0000...0xffff	Common program revision of adapter module.	-

No.	Name/Value	Description	Def/ FbEq16
51.33	FBA A appl SW ver	Shows application program revision of the adapter module in format axyz, where a = major revision number, xy = minor revision number, z = correction number or letter. Example: 190A = revision 1.90A.	0x0000
	0x0000...0xffff	Application program version of adapter module.	-

52 FBA A data in		Selection of data to be transferred from drive to fieldbus controller through fieldbus adapter A. **Note:** 32-bit values require two consecutive parameters. Whenever a 32-bit value is selected in a data parameter, the next parameter is automatically reserved.	
52.01	FBA A data in1	Parameters 52.01…52.12 select data to be transferred from the drive to the fieldbus controller through fieldbus adapter A.	None
	None	None.	0
	CW 16bit	Control Word (16 bits)	1
	Ref1 16bit	Reference REF1 (16 bits)	2
	Ref2 16bit	Reference REF2 (16 bits)	3
	SW 16bit	Status Word (16 bits)	4
	Act1 16bit	Actual value ACT1 (16 bits)	5
	Act2 16bit	Actual value ACT2 (16 bits)	6
	CW 32bit	Control Word (32 bits)	11
	Ref1 32bit	Reference REF1 (32 bits)	12
	Ref2 32bit	Reference REF2 (32 bits)	13
	SW 32bit	Status Word (32 bits)	14
	Act1 32bit	Actual value ACT1 (32 bits)	15
	Act2 32bit	Actual value ACT2 (32 bits)	16
	SW2 16bit	Status Word 2 (16 bits)	24

No.	Name/Value	Description	Def/ FbEq16
	Other	Source selection (see Terms and abbreviations on page 80).	-
…	…	…	…
52.12	FBA A data in12	See parameter 52.01 FBA A data in1.	None

53 FBA A data out		Selection of data to be transferred from fieldbus controller to drive through fieldbus adapter A. **Note:** 32-bit values require two consecutive parameters. Whenever a 32-bit value is selected in a data parameter, the next parameter is automatically reserved.	
53.01	FBA A data out1	Parameters 53.01…53.12 select data to be transferred from the fieldbus controller to the drive through fieldbus adapter A.	None
	None	None.	0
	CW 16bit	Control Word (16 bits)	1
	Ref1 16bit	Reference REF1 (16 bits)	2
	Ref2 16bit	Reference REF2 (16 bits)	3
	CW 32bit	Control Word (32 bits)	11
	Ref1 32bit	Reference REF1 (32 bits)	12
	Ref2 32bit	Reference REF2 (32 bits)	13
	CW2 16bit	Control Word 2 (16 bits)	21
	Other	Source selection (see Terms and abbreviations on page 80).	-
…	…	…	…
53.12	FBA A data out12	See parameter 53.01 FBA A data out1.	None

58 Embedded fieldbus		Configuration of the embedded fieldbus (EFB) interface. See also chapter Fieldbus control through the embedded fieldbus interface (EFB) (page 341).	
58.01	Protocol enable	Enables/disables the embedded fieldbus interface and selects the protocol to use. If you enable EFB with this parameter, panel port can also be used as EFB port. For more information, see section Change panel port to EFB port on page 73.	None
	None	None (communication disabled).	0
	Modbus RTU	Embedded fieldbus interface is enabled and uses the Modbus RTU protocol.	1

No.	Name/Value	Description	Def/ FbEq16
58.02	Protocol ID	Shows protocol ID and revision. This parameter is read-only.	-
		Protocol ID and revision.	1 = 1
58.03	Node address	Defines the node address of the drive on the fieldbus link. Values 1…247 are allowable. Two devices with the same address are not allowed on-line. Changes to this parameter take effect after the control unit is rebooted or the new settings validated by parameter 58.06 Communication control (Refresh settings).	1
	0…255	Node address (values 1…247 are allowed).	1 = 1
58.04	Baud rate	Selects the transfer rate of the fieldbus link. Changes to this parameter take effect after the control unit is rebooted or the new settings validated by parameter 58.06 Communication control (Refresh settings).	19.2 kbps
	Autodetect	Baud rate detected automatically	0
	4.8 kbps	4.8 kbit/s.	1
	9.6 kbps	9.6 kbit/s.	2
	19.2 kbps	19.2 kbit/s.	3
	38.4 kbps	38.4 kbit/s.	4
	57.6 kbps	57.6 kbit/s.	5
	76.8 kbps	76.8 kbit/s.	6
	115.2 kbps	115.2 kbit/s.	7
58.05	Parity	Selects the type of parity bit and number of stop bits. Changes to this parameter take effect after the control unit is rebooted or the new settings validated by parameter 58.06 Communication control (Refresh settings).	8 EVEN 1
	8 NONE 1	Eight data bits, no parity bit, one stop bit.	0
	8 NONE 2	Eight data bits, no parity bit, two stop bits.	1
	8 EVEN 1	Eight data bits, even parity bit, one stop bit.	2
	8 ODD 1	Eight data bits, odd parity bit, one stop bit.	3
58.06	Communication control	Takes changed EFB settings in use, or activates silent mode.	Enabled
	Enabled	Normal operation.	0

No.	Name/Value	Description	Def/ FbEq16
	Refresh settings	Refreshes settings (parameters 58.01…58.05, 58.14…58.17, 58.25, 58.28…58.34) and takes changed EFB configuration settings in use. Reverts automatically to Enabled.	1
	Silent mode	Activates silent mode (no messages are transmitted). Silent mode can be terminated by activating the Refresh settings selection of this parameter.	2
58.07	Communication diagnostics	Shows status of the EFB communication. This parameter is read-only. **Note**: Name is only visible when the error is present (bit value is 1).	0b0000

Bit	Name	Description
0	Init failed	1 = EFB initialization failed
1	Addr config err	1 = Node address not allowed by protocol
2	Silent mode	1 = Drive not allowed to transmit
		0 = Drive allowed to transmit
3	Reserved	
4	Wiring error	1 = Errors detected (A/B wires possibly swapped)
5	Parity error	1 = Error detected: check parameters 58.04 and 58.05
6	Baud rate error	1 = Error detected: check parameters 58.05 and 58.04
7	No bus activity	1 = 0 bytes received during last 5 seconds
8	No packets	1 = 0 packets (addressed to any device) detected during last 5 seconds
9	Noise or addressing error	1 = Errors detected (interference, or another device with the same address on line)
10	Comm loss	1 = 0 packets addressed to the drive received within timeout (58.16)
11	CW/Ref loss	1 = No control word or references received within timeout (58.16)
12	Not active	1 = Not active. EFB is not the active channel. Only used in redundant communication control.
13	Protocol 1	1 = Used for protocol-dependent statuses. See protocol documentation.
14	Protocol 2	See Bit 13.
15	Internal error	1 = One or more communication error has occurred between the drive and control system. The presence of this bit indicates that an invalid or unsupported request has been made. The presence of this bit does not prevent further communication or indicates an hardware issue.

	0000h…FFFFh	EFB communication status.	1 = 1

No.	Name/Value	Description	Def/ FbEq16
58.08	Received packets	Shows a count of valid packets addressed to the drive. During normal operation, this number increases constantly. Can be reset from the control panel by keeping Reset down for over 3 seconds.	-
	0…4294967295	Number of received packets addressed to the drive.	1 = 1
58.09	Transmitted packets	Shows a count of valid packets transmitted by the drive. During normal operation, this number increases constantly. Can be reset from the control panel by keeping Reset down for over 3 seconds.	-
	0…4294967295	Number of transmitted packets.	1 = 1
58.10	All packets	Shows a count of valid packets addressed to any device on the bus. During normal operation, this number increases constantly. Can be reset from the control panel by keeping Reset down for over 3 seconds.	-
	0…4294967295	Number of all received packets.	1 = 1
58.11	UART errors	Shows a count of character errors received by the drive. An increasing count indicates a configuration problem on the bus. Can be reset from the control panel by keeping Reset down for over 3 seconds.	-
	0…4294967295	Number of UART errors.	1 = 1
58.12	CRC errors	Shows a count of packets with a CRC error received by the drive. An increasing count indicates interference on the bus. Can be reset from the control panel by keeping Reset down for over 3 seconds.	-
	0…4294967295	Number of CRC errors.	1 = 1
58.14	Communication loss action	Selects how the drive reacts to an EFB communication break. Changes to this parameter take effect after the control unit is rebooted or the new settings validated by parameter 58.06 Communication control (Refresh settings). See also parameters 58.15 Communication loss mode and 58.16 Communication loss time.	No action
	No action	No action taken (monitoring disabled).	0

No.	Name/Value	Description	Def/ FbEq16
	Fault	The drive monitors communication loss when start/stop is expected from the EFB on the currently active control location. Drive trips on 6681 EFB comm loss if control in the currently active control location is expected from the EFB or reference is coming from the EFB, and the communication is lost.	1
	Fault always	Drive continuously monitors for communication loss. Drive trips on 6681 EFB comm loss. This happens even thought the drive is in a control location where the EFB start/stop or reference is not used.	4
	Warning	Drive generates an A7CE EFB comm loss warning. This occurs even though no control is expected from the EFB. ⚠ **WARNING!** Make sure that it is safe to continue operation in case of a communication break.	5
58.15	Communication loss mode	Defines which message types reset the timeout counter for detecting an EFB communication loss. Changes to this parameter take effect after the control unit is rebooted or the new settings validated by parameter 58.06 Communication control (Refresh settings). See also parameters 58.14 Communication loss action and 58.16 Communication loss time.	Any message
	Any message	Any message addressed to the drive resets the timeout.	1
	Cw / Ref1 / Ref2	A write of the control word or a reference resets the timeout.	2
58.16	Communication loss time	Sets a timeout for EFB communication. If a communication break lasts longer than the timeout, the action specified by parameter 58.14 Communication loss action is taken. Changes to this parameter take effect after the control unit is rebooted or the new settings validated by parameter 58.06 Communication control (Refresh settings). See also parameter 58.15 Communication loss mode.	60.0 s
	0.0…6000.0 s	EFB communication timeout.	1 = 1

<table>
<tr><th>No.</th><th>Name/Value</th><th>Description</th><th>Def/ FbEq16</th></tr>
<tr><td>58.17</td><td>Transmit delay</td><td>Defines a minimum response delay in addition to any fixed delay imposed by the protocol.
Changes to this parameter take effect after the control unit is rebooted or the new settings validated by parameter 58.06 Communication control (Refresh settings).</td><td>0 ms</td></tr>
<tr><td></td><td>0…65535 ms</td><td>Minimum response delay.</td><td>1 = 1</td></tr>
<tr><td>58.18</td><td>EFB control word</td><td>Shows raw (unmodified) status word sent by the drive to the Modbus controller. For debugging purposes.
This parameter is read-only.</td><td>-</td></tr>
<tr><td></td><td>0000h…FFFFh</td><td>Control word sent by Modbus controller to the drive.</td><td>1 = 1</td></tr>
<tr><td>58.19</td><td>EFB status word</td><td>Shows raw (unmodified) status word for debugging purposes.
This parameter is read-only.</td><td>-</td></tr>
<tr><td></td><td>0000h…FFFFh</td><td>Status word sent by the drive to the Modbus controller.</td><td>1 = 1</td></tr>
<tr><td>58.25</td><td>Control profile</td><td>Defines the communication profile used by the protocol.
Changes to this parameter take effect after the control unit is rebooted or the new settings validated by parameter 58.06 Communication control (Refresh settings).</td><td>ABB Drives</td></tr>
<tr><td></td><td>ABB Drives</td><td>ABB Drives control profile (with a 16-bit control word)</td><td>0</td></tr>
<tr><td></td><td>DCU Profile</td><td>DCU control profile (with a 16 or 32-bit control word)</td><td>5</td></tr>
<tr><td>58.26</td><td>EFB ref1 type</td><td>Selects the type and scaling of reference 1 received through the embedded fieldbus interface.
The scaled reference is displayed by 03.09 EFB reference 1.</td><td>Speed or frequency</td></tr>
<tr><td></td><td>Speed or frequency</td><td>Type and scaling is chosen automatically according to the currently active operation mode as follows.
<table>
<tr><th>Operation mode</th><th>Reference 1 type</th></tr>
<tr><td>Speed control</td><td>Speed</td></tr>
<tr><td>Frequency control</td><td>Frequency</td></tr>
</table></td><td>0</td></tr>
<tr><td></td><td>Transparent</td><td>No scaling is applied.</td><td>1</td></tr>
<tr><td></td><td>General</td><td>Generic reference without a specific unit. Scaling: 1 = 100.</td><td>2</td></tr>
</table>

<table>
<tr><th>No.</th><th>Name/Value</th><th>Description</th><th>Def/ FbEq16</th></tr>
<tr><td></td><td>Torque</td><td>Torque reference. The scaling is defined by parameter 46.03 Torque scaling.</td><td>3</td></tr>
<tr><td></td><td>Speed</td><td>Speed reference. The scaling is defined by parameter 46.01 Speed scaling.</td><td>4</td></tr>
<tr><td></td><td>Frequency</td><td>Frequency reference. The scaling is defined by parameter 46.02 Frequency scaling.</td><td>5</td></tr>
<tr><td>58.27</td><td>EFB ref2 type</td><td colspan="2">Not applicable.</td></tr>
<tr><td>58.28</td><td>EFB act1 type</td><td>Selects the type of actual value 1.</td><td>Speed or frequency</td></tr>
<tr><td></td><td>Speed or frequency</td><td>Type and scaling is chosen automatically according to the currently active operation mode as follows.
<table>
<tr><th>Motor control mode (see par. 99.04)</th><th>Actual 1 type</th></tr>
<tr><td>Speed control</td><td>Speed</td></tr>
<tr><td>Frequency control</td><td>Frequency</td></tr>
</table></td><td>0</td></tr>
<tr><td></td><td>Transparent</td><td>No scaling is applied.</td><td>1</td></tr>
<tr><td></td><td>General</td><td>Generic reference without a specific unit. Scaling: 1 = 100.</td><td>2</td></tr>
<tr><td></td><td>Torque</td><td>Scaling is defined by parameter 46.03 Torque scaling.</td><td>3</td></tr>
<tr><td></td><td>Speed</td><td>Scaling is defined by parameter 99.09 Motor nominal speed.</td><td>4</td></tr>
<tr><td></td><td>Frequency</td><td>Scaling is defined by parameter 99.08 Motor nominal frequency.</td><td>5</td></tr>
<tr><td>58.29</td><td>EFB act2 type</td><td colspan="2">Not applicable</td></tr>
<tr><td>58.31</td><td>EFB act1 transparent source</td><td>Selects the source of actual value 1 when parameter 58.28 EFB act1 type is set to Transparent.</td><td>Not selected</td></tr>
<tr><td></td><td>Not selected</td><td>None.</td><td>0</td></tr>
<tr><td></td><td>Other</td><td>Source selection (see Terms and abbreviations on page 80).</td><td>-</td></tr>
</table>

No.	Name/Value	Description	Def/ FbEq16
58.32	EFB act2 transparent source	Not applicable	
58.33	Addressing mode	Defines the mapping between parameters and holding registers in the 400101…465535 Modbus register range. Changes to this parameter take effect after the control unit is rebooted or the new settings validated by parameter 58.06 Communication control (Refresh settings).	Mode 0
	Mode 0	16-bit values (groups 1…99, indexes 1…99): Register address = 400000 + 100 × parameter group + parameter index. 32-bit values (groups 1…99, indexes 1…99): Register address = 420000 + 200 × parameter group + 2 × parameter index.	0
	Mode 1	16-bit values (groups 1…255, indexes 1…255): Register address = 400000 + 256 × parameter group + parameter index.	1
	Mode 2	32-bit values (groups 1…127, indexes 1…255): Register address = 400000 + 512 × parameter group + 2 × parameter index.	2
58.34	Word order	Selects in which order 16-bit registers of 32-bit parameters are transferred. For each register, the first byte contains the high order byte and the second byte contains the low order byte. Changes to this parameter take effect after the control unit is rebooted or the new settings validated by parameter 58.06 Communication control (Refresh settings).	LO-HI
	HI-LO	The first register contains the high order word, the second contains the low order word.	0
	LO-HI	The first register contains the low order word, the second contains the high order word.	1

No.	Name/Value	Description	Def/ FbEq16
58.101	Data I/O 1	Defines the address in the drive which the Modbus master accesses when it reads from or writes to the register address corresponding to Modbus register 1 (400001). The master defines the type of the data (input or output). The value is transmitted in a Modbus frame consisting of two 16-bit words. If the value is 16-bit, it is transmitted in the LSW (least significant word). If the value is 32-bit, the subsequent parameter is also reserved for it and must be set to None.	CW 16bit
	None	No mapping, register is always zero.	0
	CW 16bit	ABB Drives profile: 16-bit ABB drives control word; DCU Profile: lower 16 bits of the DCU control word	1
	Ref1 16bit	Reference REF1 (16 bits)	2
	Ref2 16bit	Reference REF2 (16 bits)	3
	SW 16bit	ABB Drives profile: 16-bit ABB drives status word; DCU Profile: lower 16 bits of the DCU status word	4
	Act1 16bit	Actual value ACT1 (16 bits)	5
	Act2 16bit	Actual value ACT2 (16 bits)	6
	Reserved		7…10
	CW 32bit	Control Word (32 bits)	11
	Ref1 32bit	Reference REF1 (32 bits)	12
	Ref2 32bit	Reference REF2 (32 bits)	13
	SW 32bit	Status Word (32 bits)	14
	Act1 32bit	Actual value ACT1 (32 bits)	15
	Act2 32bit	Actual value ACT2 (32 bits)	16
	Reserved		17…20
	CW2 16bit	ABB Drives profile: not used; DCU Profile: upper 16 bits of the DCU control word	21
	SW2 16bit	ABB Drives profile: not used / always zero; DCU Profile: upper 16 bits of the DCU status word	24
	Reserved		25…30
	RO/DIO control word	Parameter 10.99 RO/DIO control word.	31
	AO1 data storage	Parameter 13.91 AO1 data storage.	32
	AO2 data storage	Parameter 13.92 AO2 data storage.	33
	Reserved		34…39

No.	Name/Value	Description	Def/ FbEq16
	Feedback data storage	Parameter 40.91 Feedback data storage.	40
	Setpoint data storage	Parameter 40.92 Setpoint data storage.	41
	Other	Source selection (see Terms and abbreviations on page 80).	-
58.102	Data I/O 2	Defines the address in the drive which the Modbus master accesses when it reads from or writes to register address 400002. For the selections, see parameter 58.101 Data I/O 1.	Ref1 16bit
58.103	Data I/O 3	Defines the address in the drive which the Modbus master accesses when it reads from or writes to register address 400003. For the selections, see parameter 58.101 Data I/O 1.	Ref2 16bit
58.104	Data I/O 4	Defines the address in the drive which the Modbus master accesses when it reads from or writes to register address 400004. For the selections, see parameter 58.101 Data I/O 1.	SW 16bit
58.105	Data I/O 5	Defines the address in the drive which the Modbus master accesses when it reads from or writes to register address 400005. For the selections, see parameter 58.101 Data I/O 1.	Act1 16bit
58.106	Data I/O 6	Defines the address in the drive which the Modbus master accesses when it reads from or writes to register address 400006. For the selections, see parameter 58.101 Data I/O 1.	Act2 16bit
58.107	Data I/O 7	Parameter selector for Modbus register address 400007. For the selections, see parameter 58.101 Data I/O 1.	None
…	…	…	…
58.114	Data I/O 14	Parameter selector for Modbus register address 400014. For the selections, see parameter 58.101 Data I/O 1.	None

No.	Name/Value	Description	Def/ FbEq16
79 Solar pump control		Start/stop enable signal source selection; positive/negative reference enable signal source selection. See also chapter Solar pump control (page 44).	
79.01	Solar status word1	Solar status word 1. This parameter is read-only.	0b0000

Bit	Name	Description
0	Rdy ON	1 = Ready to switch on.
1	Ready run	1 = Operation enabled.
2	Running	1 = Drive is modulating.
3	Fault	1 = Drive in fault state.
4	Dry run	1 = Dry run detected.
5	DC over volt	1 = Excessive intermediate circuit DC voltage detected.
6	DC under volt	1 = Insufficient intermediate circuit DC voltage.
7	Minimum speed	1 = Minimum speed alarm active.
8	Short circuit	1 = Short circuit in motor cables or motor, or internal fault in the drive
9	Earth fault	earth (ground) fault in motor or motor cable.
10	Motor phase loss	1 = Motor phase missing. 0 = No motor circuit fault.
11	Supply phase loss	1 = Intermediate circuit DC voltage is oscillating due to missing input power line phase or blown fuse.
12	Motor stall	1 = Motor is operating in stall region due to excessive load or insufficient motor power.
13	Over current	1 = Output current exceeds trips level.
14	Ext fault1	1= External fault 1.
15	Long start delay active	1 = Long start delay alarm active.

	0b0000...0b1111	Solar status word 1.	1 = 1

<table>
<tr><th>No.</th><th>Name/Value</th><th>Description</th><th>Def/
FbEq16</th></tr>
<tr><td>79.02</td><td>Solar status word2</td><td>Solar status word 2.
This parameter is read-only.</td><td>0b0000</td></tr>
<tr><td></td><td colspan="3">
<table>
<tr><th>Bit</th><th>Name</th><th>Description</th></tr>
<tr><td>0</td><td>Ext fault2</td><td>1= External fault 2.</td></tr>
<tr><td>1</td><td>AI1 Supervision</td><td>1= Analog input AI1 signal is below the limit</td></tr>
<tr><td>2</td><td colspan="2">Reserved</td></tr>
<tr><td>3</td><td>Panel loss</td><td>1 = Control panel selected as active control location for drive has stopped communicating.</td></tr>
<tr><td>4</td><td>Device overtemp</td><td>1 = Excessive drive IGBT temperature.</td></tr>
<tr><td>5</td><td>ID run failed</td><td>1 = Motor ID run not completed successfully.</td></tr>
<tr><td>6</td><td>Output wiring</td><td>1 = Incorrect input power and motor cable connection.</td></tr>
<tr><td>7</td><td>Safe torque off</td><td>1 = STO is active.</td></tr>
<tr><td>8</td><td>Motor overtemp</td><td>1 = Motor temperature estimation is beyond the limit.</td></tr>
<tr><td>9</td><td>Start enable</td><td>1 = Start enable signal received.</td></tr>
<tr><td>10</td><td colspan="2">Reserved</td></tr>
<tr><td>11</td><td>Tank filling on</td><td>1 = Tank filling activated.</td></tr>
<tr><td>12</td><td>Cloud detected</td><td>1 = Cloud detection activated</td></tr>
<tr><td>13…15</td><td colspan="2">Reserved</td></tr>
</table>
</td></tr>
<tr><td></td><td>0b0000...0b1111</td><td>Solar status word 2.</td><td>1 = 1</td></tr>
<tr><td>79.10</td><td>Operating mode</td><td>Selects the start and stop control mode.</td><td>Manual In 1 Start; stop</td></tr>
<tr><td></td><td>Auto</td><td>Starts the drive automatically when the actual DC voltage is greater then the start DC bus voltage (79.41) and stops the drive automatically when the actual DC bus voltage is less than the PV cell minimum voltage (79.42).</td><td>0</td></tr>
<tr><td></td><td>Manual In 1 Start; stop</td><td>The source of the start and stop commands is selected by parameter 79.11 Manual input source 1. The state transitions of the source bits are interpreted as follows:
<table>
<tr><th>State of source 1 (79.11)</th><th>Command</th></tr>
<tr><td>0 -> 1
1</td><td>Start</td></tr>
<tr><td>0</td><td>Stop</td></tr>
</table>
</td><td>1</td></tr>
</table>

<table>
<tr><th>No.</th><th>Name/Value</th><th>Description</th><th>Def/ FbEq16</th></tr>
<tr><td></td><td>Manual In1P Start; In2 Stop</td><td>The sources of the start and stop commands are selected by parameters 79.11 Manual input source 1 and 79.12 Manual input source 2. The DI selected by 79.12 Manual input source 2 should be always On before you start the drive with pulse start command and during running condition.
The state transitions of the source bits are interpreted as follows:<table><tr><th>State of source 1 (79.11)</th><th>State of source 2 (79.12)</th><th>Command</th></tr><tr><td>0 -> 1</td><td>1</td><td>Start</td></tr><tr><td>Any</td><td>0</td><td>Stop</td></tr></table></td><td>2</td></tr>
<tr><td></td><td>Fieldbus A</td><td>The start and stop commands are taken from fieldbus adapter A.</td><td>4</td></tr>
<tr><td></td><td>Embedded fieldbus</td><td>The start and stop commands are taken from the embedded fieldbus interface.</td><td>5</td></tr>
<tr><td>79.11</td><td>Manual input source 1</td><td>Selects source 1 for the parameter 79.10 Operating mode.</td><td>DI1</td></tr>
<tr><td></td><td>Not selected</td><td>0 (always off).</td><td>0</td></tr>
<tr><td></td><td>Selected</td><td>1 (always on).</td><td>1</td></tr>
<tr><td></td><td>DI1</td><td>Digital input DI1 (10.02 DI delayed status, bit 0).</td><td>2</td></tr>
<tr><td></td><td>DI2</td><td>Digital input DI2 (10.02 DI delayed status, bit 1).</td><td>3</td></tr>
<tr><td></td><td>DI3</td><td>Digital input DI3 (10.02 DI delayed status, bit 2).</td><td>4</td></tr>
<tr><td></td><td>DI4</td><td>Digital input DI4 (10.02 DI delayed status, bit 3).</td><td>5</td></tr>
<tr><td></td><td>DI5</td><td>Digital input DI5 (10.02 DI delayed status, bit 4).</td><td>6</td></tr>
<tr><td></td><td>DI6</td><td>Digital input DI6 (10.02 DI delayed status, bit 5).</td><td>7</td></tr>
<tr><td></td><td>Timed function 1</td><td>Bit 0 of 34.01 Timed functions status (see page 166).</td><td>8</td></tr>
<tr><td></td><td>Timed function 2</td><td>Bit 1 of 34.01 Timed functions status (see page 166).</td><td>9</td></tr>
<tr><td></td><td>Timed function 3</td><td>Bit 2 of 34.01 Timed functions status (see page 166).</td><td>10</td></tr>
<tr><td></td><td>Other [bit]</td><td>Source selection (see Terms and abbreviations on page 80).</td><td>-</td></tr>
<tr><td>79.12</td><td>Manual input source 2</td><td>Selects source 2 for the parameter 79.10 Operating mode. See parameter 79.11 Manual input source 1.</td><td>DI2</td></tr>
</table>

No.	Name/Value	Description	Def/ FbEq16
79.15	Enable tank level operation	Selects the source for the tank level operation enable signal. 0 = Disabled. 1 = Enabled. **Notes**: • Works only with Manual In 1 Start; stop operating mode. See parameter 79.10 Operating mode. • Enables only when the drive is not in running mode.	Disable
	Disable	0 = Tank level sensor operation is disabled.	0
	Enable	1 = Tank level sensor operation is enabled.	1
	DI1	Digital input DI1 (10.02 DI delayed status, bit 0).	2
	DI2	Digital input DI2 (10.02 DI delayed status, bit 1).	3
	DI3	Digital input DI3 (10.02 DI delayed status, bit 2).	4
	DI4	Digital input DI4 (10.02 DI delayed status, bit 3).	5
	DI5	Digital input DI5 (10.02 DI delayed status, bit 4).	6
	DI6	Digital input DI6 (10.02 DI delayed status, bit 5).	7
	Other [bit]	Source selection (see Terms and abbreviations on page 80).	-
79.17	Tank low sensor	Selects the source for tank low level sensor enable signal. 0 = Not selected 1 = Selected.	DI5
	Not selected	0 (always off). Tank low level sensor is not activated.	0
	Selected	1 (always on). Tank low level sensor is activated.	1
	DI1	Digital input DI1 (10.02 DI delayed status, bit 0).	2
	DI2	Digital input DI2 (10.02 DI delayed status, bit 1).	3
	DI3	Digital input DI3 (10.02 DI delayed status, bit 2).	4
	DI4	Digital input DI4 (10.02 DI delayed status, bit 3).	5
	DI5	Digital input DI5 (10.02 DI delayed status, bit 4).	6
	DI6	Digital input DI6 (10.02 DI delayed status, bit 5).	7
	Other [bit]	Source selection (see Terms and abbreviations on page 80).	-
79.18	Tank high sensor	Selects the source for tank high level sensor enable signal. 0 = Not selected. 1 = Selected. See parameter 79.17 Tank low sensor.	DI6

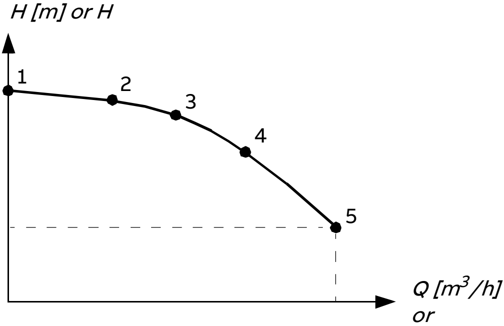
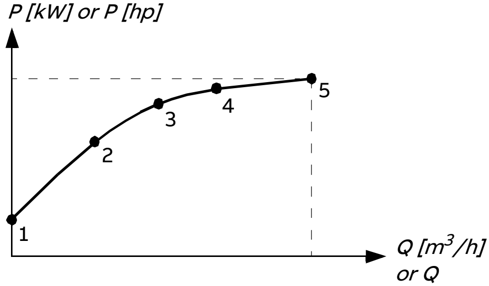
No.	Name/Value	Description	Def/ FbEq16
79.39	Pump start interlock	Selects the interlock source for pump start and stop. When the interlock is disabled, pump cannot be started in any operating modes and tank level sensor operation cannot function.	Enable
	Disable	0 = Pump start interlock is disabled.	0
	Enable	1 = Pump start interlock is enabled.	1
	DI1	Digital input DI1 (10.02 DI delayed status, bit 0).	2
	DI2	Digital input DI2 (10.02 DI delayed status, bit 1).	3
	DI3	Digital input DI3 (10.02 DI delayed status, bit 2).	4
	DI4	Digital input DI4 (10.02 DI delayed status, bit 3).	5
	DI5	Digital input DI5 (10.02 DI delayed status, bit 4).	6
	DI6	Digital input DI6 (10.02 DI delayed status, bit 5).	7
	Other [bit]	Source selection (see Terms and abbreviations on page 80).	-
79.41	Start DC voltage	Defines the minimum DC voltage for drive to start running the pump motor. The pump motor stops running if the voltage goes below this value. **Note:** If you change this value while the inverter is running, the changed value is effective only during the next start	225
	225...800 V	DC voltage.	1 = 1
79.42	PV cell min voltage	Defines the minimum DC voltage below which the drive turns off all the controls. **Note:** The drive stops operating below this voltage.	225
	225...800 V	DC voltage.	1 = 1
79.43	PV cell max voltage	Defines the maximum DC voltage. At any value above this voltage, the drive trips due to D4B1 PV max volt fault.	800
	225...800 V	DC voltage.	1 = 1

No.	Name/Value	Description	Def/ FbEq16
79.51	Pump minimum speed	Defines the minimum motor speed. At any value below this speed, the MPPT function is not active and drive stops functioning. The drive auto restarts after the time defined in 79.61 Fault reset time. This setting avoids unnecessary operation of pump at low speed. **Note:** Setting the value at 500 can helps to create suction in the pump.	500
	0...30000 rpm	Speed.	1 = 1
79.52	Pump maximum speed	Defines the maximum motor speed.	30000
	0...30000 rpm	Speed.	1 = 1
79.56	Boost voltage	Defines the DC voltage above which 79.57 Boost factor is effective. Below this value, motor speed follows the V/F factor.	450
	225...600 V	DC voltage.	1 = 1
79.57	Boost factor	Defines the factor at which the drive functions the best. This parameter is effective when DC voltage is above the value in the parameter 79.56 Boost factor.	1.00
	0.75...1.50	Boost factor.	100 = 1
79.61	Fault reset time	Allows drive to wait for this time to restart automatically when drive trips due to undervoltage fault, PV cell maximum voltage fault or when actual speed decreases below the minimum motor speed defined in the parameter 79.51 Pump minimum speed.	120.0
	1.0...1200.0 s	Time.	1 = 1

80 Flow calculation		Actual flow calculation. See section Flow calculation (page 45).	
80.01	Calculated flow	Shows the calculated flow rate of water in cubic meter per hour. This values are displayed when the parameter 80.13 Flow function is selected as PQ curve and is based on the correction factor defined in the parameter 79.51 Pump minimum speed.	0.00
	-200000.00... 200000.00 m^3/h	Flow.	100 = 1
80.02	Actual flow percentage	Shows the percentage of parameter 80.01 Calculated flow from 80.15 Maximum flow.	-
	-100.00… 100.00%	Flow percentage of maximum flow.	100 = 1%

No.	Name/Value	Description	Def/ FbEq16
80.03	Total flow	Shows cumulative calculated flow.	0.00
	0.00… 21474836.00 m^3	Total flow.	1 = 1
80.04	Specific energy	Shows the ratio of pump flow rate and power input.	0.00
	0.00…32767.95 m^3/kWh	Specific energy of the pump.	1 = 1 m^3/kWh
80.05	Estimated pump head	Shows the estimated head produced by the pump.	-
	0.00… 32767.00 m	Estimated pump head.	1 = 1 m
80.06	Today's flow	Shows the measured flow of current day in cubic meter. **Note:** You can reset this value using the parameter 80.29 Total flow reset.	0.00
	0.00… 21474836.00 m^3	Measured flow of the current day.	10 = 1
80.07	Sensored flow	Shows the flow rate based on the counts received from the sensors. This value is displayed when the parameter 80.13 Flow function is selected as DI based.	0
	0…2147483648	Measured flow rate.	1 = 1
80.11	Flow feedback 1 source	Selects the source for the flow feedback 1.	Not selected
	Not selected	Feedback not used.	0
	AI1 scaled	12.12 AI1 scaled value (see page 110).	1
	AI2 scaled	12.22 AI2 scaled value (see page 112).	2
	Freq in scaled	11.39 Freq in 1 scaled value (see page 107).	3
	AI1 percent	12.101 AI1 percent value (see page 114).	8
	AI2 percent	12.102 AI2 percent value (see page 114).	9
	Feedback data storage	40.91 Feedback data storage (see page 204).	10
	Other	Source selection (see Terms and abbreviations on page 80).	-
80.12	Flow feedback 2 source	Selects the source for the flow feedback 2.	Not selected
	Not selected	Feedback not used.	0
	AI1 scaled	12.12 AI1 scaled value (see page 110).	1
	AI2 scaled	12.22 AI2 scaled value (see page 112).	2
	Freq in scaled	11.39 Freq in 1 scaled value (see page 107).	3

No.	Name/Value	Description	Def/ FbEq16
	AI1 percent	12.101 AI1 percent value (see page 114).	8
	AI2 percent	12.102 AI2 percent value (see page 114).	9
	Feedback data storage	40.91 Feedback data storage (see page 204).	10
	Other	Source selection (see Terms and abbreviations on page 80).	-
80.13	Flow function	Selects a function between the flow feedback sources selected by parameters 80.11 Flow feedback 1 source and 80.12 Flow feedback 2 source. The result of the function (for any selection) is multiplied by parameter 80.14 Flow calc gain.	PQ curve
	In1	Use 80.11 Flow feedback 1 source directly as the flow value.	0
	In2	Use 80.12 Flow feedback 2 source directly as the flow value.	1
	Reserved		2…7
	sqrt(In1)	Flow is calculated as a square root of a differential pressure measurement: $k\sqrt{\Delta P}$ The differential pressure value is selected with 80.11 Flow feedback 1 source.	8
	sqrt(In1-In2)	Flow is calculated as a square root of two measured absolute pressure measurements: $k\sqrt{(P_1 - P_2)}$ The pressure measurement sources are selected with 80.11 Flow feedback 1 source and 80.12 Flow feedback 2 source.	9

No.	Name/Value	Description	Def/ FbEq16
	HQ curve	The HQ curve is used for flow calculation. You can configure pressure sensor settings with parameter group 81 Sensor settings. The figure below shows the HQ performance curve of the pump for the flow calculation function. 	100
	PQ curve	The PQ curve is used for flow calculation. You can configure pressure sensor settings with parameter group 81 Sensor settings. The figure below shows the PQ performance curve of the pump for the flow calculation function. 	101
	DI based	Uses DI5 inputs for flow calculation.	
80.14	Flow calc gain	Defines the flow calculation gain for possible calculation correction.	1.00
	-20000.00… 20000.00	Gain value.	100 = 1

No.	Name/Value	Description	Def/ FbEq16
80.15	Maximum flow	Defines the nominal maximum flow of the system. This value is used to calculate the actual flow percentage value so that the value 100% for 80.02 corresponds to the value of this parameter.	1000.00 m^3/h
	-200000.00… 200000.00 m^3/h	Limit for maximum flow protection.	1 = 1 m^3/h
80.16	Minimum flow	Defines the nominal minimum flow of the system.	1.00
	-200000.00... 200000.00 m^3/h	Limit for minimum flow protection.	1 = 1 m^3/h
80.17	Maximum flow protection	Selects the action for maximum flow protection function.	No action
	No action	Maximum flow protection is disabled.	0
	Warning	Drive generates warning D50C Maximum flow protection.	1
	Fault	Drive trips on fault D406 Maximum flow protection	2
80.18	Minimum flow protection	Selects the action for minimum flow protection function.	No action
	No action	Minimum flow protection is disabled.	0
	Warning	Drive generates warning D50D Minimum flow protection.	1
	Fault	Drive trips on fault D407 Minimum flow protection.	2
80.19	Flow check delay	Defines the time after motor start when the flow protection is active.	5.00 s
	0.00...3600.00 s	Flow check delay.	1 = 1 s
80.22	Pump inlet diameter	Defines the nominal speed of pump. This value is used for flow calculation (80.01).	0
	0.010... 32767.000 m	Pump inlet pipe diameter.	1 = 1 m
80.23	Pump outlet diameter	Defines the pump outlet pipe diameter.	0.100 m
	0.010... 32767.000 m	Pump outlet pipe diameter.	1 = 1 m
80.26	Calc low speed	Defines the minimum speed/frequency limit below which flow is not calculated.	5.00
	0.00... 32767.00 Hz	Minimum speed/frequency limit for flow calculation.	1 = 1

No.	Name/Value	Description	Def/ FbEq16
80.28	Density	Defines the density of the fluid to be pumped for the flow calculation function.	1000.00 kg/m^3
	0.00… 32767.00 kg/m^3	Fluid density.	1 = 1 kg/m^3
80.29	Total flow reset	Resets the measured flow data of actual signals to zero in the parameters 80.06 Today’s flow and 80.03 Total flow.	Not selected
	Not selected	Disables the flow reset.	0
	Reset	Activates the flow reset.	1
80.40	HQ curve H1	Defines the head at point 1 of the HQ performance curve.	0.00 m
	0.00… 32767.00 m	Head at point 1 of the HQ curve.	1 = 1 m
80.41	HQ curve H2	Defines the head at point 2 of the HQ performance curve. See parameter 80.40 HQ curve H1 (page 236).	0.00 m
80.42	HQ curve H3	Defines the head at point 3 of the HQ performance curve. See parameter 80.40 HQ curve H1 (page 236).	0.00 m
80.43	HQ curve H4	Defines the head at point 4 of the HQ performance curve. See parameter 80.40 HQ curve H1 (page 236).	0.00 m
80.44	HQ curve H5	Defines the head at point 5 of the HQ performance curve. See parameter 80.40 HQ curve H1 (page 236).	0.00 m
80.50	PQ curve P1	Defines the power input of pump at point 1 on the PQ performance curve. See section Flow calculation (page45).	0.00
	0.00… 32767.00 kW	Power input of pump at point 1.	
80.51	PQ curve P2	Defines the power input of pump at point 2 on the PQ performance curve. See parameter 80.50 PQ curve P2.	0.00
80.52	PQ curve P3	Defines the power input of pump at point 3 on the PQ performance curve. See parameter 80.50 PQ curve P2.	0.00
80.53	PQ curve P4	Defines the power input of pump at point 4 on the PQ performance curve. See parameter 80.50 PQ curve P2.	0.00
80.54	PQ curve P5	Defines the power input of pump at point 5 on the PQ performance curve. See parameter 80.50 PQ curve P2.	0.00

No.	Name/Value	Description	Def/ FbEq16
80.60	Q value Q1	Defines the flow rate at point 1 on the PQ performance curve. See section Flow calculation (page45).	0.00
	0.00… 200000.00 m^3/h	Flow rate at point 1 of the PQ curve.	1 = 1
80.61	Q value Q2	Defines the flow rate at point 2 on the PQ performance curve. See parameter 80.60 Q value Q1.	0.00
80.62	Q value Q3	Defines the flow rate at point 3 on the PQ performance curve. See parameter 80.60 Q value Q1.	0.00
80.63	Q value Q4	Defines the flow rate at point 4 on the PQ performance curve. See parameter 80.60 Q value Q1.	0.00
80.64	Q value Q5	Defines the flow rate at point 5 on the PQ performance curve. See parameter 80.60 Q value Q1.	0.00

81 Sensor settings		Sensor settings for inlet and outlet pressure protection function.	
81.01	Actual inlet pressure	Shows the actual inlet pressure. **Note:** By default the parameter unit will be bar. However, the unit can be changed according to the parameter 81.20 Pressure unit.	-
	0.00… 32767.00 bar	Actual inlet pressure.	1 = 1 bar
81.02	Actual outlet pressure	Shows the actual outlet pressure.	-
	0.00… 32767.00 bar	Actual outlet pressure.	1 = 1 bar
81.10	Inlet pressure source	Selects the primary source used for pump inlet pressure measurement.	Not selected
	Not selected	None.	0
	AI1 scaled	Parameter 12.12 AI1 scaled value.	1
	AI2 scaled	Parameter 12.22 AI2 scaled value.	2
	Freq in scaled	Parameter 11.39 Freq in 1 scaled value.	3
	AI1 percent	Parameter 12.101 AI1 percent value.	8
	AI2 percent	Parameter 12.102 AI2 percent value.	9
	Feedback data storage	Parameter 40.91 Feedback data storage.	10

No.	Name/Value	Description	Def/ FbEq16
	Other	Source selection (see Terms and abbreviations on page 80).	-
81.11	Outlet pressure source	Selects the primary source used for pump outlet pressure measurement.	Not selected
	Not selected	None.	0
	AI1 scaled	Parameter 12.12 AI1 scaled value.	1
	AI2 scaled	Parameter 12.22 AI2 scaled value.	2
	Freq in scaled	Parameter 11.39 Freq in 1 scaled value.	3
	AI1 percent	Parameter 12.101 AI1 percent value.	8
	AI2 percent	Parameter 12.102 AI2 percent value.	9
	Feedback data storage	Parameter 40.91 Feedback data storage.	10
	Other	Source selection (see Terms and abbreviations on page 80).	-
81.12	Sensors height difference	Defines the height difference between inlet and outlet pressure sensors for flow calculation.	0.00 m
	0.00… 32767.00 m	Sensors height difference.	1 = 1 m
81.20	Pressure unit	Selects the unit of pressure.	bar
	bar	Pressure.	0
	kPa	Kilo pascal.	1
	psi	Pound per square inch.	2
	Pa	Pascal.	3
81.21	Flow unit	Selects the unit of flow. The selection affects total flow and specific energy units.	m3/h
	m^3/h	Cubic meter per hour.	0
	l/s	Liters per second.	1
	gpm	US gallon per minute.	2
81.22	Length unit	Selects the unit of estimated head points, sensors height difference and pump inlet/outlet diameters.	meters
	centimeters	Length unit in centimeter.	69
	meters	Length unit in meter.	72
	Inches	Length unit in inch.	73
	feet	Length unit in feet.	27
81.23	Density unit	Selects the unit of density.	kg/m3
	kg/m^3	Kilograms per cubic meter.	0
	kg/l	Kilograms per liter.	1

No.	Name/Value	Description	Def/ FbEq16
	lb/gal	Pounds per US gallon.	2

82 Pump protections		Settings for pup dry run protection. See section Dry run protection (page 51).	
82.02	Dry run source	Selects the source for dry run protection.	Min load current
	Not selected	0 (always off).	0
	Selected	1 (always on).	1
	DI1	Digital input DI1 (10.02 DI delayed status, bit 0).	2
	DI2	Digital input DI2 (10.02 DI delayed status, bit 1).	3
	DI3	Digital input DI3 (10.02 DI delayed status, bit 2).	4
	DI4	Digital input DI4 (10.02 DI delayed status, bit 3).	5
	DI5	Digital input DI5 (10.02 DI delayed status, bit 4).	6
	DI6	Digital input DI6 (10.02 DI delayed status, bit 5).	7
	Min load current	Enables the dry run protection when the actual load is below the dry run current limit.	8
	Other [bit]	Source selection (see Terms and abbreviations on page 80).	-
82.30	Outlet minimum pressure protection	Enables outlet minimum pressure protection function.	Disabled
	Disabled	Outlet minimum pressure protection function is disabled.	0
	Warning	Outlet minimum pressure protection function generates warning D50E Outlet minimum pressure when the outlet minimum pressure is below the level defined with parameter 82.31 Outlet minimum pressure warning level for a time set in 82.45 Pressure check delay.	1
	Fault	Outlet minimum pressure protection function generates fault D50E Outlet minimum pressure when the outlet minimum pressure is below the level defined with parameter 82.32 Outlet minimum pressure fault level for a time set in parameter 82.45 Pressure check delay.	2

No.	Name/Value	Description	Def/ FbEq16
	Warning/Fault	Outlet minimum pressure protection function first generates a warning when the pressure is below the level defined with parameter 82.31 Outlet minimum pressure warning level for a time set in parameter 82.45 Pressure check delay. If the pressure continues to fall below the level defined with parameter 82.32 Outlet minimum pressure fault level, outlet minimum pressure fault is generated.	3
82.31	Outlet minimum pressure warning level	Defines the level at which drive should generate the outlet minimum pressure warning.	0.00 bar
	0.00… 32767.00 bar	Outlet minimum pressure warning level.	1 = 1 bar
82.32	Outlet minimum pressure fault level	Defines the level at which drive should generate the outlet minimum pressure fault.	0.00 bar
	0.00… 32767.00 bar	Outlet minimum pressure fault level.	1 = 1 bar
82.35	Outlet maximum pressure protection	Enables outlet maximum pressure protection function.	Disabled
	Disabled	Outlet maximum pressure protection is disabled.	0
	Warning	Outlet maximum pressure protection function generates warning D50F Outlet maximum pressure when the pressure is above the level defined with parameter 82.37 Outlet maximum pressure warning level for a time set in parameter 82.45 Pressure check delay.	1
	Fault	Outlet maximum pressure protection function generates fault D409 Outlet maximum pressure when the pressure is above the level defined with parameter 82.38 Outlet maximum pressure fault level for a time set in parameter 82.45 Pressure check delay.	2
	Warning/Fault	Outlet maximum pressure protection function first generates a warning when the pressure is above the level defined with parameter 82.37 Outlet maximum pressure warning level for a time set in parameter 82.45 Pressure check delay. If the pressure raises above the level defined with parameter 82.38 Outlet maximum pressure fault level, outlet maximum pressure fault is generated.	3

No.	Name/Value	Description	Def/ FbEq16
82.37	Outlet maximum pressure warning level	Defines the level at which drive should generate the outlet maximum pressure warning.	0.00 bar
	0.00… 32767.00 bar	Outlet maximum pressure warning level.	1 = 1 bar
82.38	Outlet maximum pressure fault level	Defines the level at which drive should generate the outlet maximum pressure fault.	0.00 bar
	0.00… 32767.00 bar	Outlet maximum pressure fault level.	1 = 1 bar
82.40	Inlet minimum pressure protection	Enables inlet minimum pressure protection function.	Disabled
	Disabled	Inlet minimum pressure protection is disabled.	0
	Warning	Inlet minimum pressure protection function generates warning D510 Inlet minimum pressure when the pressure is below the level defined with parameter 82.41 Inlet minimum pressure warning level for a time set in 82.45 Pressure check delay.	1
	Fault	Inlet minimum pressure protection function generates fault D40A Inlet minimum pressure when the pressure is below the level defined with parameter 82.42 Inlet minimum pressure fault level for a time set in 82.45 Pressure check delay.	2
	Warning/Fault	Inlet minimum pressure protection function first generates a warning when the pressure is below the level defined with parameter 82.41 Inlet minimum pressure warning level for a time set in 82.45 Pressure check delay. If the pressure continues to fall below the level defined with parameter 82.42 Inlet minimum pressure fault level, a fault is generated.	3
82.41	Inlet minimum pressure warning level	Defines the level at which drive should generate the inlet minimum pressure warning.	0.00 bar
	0.00… 32767.00 bar	Inlet minimum pressure warning level.	1 = 1 bar
82.42	Inlet minimum pressure fault level	Defines the level at which drive should generate the inlet minimum pressure fault.	0.00 bar
	0.00… 32767.00 bar	Inlet minimum pressure fault level.	1 = 1 bar

No.	Name/Value	Description	Def/ FbEq16
82.45	Pressure check delay	Defines the delay time at which the pressure supervisions are inactive. You can adjust check delay for a system in which the pressure does not increase immediately after starting the motor.	3.00 s
	0.00…3600.00 s	Pressure check delay time.	1 = 1 s
82.46	Dry run current limit	Defines the dry run current limit. When the actual current goes below the dry run current limit for a defined time (82.47), the drive considers it as a dry run condition and trips on the fault, D4B0 Running dry. **Note:** This parameter is not applicable, if the parameter 82.02 Dry run source selection is set to DI.	0.00 A
	0.00…3000.00 A	Current limit.	100 = 1
82.47	Dry run trip monitor time	Defines the time to monitor dry run current limit. After the defined time elapses, the drive considers it as dry run condition and trips on the fault, D4B0 Running dry. **Note:** This parameter is not applicable, if the parameter 82.02 Dry run source is DI.	120.0
	1.0…300.0 s	Run trip monitor time.	10 = 1
82.48	Dry run reset time	Defines the rest time to reset the dry run fault (D4B0). The drive starts automatically if it receives a start command.	120.0
	1.0…18000.0 s	Dry run reset time.	10 = 1

83 Pump cleaning		Settings for the pump cleaning sequence. See section Pump cleaning (page 47).	
83.01	Pump cleaning status	Displays the status of pump cleaning.	Disabled
	Disabled	Pump cleaning is disabled.	0
	Clean pump	Pump cleaning is active.	1
	No triggers configured	Pump cleaning is not active.	2
	Waiting for triggering	Waiting for triggering signal.	3
83.02	Pump cleaning progress	Displays the pump cleaning progress.	0
	0.0…100.0%	Percentage	10 = 1

<table>
<tr><th>No.</th><th>Name/Value</th><th>Description</th><th>Def/
FbEq16</th></tr>
<tr><td>83.03</td><td>Total cleaning count</td><td>Displays the cleaning count. Cleaning count increments by one, when the sequence of cleaning cycles are completed.
For example, if 83.16 Cycles in cleaning program is set as 3, the pump cleaning completes after three cycles of reverse and forward motions of the pump and the cleaning count changes to 1.</td><td>0</td></tr>
<tr><td></td><td>0…
42994967000</td><td>Total cleaning count.</td><td>1 = 1</td></tr>
<tr><td>83.10</td><td>Pump cleaning action</td><td>Enables the pump cleaning action.</td><td>Cleaning</td></tr>
<tr><td></td><td>Off</td><td>Pump cleaning is disabled.</td><td>0</td></tr>
<tr><td></td><td>Cleaning</td><td>Pump cleaning is started based on triggers.</td><td>1</td></tr>
<tr><td></td><td>Warning only</td><td>Generates D507 Pump cleaning needed warning message based on triggers.</td><td>2</td></tr>
<tr><td>83.11</td><td>Pump cleaning triggers</td><td>Enables/disables the pump cleaning sequence for the drive, and defines the triggering conditions.
Note: If DI1 remains On after cleaning is finished, no cleaning sequence is started. The drive starts cleaning on next start, if the trigger signal is On when motor is started.</td><td>0b0000</td></tr>
<tr><td></td><td colspan="3">
<table>
<tr><th>Bit</th><th>Name</th><th>Description</th></tr>
<tr><td>0</td><td colspan="2">Reserved</td></tr>
<tr><td>1</td><td>Every start</td><td>Cleaning starts at every start.</td></tr>
<tr><td>2</td><td>Every stop</td><td>Cleaning starts at every stop.</td></tr>
<tr><td>3...5</td><td colspan="2">Reserved</td></tr>
<tr><td>6</td><td>Fixed time interval</td><td>Time interval defined by parameter 83.15 Fixed time interval.</td></tr>
<tr><td>7</td><td>Combined timer1</td><td>Combined timer 1 of timed functions starts cleaning.</td></tr>
<tr><td>8…9</td><td colspan="2">Reserved</td></tr>
<tr><td>10</td><td>Supervision 1</td><td>Cleaning sequence starts when Supervision 1 is high.</td></tr>
<tr><td>11</td><td>Supervision 2</td><td>Cleaning sequence starts when Supervision 2 is high.</td></tr>
<tr><td>12</td><td>Supervision 3</td><td>Cleaning sequence starts when Supervision 3 is high.</td></tr>
<tr><td>13</td><td>DI4</td><td>Cleaning sequence starts when DI4 is high.</td></tr>
<tr><td>14</td><td>DI5</td><td>Cleaning sequence starts when DI5 is high.</td></tr>
<tr><td>15</td><td>DI6</td><td>Cleaning sequence starts when DI6 is high.</td></tr>
</table>
</td></tr>
<tr><td></td><td>0000h…FFFFh</td><td>Pump cleaning triggers,</td><td>1 = 1</td></tr>
</table>

No.	Name/Value	Description	Def/ FbEq16
83.12	Start pump cleaning	Enables/disables the pump cleaning.	Not active
	Not active	Pump cleaning is not active.	0
	Start cleaning now	Starts pump cleaning immediately.	1
	DI4	Starts pump cleaning when DI4 goes high.	2
	DI5	Starts pump cleaning when DI5 goes high.	3
	DI6	Starts pump cleaning when DI6 goes high.	4
	Other [bit]	Source selection (see Terms and abbreviations on page 80).	-
83.15	Fixed time interval	Defines the constant time interval between cleaning cycles. **Note**: This parameter is used only when cleaning is triggered by time interval.	02 00:00
	00 00:00… 45:12:15	Time interval in format DD HH:MM (day hour:min).	-
83.16	Cycles in cleaning program	Defines the number of cycles performed in cleaning program. For example, 1 cycle = 1 forward + 1 reverse step.	3
	1...65535	Value range	
83.20	Cleaning speed step	Defines the speed/frequency step size in pump cleaning. Cleaning speed step is same for positive and negative directions. **Note:** If you have disabled the negative rotation direction by speed limits, the pump cleaning does not operate in the negative direction.	2400
	0...3000 rpm	Cleaning speed/frequency value.	1 = 1 rpm
83.25	Time to cleaning speed	Defines the time required for the drive to reach cleaning speed set by parameter 83.20 Cleaning speed step.	3.000
	0.000...60.000 s	Time	1 = 1s
83.26	Time to zero-speed	Defines the time required for the drive to reach zero speed from the cleaning speed set by parameter 83.20 Cleaning speed step.	3.000
	0.000...60.000 s	Time	1 = 1s
83.27	Cleaning on time	Defines the pump cleaning time in a cycle when the drive is running at cleaning speed set by 83.20 Cleaning speed step.	10.000
	0.000... 1000.000 s	Time	1 = 1s

No.	Name/Value	Description	Def/ FbEq16
83.28	Cleaning off time	Defines the cleaning off time when the drive stays at zero speed between positive and negative pulses and after one cleaning cycle before starting a new cleaning cycle.	5.000
	0.000… 1000.000 s	Time	1 = 1s
83.35	Cleaning count fault	Activates the cleaning count monitoring, and selects the action it takes if it detects too many cleaning starts within the time defined by parameter 83.36 Cleaning count time. See section Cleaning count monitoring (page 50).	No action
	No action	No action.	0
	Warning	Warning.	1
	Fault	Fault.	2
83.36	Cleaning count time	Defines the time for cleaning count monitoring. See section Cleaning count monitoring (page 50).	00 01:00
	00 00:00… 45:12:15	Time.	-
83.37	Maximum cleaning count	Defines the maximum cleaning counts allowed. See section Cleaning count monitoring (page 50).	5
	0…30	Maximum cleaning counts.	1 = 1
83.41	Pump cleaning time 1	Defines the user defined pump cleaning time 1 at which the pump cleaning starts automatically.	00:00:00
	00:00:00… 23:59:59	Pump cleaning time.	1 = 1
83.42	Pump cleaning time 2	Defines the user defined pump cleaning time 2 at which the pump cleaning starts automatically.	00:00:00
	00:00:00… 23:59:59	Pump cleaning time.	1 = 1
83.43	Pump cleaning time 3	Defines the user defined pump cleaning time 3 at which the pump cleaning starts automatically.	00:00:00
	00:00:00… 23:59:59	Pump cleaning time.	1 = 1
83.44	Pump cleaning time 4	Defines the user defined pump cleaning time 4 at which the pump cleaning starts automatically.	00:00:00
	00:00:00… 23:59:59	Pump cleaning time.	1 = 1
83.45	Pump cleaning time 5	Defines the user defined pump cleaning time 5 at which the pump cleaning starts automatically.	00:00:00
	00:00:00… 23:59:59	Pump cleaning time.	1 = 1

No.	Name/Value	Description	Def/ FbEq16
95 HW configuration		Various hardware-related settings.	
95.01	Supply voltage	Selects the supply voltage range. This parameter is used by the drive to determine the nominal voltage of the supply network. The parameter also affects the current ratings and the DC voltage control functions of the drive. ⚠ **WARNING!** An incorrect setting may cause the motor to rush uncontrollably. **Note:** The selections shown depend on the hardware of the drive. If only one voltage range is valid for the drive in question, it is selected by default.	Automatic / not selected
	Automatic / not selected	No voltage range selected. The drive will not start modulating before a range is selected, unless parameter 95.02 Adaptive voltage limits is set to Enable, in which case the drive estimates the supply voltage itself.	0
	380…415 V	380…415 V	2
95.02	Adaptive voltage limits	Enables adaptive voltage limits. Adaptive voltage limits can be used if, for example, an IGBT supply unit is used to raise the DC voltage level. If the communication between the inverter and IGBT supply unit is active, the voltage limits are related to the DC voltage reference from the IGBT supply unit. Otherwise the limits are calculated based on the measured DC voltage at the end of the pre-charging sequence. This function is also useful if the AC supply voltage to the drive is high, as the warning levels are raised accordingly.	Enable
	Disable	Adaptive voltage limits disabled.	0
	Enable	Adaptive voltage limits enabled.	1
95.03	Estimated AC supply voltage	AC supply voltage estimated by calculation. Estimation is done every time the drive is powered up and is based on the rise speed of voltage level of the DC bus while the drive charges the DC bus.	0
	0…65535 V	Voltage.	10 = 1 V
95.04	Control board supply	Specifies how the control board of the drive is powered.	Internal 24V
	Internal 24V	The drive control board is powered from the drive power unit it is connected to.	0

No.	Name/Value	Description	Def/ FbEq16
	External 24V	The drive control board is powered from an external power supply.	1
95.15	Special HW settings	Contains hardware-related settings that can be enabled and disabled by toggling the specific bits. **Note:** The installation of the hardware specified by this parameter may require derating of drive output, or impose other limitations. Refer to the hardware manual of the drive.	0b0000

Bit	Name	Information
0	Reserved	
1	ABB Sine filter	1 = An ABB sine filter is connected to the output of the drive.
2…15	Reserved	

	0b0000…0b1111	Hardware options configuration word.	1 = 1
95.20	HW options word 1	Specifies hardware-related options that require differentiated parameter defaults. This parameter is not affected by a parameter restore.	0b0000

Bit	Name	Value
0	Supply frequency 60 Hz	If you change the value of this bit, you have to do a complete reset to the drive after the change. After reset you have to reselect the macro to be used. See section Differences in the default values between 50 Hz and 60 Hz supply frequency settings on page 272. 0 = 50 Hz. 1 = 60 Hz.
1…12	Reserved	
13	du/dt filter activation	When active, an external du/dt filter is connected to the drive/inverter output. The setting will limit the output switching frequency, and force the fan of the drive/inverter module to full speed. 0 = du/dt filter inactive. 1 = du/dt filter active.
14…15	Reserved	

	0b0000…0b1111	Hardware options configuration word.	1 = 1

No.	Name/Value	Description	Def/ FbEq16
95.26	Motor disconnect switch	Enables the use of the motor disconnect switch. When enabled, the drive does not trip to a fault when it detects the disconnection but remains operational and returns to normal operation after a reconnection. When this parameter is enabled, the drive will go through the following sequence: 1. Motor is disconnected: Drive detects the disconnection and indicates it with warning A784. The drive remains in operation and waits for motor reconnection. 2. Motor is reconnected: Drive detects the reconnection, removes the warning and returns to normal operation. The last active reference before the disconnection is in use. **Note:** This feature is only available in scalar mode. This parameter does not affect vector mode behavior.	Disable
	Disable	Motor disconnect switch disabled.	0
	Enable	Motor disconnect switch enabled.	1
95.200	Cooling fan mode	Selects the fan control type. The fan control functionality enables heat dissipation from the drive and avoids dust accumulation in the drive.	Auto
	Auto	Controls the fan automatically according to the temperature changes of the drive.	0
	Always on	Fan runs continuously with the maximum speed (50Hz).	1

96 System		Language selection; access levels; macro selection; parameter save and restore; control unit reboot; user parameter sets; unit selection.	
96.01	Language	Selects the language of the parameter interface and other displayed information when viewed on the control panel. **Notes**: • Not all languages listed below are necessarily supported. • This parameter does not affect the languages visible in the Drive composer PC tool. (Those are specified under **View – Settings – Drive default language**.)	Not selected
	Not selected	None.	0
	English	English.	1033
	Italiano	Italian.	1040

No.	Name/Value	Description	Def/ FbEq16
	Español	Spanish.	3082
	Portugues	Portuguese.	2070
	Français	French.	1036
	Chinese (Simplified, PRC)	Simplified Chinese.	2052
96.02	Pass code	Pass codes can be entered into this parameter to activate further access levels (see parameter 96.03 Access level status) or to configure the user lock. Entering “358” toggles the parameter lock, which prevents the changing of all other parameters through the control panel or the Drive composer PC tool. Entering the user pass code (by default, “10000000”) enables parameters 96.100…96.102, which can be used to define a new user pass code and to select the actions that are to be prevented. Entering an invalid pass code will close the user lock if open, ie. hide parameters 96.100…96.102. After entering the code, check that the parameters are in fact hidden. **Note:** You must change the default user pass code to maintain a high level of cybersecurity. Store the code in a safe place – the protection cannot be disabled even by ABB if the code is lost. See also section User lock (page 69).	0
	0…99999999	Pass code.	-
96.03	Access level status	Shows which access levels have been activated by pass codes entered into parameter 96.02 Pass code.	0b0000
	0b0000...0b1111		1=1

<table>
<tr><th>No.</th><th>Name/Value</th><th>Description</th><th>Def/
FbEq16</th></tr>
<tr><td></td><td colspan="3">
<table>
<tr><th>Bit</th><th>Name</th></tr>
<tr><td>0</td><td>End user</td></tr>
<tr><td>1</td><td>Service</td></tr>
<tr><td>2…9</td><td>Reserved</td></tr>
<tr><td>10</td><td>Override parameter lock</td></tr>
<tr><td>11</td><td>OEM access level 1</td></tr>
<tr><td>12</td><td>OEM access level 2</td></tr>
<tr><td>13</td><td>OEM access level 3</td></tr>
<tr><td>14</td><td>Parameter lock</td></tr>
<tr><td>15</td><td>Reserved</td></tr>
</table>
</td></tr>
<tr><td></td><td>0b0000…
0b1111</td><td>Active access levels.</td><td>-</td></tr>
<tr><td>96.04</td><td>Macro select</td><td>Selects the control macro. See chapter Control macros (page 75) for more information.
After a selection is made, the parameter reverts automatically to Done.</td><td>Done</td></tr>
<tr><td></td><td>Done</td><td>Macro selection complete; normal operation.</td><td>0</td></tr>
<tr><td></td><td>ABB standard</td><td>Factory macro (see page 76). For scalar motor control.</td><td>1</td></tr>
<tr><td></td><td>PID</td><td>PID macro (see page 77).</td><td>14</td></tr>
<tr><td>96.05</td><td>Macro active</td><td>Shows which control macro is currently selected. See chapter Control macros (page 75) for more information.
To change the macro, use parameter 96.04 Macro select.</td><td>ABB standard</td></tr>
<tr><td></td><td>ABB standard</td><td>Factory macro (see page 76). For scalar motor control.</td><td>1</td></tr>
<tr><td></td><td>PID</td><td>PID macro (see page 77).</td><td>14</td></tr>
<tr><td>96.06</td><td>Parameter restore</td><td>Restores the original settings of the control program, ie. parameter default values.
Note: This parameter cannot be changed while the drive is running.</td><td>Done</td></tr>
<tr><td></td><td>Done</td><td>Restoring is completed.</td><td>0</td></tr>
<tr><td></td><td>Reset motor data</td><td>Restore all motor rating ID run results to default values</td><td>2</td></tr>
</table>

No.	Name/Value	Description	Def/ FbEq16
	Restore defaults	Restores all editable parameter values to default values, except • motor data and ID run results • I/O extension module settings • end user texts, such as customized warnings and faults, and the drive name • control panel/PC communication settings • fieldbus adapter settings • control macro selection and the parameter defaults implemented by it • parameter 95.20 HW options word 1 and the differentiated defaults implemented by it.	8
	Reset all fieldbus settings	Restores all fieldbus and communication related settings to default values. **Note:** Fieldbus, control panel and PC tool communication are interrupted during the restore.	32
	Clear all	Restores all editable parameter values to default values, except • end user texts, such as customized warnings and faults, and the drive name • control macro selection and the parameter defaults implemented by it • parameter 95.20 HW options word 1 and the differentiated defaults implemented by it • group 49 Panel port communication parameters.	62
	Reset home view	Restores the home view layout back to show the values of the default parameters defined by the control macro in use	512
	Reset end user texts	Restores all end user texts to default values, including the drive name, contact info, customized fault and warning texts, PID unit and currency unit.	1024
	All to factory defaults	Restores settings and all editable parameters back to initial factory values, except differentiated defaults implemented by parameter 95.20 HW options word 1.	34560

No.	Name/Value	Description	Def/ FbEq16
96.07	Parameter save manually	Saves the valid parameter values to the permanent memory on the drive control unit to ensure that operation can continue after cycling the power. The new parameter values are saved automatically when changed from a PC tool or control panel, after the drive is powered on for more than 60 seconds. Save the parameters with this parameter • to store values sent from the fieldbus • when using external +24 V DC power supply to the control unit: to save parameter changes before you power down the control unit. The supply has a very short hold-up time when powered off. • to save the parameter value changes when the drive is powered off within 60 seconds after being powered on.	Done
	Done	Save completed.	0
	Save	Save in progress.	1
96.08	Control board boot	Changing the value of this parameter to 1 reboots the control unit (without requiring a power off/on cycle of the complete drive module). The value reverts to 0 automatically.	No action
	No action	1 = No action.	0
	Reboot	1 = Reboot the control unit.	1
96.10	User set status	Shows the status of the user parameter sets. This parameter is read-only. See also section User parameter sets (page 69).	n/a
	n/a	No user parameter sets have been saved.	0
	Loading	A user set is being loaded.	1
	Saving	A user set is being saved.	2
	Faulted	Invalid or empty parameter set.	3
	User1 IO active	User set 1 has been selected by parameters 96.12 User set I/O mode in1 and 96.13 User set I/O mode in2.	4
	User2 IO active	User set 2 has been selected by parameters 96.12 User set I/O mode in1 and 96.13 User set I/O mode in2.	5

No.	Name/Value	Description	Def/ FbEq16
	User3 IO active	User set 3 has been selected by parameters 96.12 User set I/O mode in1 and 96.13 User set I/O mode in2.	6
	User4 IO active	User set 4 has been selected by parameters 96.12 User set I/O mode in1 and 96.13 User set I/O mode in2.	7
	Reserved		8…19
	User1 backup	User set 1 has been saved or loaded.	20
	User2 backup	User set 2 has been saved or loaded.	21
	User3 backup	User set 3 has been saved or loaded.	22
	User4 backup	User set 4 has been saved or loaded.	23
96.11	User set save/load	Enables the saving and restoring of up to four custom sets of parameter settings. The set that was in use before powering down the drive is in use after the next power-up. Notes: • Some hardware configuration settings, such as I/O extension module and fieldbus configuration parameters (groups 14…16, 47, 50…58 and 92…93) are not included in user parameter sets. • Parameter changes made after loading a set are not automatically stored – they must be saved using this parameter. • This parameter cannot be changed while the drive is running	No action
	No action	Load or save operation complete; normal operation.	0
	User set I/O mode	Load user parameter set using parameters 96.12 User set I/O mode in1 and 96.13 User set I/O mode in2.	1
	Load set 1	Load user parameter set 1.	2
	Load set 2	Load user parameter set 2.	3
	Load set 3	Load user parameter set 3.	4
	Load set 4	Load user parameter set 4.	5
	Save to set 1	Save user parameter set 1.	18
	Save to set 2	Save user parameter set 2.	19
	Save to set 3	Save user parameter set 3.	20
	Save to set 4	Save user parameter set 4.	21

<table>
<tr><th>No.</th><th>Name/Value</th><th>Description</th><th>Def/ FbEq16</th></tr>
<tr><td>96.12</td><td>User set I/O mode in1</td><td>When parameter 96.11 User set save/load is set to User set I/O mode, selects the user parameter set together with parameter 96.13 User set I/O mode in2 as follows:
<table>
<tr><th>Status of source defined by par. 96.12</th><th>Status of source defined by par. 96.13</th><th>User parameter set selected</th></tr>
<tr><td>0</td><td>0</td><td>Set 1</td></tr>
<tr><td>1</td><td>0</td><td>Set 2</td></tr>
<tr><td>0</td><td>1</td><td>Set 3</td></tr>
<tr><td>1</td><td>1</td><td>Set 4</td></tr>
</table></td><td>Not selected</td></tr>
<tr><td></td><td>Not selected</td><td>0.</td><td>0</td></tr>
<tr><td></td><td>Selected</td><td>1.</td><td>1</td></tr>
<tr><td></td><td>DI1</td><td>Digital input DI1 (10.02 DI delayed status, bit 0).</td><td>2</td></tr>
<tr><td></td><td>DI2</td><td>Digital input DI2 (10.02 DI delayed status, bit 1).</td><td>3</td></tr>
<tr><td></td><td>DI3</td><td>Digital input DI3 (10.02 DI delayed status, bit 2).</td><td>4</td></tr>
<tr><td></td><td>DI4</td><td>Digital input DI4 (10.02 DI delayed status, bit 3).</td><td>5</td></tr>
<tr><td></td><td>DI5</td><td>Digital input DI5 (10.02 DI delayed status, bit 4).</td><td>6</td></tr>
<tr><td></td><td>DI6</td><td>Digital input DI6 (10.02 DI delayed status, bit 5).</td><td>7</td></tr>
<tr><td></td><td>Reserved</td><td></td><td>8...17</td></tr>
<tr><td></td><td>Timed function 1</td><td>Bit 0 of 34.01 Timed functions status (see page 166).</td><td>18</td></tr>
<tr><td></td><td>Timed function 2</td><td>Bit 1 of 34.01 Timed functions status (see page 166).</td><td>19</td></tr>
<tr><td></td><td>Timed function 3</td><td>Bit 2 of 34.01 Timed functions status (see page 166).</td><td>20</td></tr>
<tr><td></td><td>Reserved</td><td></td><td>21...13</td></tr>
<tr><td></td><td>Supervision 1</td><td>Bit 0 of 32.01 Supervision status (see page 152).</td><td>24</td></tr>
<tr><td></td><td>Supervision 2</td><td>Bit 1 of 32.01 Supervision status (see page 152).</td><td>25</td></tr>
<tr><td></td><td>Supervision 3</td><td>Bit 2 of 32.01 Supervision status (see page 152).</td><td>26</td></tr>
<tr><td></td><td>Other [bit]</td><td>Source selection (see Terms and abbreviations on page 80).</td><td>-</td></tr>
<tr><td>96.13</td><td>User set I/O mode in2</td><td>See parameter 96.12 User set I/O mode in1.</td><td>Not selected</td></tr>
</table>

<table>
<tr><th>No.</th><th>Name/Value</th><th>Description</th><th>Def/
FbEq16</th></tr>
<tr><td>96.16</td><td>Unit selection</td><td>Selects the unit of parameters indicating power, temperature and torque.</td><td>0b0000</td></tr>
<tr><td colspan="4">
<table>
<tr><th>Bit</th><th>Name</th><th>Information</th></tr>
<tr><td rowspan="2">0</td><td rowspan="2">Power unit</td><td>0 = kW</td></tr>
<tr><td>1 = hp</td></tr>
<tr><td>1</td><td colspan="2">Reserved</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">Temperature unit</td><td>0 = °C</td></tr>
<tr><td>1 = °F</td></tr>
<tr><td>3</td><td colspan="2">Reserved</td></tr>
<tr><td rowspan="2">4</td><td rowspan="2">Torque unit</td><td>0 = Nm (N·m)</td></tr>
<tr><td>1 = lbft (lb·ft)</td></tr>
<tr><td>5…15</td><td colspan="2">Reserved</td></tr>
</table>
</td></tr>
<tr><td></td><td>0b0000…
0b1111</td><td>Unit selection word.</td><td>1 = 1</td></tr>
<tr><td>96.20</td><td>Time sync primary source</td><td>Defines the 1st priority external source for synchronization of the drive’s time and date.</td><td>Panel link</td></tr>
<tr><td></td><td>Internal</td><td>No external source selected.</td><td>0</td></tr>
<tr><td></td><td>Fieldbus A</td><td>Fieldbus interface A.</td><td>3</td></tr>
<tr><td></td><td>Embedded FB</td><td>Embedded fieldbus interface.</td><td>6</td></tr>
<tr><td></td><td>Panel link</td><td>Control panel, or Drive composer PC tool connected to the control panel.</td><td>8</td></tr>
<tr><td></td><td>Ethernet tool link</td><td>Drive composer PC tool through an FENA module.</td><td>9</td></tr>
<tr><td>96.24</td><td>Full days since 1st Jan 1980</td><td>Number of full days passed since beginning of the year 1980.
This parameter, together with 96.25 Time in minutes within 24 h and 96.26 Time in ms within one minute makes it possible to set the date and time in the drive via the parameter interface from a fieldbus or application program. This may be necessary if the fieldbus protocol does not support time synchronization.</td><td>-</td></tr>
<tr><td></td><td>1…59999</td><td>Days since beginning of 1980.</td><td>1 = 1</td></tr>
<tr><td>96.25</td><td>Time in minutes within 24 h</td><td>Number of full minutes passed since midnight. For example, the value 860 corresponds to 2:20 pm.
See parameter 96.24 Full days since 1st Jan 1980.</td><td>0 min</td></tr>
<tr><td></td><td>1…1439</td><td>Minutes since midnight.</td><td>1 = 1</td></tr>
<tr><td>96.26</td><td>Time in ms within one minute</td><td>Number of milliseconds passed since last minute.
See parameter 96.24 Full days since 1st Jan 1980.</td><td>0 ms</td></tr>
<tr><td></td><td>0…59999</td><td>Number of milliseconds since last minute.</td><td>1 = 1</td></tr>
</table>

No.	Name/Value	Description	Def/ FbEq16
96.51	Clear fault and event logger	Clears all events from the drive’s fault and event logs.	0
	0…1		1 = 1
96.70	Disable adaptive program	Enables/disables the adaptive program (if present). See also section Adaptive programming (page 38).	Yes
	No	Adaptive program enabled.	0
	Yes	Adaptive program disabled.	1
96.78	Legacy Modbus mapping	Enables a Modbus user to access a select set of parameters using legacy register numbering. See the supported parameters in section Modbus holding register addresses on page 361.	Disable
	Disable	Using legacy register numbering disabled.	0
	Enable	Using legacy register numbering enabled. This selection sets parameter 58.33 Addressing mode to Mode 0. Only 16-bit addressing is used, and only 16-bit data is used for reading and writing. 16-bit values (groups 1…99, indexes 1…99): Register address = 40000 + 100 × parameter group + parameter index. For example, parameter 22.80 would be mapped to register 40000 + 2200 + 80 = 42280.	1
96.79	Legacy control profile	Enables using a legacy control profile. Currently only EFB supports legacy profiles.	Not selected
	Not selected	EFB: Control profile selected with 58.25 Control profile used.	0
	DCU	Legacy DCU profile used.	1
	ABB drives	ABB drives profile used.	2
	ABB drives limited	Legacy ABB drives limited profile used.	3

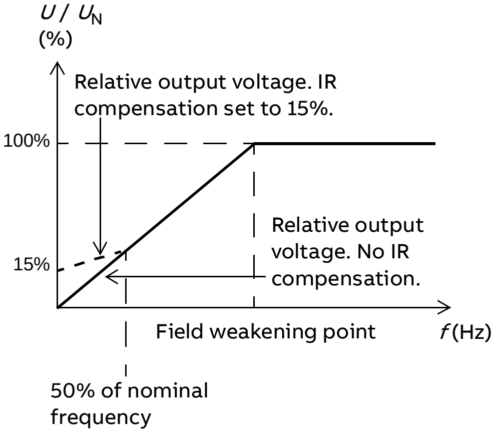
No.	Name/Value	Description	Def/ FbEq16
96.100	Change user pass code	(*Visible when user lock is open*) To change the current user pass code, enter a new code into this parameter as well as 96.101 Confirm user pass code. A warning will be active until the new pass code is confirmed. To cancel changing the pass code, close the user lock without confirming. To close the lock, enter an invalid pass code in parameter 96.02 Pass code, activate parameter 96.08 Control board boot, or cycle the power. See also section User lock (page 69).	10000000
	10000000… 99999999	New user pass code.	-
96.101	Confirm user pass code	(*Visible when user lock is open*) Confirms the new user pass code entered in 96.100 Change user pass code.	
	10000000… 99999999	Confirmation of new user pass code.	-

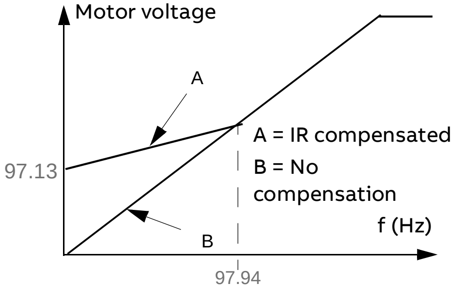
No.	Name/Value	Description	Def/ FbEq16
96.102	User lock functionality	(*Visible when user lock is open*) Selects the actions or functionalities to be prevented by the user lock. Note that the changes made take effect only when the user lock is closed. See parameter 96.02 Pass code. **Note:** ABB recommends to select all the actions and functionalities unless otherwise required by the application.	0000h

Bit	Name	Information
0	Disable ABB access levels	1 = ABB access levels (service, advanced programmer, etc.; see 96.03) disabled
1	Freeze parameter lock state	1 = Changing the parameter lock state prevented, ie. pass code 358 has no effect
2	Disable file download	1 = Loading of files to drive prevented. This applies to • firmware upgrades • parameter restore • changing home view of control panel • editing drive texts • editing the favorite parameters list on control panel • configuration settings made through control panel such as time/date formats and enabling/disabling clock display.
3…10	Reserved	
11	Disable OEM access level 1	1 = OEM access level 1 disabled
12	Disable OEM access level 2	1 = OEM access level 2 disabled
13	Disable OEM access level 3	1 = OEM access level 3 disabled
14…15	Reserved	

	0000h…FFFFh	Selection of actions to be prevented by user lock.	-

No.	Name/Value	Description	Def/ FbEq16
97 Motor control		Switching frequency; slip gain; voltage reserve; flux braking; anti-cogging (signal injection); IR compensation.	
97.01	Switching frequency reference	Defines the switching frequency of the drive that is used as long as the drive does not heat too much. See section Switching frequency on page 57. Higher switching frequency results in lower acoustic noise. **Note:** If you have a multimotor system, contact your local ABB representative.	4 kHz
	2 kHz	2 kHz	2
	4 kHz	4 kHz	4
	8 kHz	8 kHz	8
	16 kHz	16 kHz	16
97.02	Minimum switching frequency	Lowest switching frequency that is allowed. Depends on the frame size.	1.5 kHz
	1.5 kHz	1.5 kHz. Not for all frame sizes.	1
	2 kHz	2 kHz.	2
	4 kHz	4 kHz.	4
	8 kHz	8 kHz.	8
	12 kHz	12 kHz.	12

No.	Name/Value	Description	Def/ FbEq16
97.13	IR compensation	Defines the relative output voltage boost at zero speed (IR compensation). The function is useful in applications with a high break-away torque where vector control cannot be applied.  See also section IR compensation for scalar motor control on page 56.	3.50%
	0.00…50.00%	Voltage boost at zero speed in percent of nominal motor voltage.	1 = 1%
97.20	U/F ratio	Selects the form for the U/f (voltage to frequency) ratio below field weakening point. For scalar control only.	Linear
	Linear	Linear ratio for constant torque applications.	0
	Squared	Squared ratio for centrifugal pump and fan applications. With squared U/f ratio the noise level is lower for most operating frequencies. Not recommended for permanent magnet motors.	1
97.48	Udc stabilizer	Enables or disables the DC bus voltage stabilizer.	Disabled
	Disabled	DC bus voltage stabilizer disabled.	0
	Enabled min	DC bus voltage stabilizer enabled, minimum stabilization.	50
	Enabled mild	DC bus voltage stabilizer enabled, mild stabilization.	100
	Enabled medium	DC bus voltage stabilizer enabled, medium stabilization.	300
	Enabled strong	DC bus voltage stabilizer enabled, strong stabilization.	500

No.	Name/Value	Description	Def/ FbEq16
	Enabled max	DC bus voltage stabilizer enabled, maximum stabilization.	800
97.49	Slip gain for scalar	Sets gain for slip compensation (in %) while drive is operating in scalar control mode. • A squirrel-cage motor slips under load. Increasing the frequency as the motor torque increases compensates for the slip. • Requires parameter 99.04 Motor control mode = Scalar. 0 = No slip compensation. 1...200 = Increasing slip compensation. 100% means full slip compensation according to parameters 99.08 Motor nominal frequency and 99.09 Motor nominal speed.	0
	0...200 %	Slip compensation in %.	1 = 1%
97.94	IR comp max frequency	Sets the frequency at which IR compensation (set by parameter 97.13 IR compensation) reaches 0 V. The unit is % of motor nominal frequency. **IR compensation** When enabled, IR compensation provides an extra voltage boost to the motor at low speeds. Use IR compensation, for example, in applications that require a high breakaway torque.  	80.0%
	1.0...200.0%	IR compensation maximum frequency in %.	1 = 1%
97.135	Udc ripple	Calculates ripple voltage.	-
	0.0...200.0 V	Voltage	1 = 1 V

No.	Name/Value	Description	Def/ FbEq16
98 User motor parameters		Motor values supplied by the user that are used in the motor model. These parameters are useful for non-standard motors, or to just get more accurate motor control of the motor on site. A better motor model always improves the shaft performance.	
98.01	User motor model mode	Activates the motor model parameters 98.02…98.12. **Notes**: • Parameter value is automatically set to zero when ID run is selected by parameter 99.13 ID run requested. The values of parameters 98.02…98.12 are then updated according to the motor characteristics identified during the ID run. • Measurements made directly from the motor terminals during the ID run are likely to produce slightly different values than those on a data sheet from a motor manufacturer. • This parameter cannot be changed while the drive is running.	Not selected
	Not selected	Parameters 98.02…98.12 inactive.	0
	Motor parameters	The values of parameters 98.02… 98.12 are used as the motor model.	1
98.02	Rs user	Defines the stator resistance R_S of the motor model. With a star-connected motor, R_S is the resistance of one winding. With a delta-connected motor, R_S is one-third of the resistance of one winding.	0.00000 p.u.
	0.00000… 0.50000 p.u.	Stator resistance in per unit.	-
98.03	Rr user	Defines the rotor resistance R_R of the motor model.	0.00000 p.u.
	0.00000… 0.50000 p.u.	Rotor resistance in per unit.	-
98.04	Lm user	Defines the main inductance L_M of the motor model.	0.00000 p.u.
	0.00000… 10.00000 p.u.	Main inductance in per unit.	-
98.05	SigmaL user	Defines the leakage inductance σL_S.	0.00000 p.u.
	0.00000… 1.00000 p.u.	Leakage inductance in per unit.	-

No.	Name/Value	Description	Def/ FbEq16
98.06	Ld user	Defines the direct axis (synchronous) inductance. **Note:** This parameter is valid only for permanent magnet motors.	0.00000 p.u.
	0.00000 … 10.00000 p.u	Direct axis inductance in per unit.	-
98.07	Lq user	Defines the quadrature axis (synchronous) inductance. **Note:** This parameter is valid only for permanent magnet motors.	0.00000 p.u.
	0.00000 … 10.00000 p.u	Quadrature axis inductance in per unit.	-
98.08	PM flux user	Defines the permanent magnet flux. **Note:** This parameter is valid only for permanent magnet motors.	0.00000 p.u.
	0.00000 … 2.00000 p.u	Permanent magnet flux in per unit.	-
98.09	Rs user SI	Defines the stator resistance R_S of the motor model.	0.00000 ohm
	0.00000… 100.00000 ohm	Stator resistance.	-
98.10	Rr user SI	Defines the rotor resistance R_R of the motor model.	0.00000 ohm
	0.00000… 100.00000 ohm	Rotor resistance.	-
98.11	Lm user SI	Defines the main inductance L_M of the motor model.	0.00 mH
	0.00… 100000.00 mH	Main inductance.	1 = 10000 mH
98.12	SigmaL user SI	Defines the leakage inductance σL_S.	0.00 mH
	0.00… 100000.00 mH	Leakage inductance.	1 = 10000 mH
98.13	Ld user SI	Defines the direct axis (synchronous) inductance. **Note:** This parameter is valid only for permanent magnet motors.	0.00 mH
	0.00 … 100000.00 mH	Direct axis inductance.	1 = 10000 mH
98.14	Lq user SI	Defines the quadrature axis (synchronous) inductance. **Note:** This parameter is valid only for permanent magnet motors.	0.00 mH
	0.00 … 100000.00 mH	Quadrature axis inductance.	1 = 10000 mH

No.	Name/Value	Description	Def/ FbEq16
99 Motor data		Motor configuration settings.	
99.03	Motor type	Selects the motor type. **Note:** This parameter cannot be changed while the drive is running.	Asynchronous motor
	Asynchronous motor	Standard squirrel cage AC induction motor (asynchronous induction motor).	0
	Permanent magnet motor	Permanent magnet motor. Three-phase AC synchronous motor with permanent magnet rotor and sinusoidal BackEMF voltage. **Note:** With permanent magnet motors special attention must be paid on setting the motor nominal values correctly in parameter group 99 Motor data. You must use vector control. If the nominal BackEMF voltage of the motor is not available, a full ID run should be performed for improving performance.	1
	PMaSynRM	Permanent magnet assisted Synchronous Reluctance Motor.	2
99.04	Motor control mode	Selects the motor control mode.	Scalar
	Vector	Vector control. Vector control has better accuracy than scalar control but cannot be used in all situations (see selection Scalar below). Requires motor identification run (ID run). See parameter 99.13 ID run requested. **Note:** In vector control the drive performs a standstill ID run at the first start if ID run has not been previously performed. A new start command is required after standstill ID run. **Note:** To achieve a better motor control performance, you can perform a normal ID run without load. See also section Operating modes of the drive (page 37).	0

No.	Name/Value	Description	Def/ FbEq16
	Scalar	Scalar control. Suitable for most applications, if top performance is not required. Motor identification run is not required. **Note:** Scalar control must be used in the following situations: • with multimotor systems 1) if the load is not equally shared between the motors, 2) if the motors are of different sizes, or 3) if the motors are going to be changed after the motor identification (ID run) • if the nominal current of the motor is less than 1/6 of the nominal output current of the drive • if the drive is used with no motor connected (for example, for test purposes). **Note**: Correct motor operation requires that the magnetizing current of the motor does not exceed 90% of the nominal current of the inverter. See section Operating modes of the drive (page 37).	1
99.06	Motor nominal current	Defines the nominal motor current. This value must be equal to the value on the motor rating plate. If multiple motors are connected to the drive, enter the total current of the motors. **Notes**: • Correct motor operation requires that the magnetizing current of the motor does not exceed 90% of the nominal current of the drive. • This parameter cannot be changed while the drive is running.	1.8 A
	0.0 …5.2 A	Nominal current of the motor. The allowable range is 1/6…2 × I_N of the drive (0…2 × I_N with scalar control mode).	1 = 1 A

No.	Name/Value	Description	Def/ FbEq16
99.07	Motor nominal voltage	Defines the nominal motor voltage supplied to the motor. This setting must match the value on the rating plate of the motor. **Notes**: • With permanent magnet motors, the nominal voltage is the BackEMF voltage at nominal speed of the motor. If the voltage is given as voltage per rpm, e.g. 60 V per 1000 rpm, the voltage for a nominal speed of 3000 rpm is 3 × 60 V = 180 V. • The stress on the motor insulation is always dependent on the drive supply voltage. This also applies to the case where the motor voltage rating is lower than that of the drive and the supply. • This parameter cannot be changed while the drive is running.	400.0 V
	69.2...830.0 V	Nominal voltage of the motor.	10 = 1 V
99.08	Motor nominal frequency	Defines the nominal motor frequency. This setting must match the value on the rating plate of the motor. **Note:** This parameter cannot be changed while the drive is running.	50.0 Hz
	0.0…500.0 Hz	Nominal frequency of the motor.	10 = 1 Hz
99.09	Motor nominal speed	Defines the nominal motor speed. The setting must match the value on the rating plate of the motor. **Note:** This parameter cannot be changed while the drive is running.	1430 rpm
	0…30000 rpm	Nominal speed of the motor.	1 = 1 rpm
99.10	Motor nominal power	Defines the nominal motor power. The setting must match the value on the rating plate of the motor. If multiple motors are connected to the drive, enter the total power of the motors. The unit is selected by parameter 96.16 Unit selection. **Note:** This parameter cannot be changed while the drive is running.	0.75 kW
	0.00… 10000.00 kW or 0.00… 13404.83 hp	Nominal power of the motor.	1 = 1 unit

No.	Name/Value	Description	Def/ FbEq16
99.11	Motor nominal cos Ө	Defines the cosphi of the motor for a more accurate motor model. The value is not obligatory, but is useful with an asynchronous motor, especially when performing a standstill identification run. With a permanent magnet or synchronous reluctance motor, this value is not needed. **Notes:** • Do not enter an estimated value. If you do not know the exact value, leave the parameter at zero. • This parameter cannot be changed while the drive is running.	0.00
	0.00…1.00	Cosphi of the motor.	100 = 1
99.12	Motor nominal torque	Defines the nominal motor shaft torque for a more accurate motor model. Not obligatory. The unit is selected by parameter 96.16 Unit selection. **Note:** This parameter cannot be changed while the drive is running.	0.000 N·m or lb·ft
	0.000… 4000000.000 N·m or 0.000… 2950248.597 lb·ft	Nominal motor torque.	1 = 100 unit

No.	Name/Value	Description	Def/ FbEq16
99.13	ID run requested	Selects the type of the motor identification routine (ID run) performed at the next start of the drive. During the ID run, the drive will identify the characteristics of the motor for optimum motor control. If no ID run has been performed yet (or if default parameter values have been restored using parameter 96.06 Parameter restore), this parameter is automatically set to Standstill, signifying that an ID run must be performed. After the ID run, the drive stops and this parameter is automatically set to None. **Notes**: • To ensure that the ID run can work properly, the drive limits in group 30 (maximum speed and minimum speed, and maximum torque and minimum torque) must to be large enough (the range specified by the limits must be wide enough. If eg. speed limits are less than the motor nominal speed, the ID run cannot be completed. • For the Advanced ID run, the machinery must always be de-coupled from the motor. • With a permanent magnet or synchronous reluctance motor, a Normal, Reduced or Standstill ID run requires that the motor shaft is NOT locked and the load torque is less than 10%. • Once the ID run is activated, it can be canceled by stopping the drive. • The ID run must be performed every time any of the motor parameters (99.04, 99.06…99.12) have been changed. • Ensure that the Safe Torque Off and emergency stop circuits (if any) are closed during the ID run. • This parameter cannot be changed while the drive is running.	None
	None	No motor ID run is requested. This mode can be selected only if the ID run (Normal/Reduced/Standstill/Advanced) has already been performed once.	0

No.	Name/Value	Description	Def/FbEq16
	Normal	Normal ID run. Guarantees good control accuracy for all cases. The ID run takes about 90 seconds. This mode should be selected whenever it is possible. **Notes**: • If the load torque will be higher than 20% of motor nominal torque, or if the machinery is not able to withstand the nominal torque transient during the ID run, then the driven machinery must be de-coupled from the motor during a Normal ID run. • Check the direction of rotation of the motor before starting the ID run. During the run, the motor will rotate in the forward direction. ⚠ **WARNING!** The motor will run at up to approximately 50…100% of the nominal speed during the ID run. ENSURE THAT IT IS SAFE TO RUN THE MOTOR BEFORE PERFORMING THE ID RUN!	1
	Reduced	Reduced ID run. This mode should be selected instead of the Normal or Advanced ID Run if • mechanical losses are higher than 20% (ie. the motor cannot be de-coupled from the driven equipment), or if • flux reduction is not allowed while the motor is running With this ID run mode, the resultant motor control in the field weakening area or at high torques is not necessarily as accurate as motor control following a Normal ID run. Reduced ID run is completed faster than the Normal ID Run (< 90 seconds). **Note:** Check the direction of rotation of the motor before starting the ID run. During the run, the motor will rotate in the forward direction. ⚠ **WARNING!** The motor will run at up to approximately 50…100% of the nominal speed during the ID run. ENSURE THAT IT IS SAFE TO RUN THE MOTOR BEFORE PERFORMING THE ID RUN!	2

No.	Name/Value	Description	Def/FbEq16
	Standstill	Standstill ID run. The motor is injected with DC current. With an AC induction (asynchronous) motor, the motor shaft is not rotated. With a permanent magnet motor, the shaft can rotate up to half a revolution. **Note:** This mode should be selected only if the Normal, Reduced or Advanced ID run is not possible due to the restrictions caused by the connected mechanics (e.g. with lift or crane applications).	3
	Autophasing	Not applicable	4
	Current measurement calibration	Requests current measurement calibration, ie. identification of current measurement offset and gain errors. The calibration will be performed at next start.	5
	Advanced	Advanced ID run. Only for frames R6…R8. Guarantees the best possible control accuracy. The ID run takes a very long time to complete. This mode should be selected when top performance is needed across the whole operating area. Note: The driven machinery must be de-coupled from the motor because of high torque and speed transients that are applied. ⚠ **WARNING!** The motor may run at up to the maximum (positive) and minimum (negative) allowed speed during the ID run. Several accelerations and decelerations are done. The maximum torque, current and speed allowed by the limit parameters may be utilized. ENSURE THAT IT IS SAFE TO RUN THE MOTOR BEFORE PERFORMING THE ID RUN!	6
	Adaptive	Adaptive ID run. Initially, drive runs in Standstill ID run mode and then refines the motor parameters during the normal operation. This helps to achieve more optimal performance. **Note:** This is applicable for R0...R5 frames only.	7
99.14	Last ID run performed	Shows the type of ID run that was performed last. For more information about the different modes, see the selections of parameter 99.13 ID run requested.	None
	None	No ID run has been performed.	0
	Normal	Normal ID run.	1
	Reduced	Reduced ID run.	2

No.	Name/Value	Description	Def/ FbEq16
	Standstill	Standstill ID run.	3
	Advanced	Advanced ID run.	6
	Adaptive	Adaptive ID run.	7
99.15	Motor polepairs calculated	Calculated number of pole pairs in the motor.	0
	0…1000	Number of pole pairs.	1 = 1
99.16	Motor phase order	Switches the rotation direction of motor. This parameter can be used if the motor turns in the wrong direction (for example, because of the wrong phase order in the motor cable), and correcting the cabling is considered impractical. **Note**: • Changing this parameter does not affect speed reference polarities, so positive speed reference will rotate the motor forward. The phase order selection just ensures that "forward" is in fact the correct direction.	U V W
	U V W	Normal.	0
	U W V	Reversed rotation direction.	1

Differences in the default values between 50 Hz and 60 Hz supply frequency settings

Parameter 95.20 HW options word 1 bit 0 Supply frequency 60 Hz changes the drive parameter default values according to the supply frequency, 50 Hz or 60 Hz. The bit is set according to the market before the drive is delivered.

If you need to change from 50 Hz to 60 Hz, or vice versa, change the value of the bit and then do a complete reset to the drive. After that you have to reselect the macro to be used.

The table below shows the parameters whose default values depend on the supply frequency setting. The supply frequency setting, with the type designation of the drive, also affects Group 99 Motor data parameter values though these parameters are not listed in the table.

No	Name	95.20 HW options word 1 bit Supply frequency 60 Hz = 50 Hz	95.20 HW options word 1 bit Supply frequency 60 Hz = 60 Hz
11.45	Freq in 1 at scaled max	1500.000	1800.000
12.20	AI1 scaled at AI1 max	1500.000	1800.000
13.18	AO1 source max	1500.0	1800.0
30.11	Minimum speed	-1500.00 rpm	-1800.00 rpm
30.12	Maximum speed	1500.00 rpm	1800.00 rpm
30.13	Minimum frequency	-50.00 Hz	-60.00 Hz
30.14	Maximum frequency	50.00 Hz	60.00 Hz

7

Additional parameter data

What this chapter contains

This chapter lists the parameters with some additional data such as their ranges and 32-bit fieldbus scaling. For parameter descriptions, see chapter Parameters (page 79).

Terms and abbreviations

Term	**Definition**
Actual signal	Signal measured or calculated by the drive. Usually can only be monitored but not adjusted; some counter-type signals can however be reset.
Analog src	Analog source: the parameter can be set to the value of another parameter by choosing “Other”, and selecting the source parameter from a list. In addition to the “Other” selection, the parameter may offer other pre-selected settings.
Binary src	Binary source: the value of the parameter can be taken from a specific bit in another parameter value (“Other”). Sometimes the value can be fixed to 0 (false) or 1 (true). In addition, the parameter may offer other pre-selected settings.
Data	Data parameter
FbEq32	32-bit fieldbus equivalent: The scaling between the value shown on the panel and the integer used in communication when a 32-bit value is selected for transmission to an external system. The corresponding 16-bit scalings are listed in chapter Parameters (page 79).
List	Selection list.
No.	Parameter number.

Term	**Definition**
PB	Packed Boolean (bit list).
Real	Real number.
Type	Parameter type. See Analog src, Binary src, List, PB, Real.

Fieldbus addresses

Refer to the *User's manual* of the fieldbus adapter.

Parameter groups 1…9

No.	Name	Type	Range	Unit	FbEq32
01 Actual values					
01.01	Motor speed used	Real	-30000.00…30000.00	rpm	100 = 1 rpm
01.02	Motor speed estimated	Real	-30000.00…30000.00	rpm	100 = 1 rpm
01.03	Motor speed %	Real	-1000.00…1000.00	%	100 = 1%
01.06	Output frequency	Real	-500.00…500.00	Hz	100 = 1 Hz
01.07	Motor current	Real	0.00…30000.00	A	100 = 1 A
01.08	Motor current % of motor nom	Real	0.0…1000.0	%	10 = 1%
01.09	Motor current % of drive nom	Real	0.0…1000.0	%	10 = 1%
01.10	Motor torque	Real	-1600.0…1600.0	%	10 = 1%
01.11	DC voltage	Real	0.00…2000.00	V	100 = 1 V
01.13	Output voltage	Real	0…2000	V	1 = 1 V
01.14	Output power	Real	-32768.00…32767.00	kW	100 = 1 unit
01.15	Output power % of motor nom	Real	-300.00…300.00	%	100 = 1%
01.17	Motor shaft power	Real	-32768.00…32767.00	kW or hp	100 = 1 unit
01.18	Inverter GWh counter	Real	0…65535	GWh	1 = 1 GWh
01.19	Inverter MWh counter	Real	0…1000	MWh	1 = 1 MWh
01.20	Inverter kWh counter	Real	0…1000	kWh	1 = 1 kWh
01.24	Flux actual %	Real	0…200	%	1 = 1%
01.30	Nominal torque scale	Real	0.000…4000000	N·m	1000 = 1 unit
01.50	Current hour kWh	Real	0.00…1000000.00	kWh	100 = 1 kWh
01.51	Previous hour kWh	Real	0.00…1000000.00	kWh	100 = 1 kWh
01.52	Current day kWh	Real	0.00…1000000.00	kWh	100 = 1 kWh
01.53	Previous day kWh	Real	0.00…1000000.00	kWh	100 = 1 kWh
01.54	Cumulative inverter energy	Real	0…1000000.00	kWh	100 = 1 kWh
01.55	Inverter GWh counter (resettable)	Real	-200000000.0…200000000.0	kWh	1 = 1 kWh
01.56	Inverter MWh counter (resettable)	Real	0…65535	GWh	1 = 1 kWh
01.57	Inverter kWh counter (resettable)	Real	0…1000	MWh	1 = 1 kWh
01.58	Cumulative inverter energy (resettable)	Real	0…1000	kWh	1 = 1 kWh
01.61	Abs motor speed used	Real	0.00…30000.00	rpm	100 = 1 rpm

No.	Name	Type	Range	Unit	FbEq32
01.62	Abs motor speed %	Real	0.00…1000.00%	%	100 = 1%
01.63	Abs output frequency	Real	0.00…500.00 Hz	Hz	100 = 1 Hz
01.64	Abs motor torque	Real	0.0…1600.0	%	10 = 1%
01.65	Abs output power	Real	0.00…32767.00	kW	100 = 1 kW
01.66	Abs output power % motor nom	Real	0.00…300.00	%	100 = 1%
01.68	Abs motor shaft power	Real	0.00…32767.00	kW or hp	100 = 1 kW
03 Input references					
03.01	Panel reference	Real	-10000.00…100000.00	-	100 = 1
03.02	Panel reference remote	Real	-10000.00…100000.00	-	100 = 1
03.05	FB A reference 1	Real	-10000.00…100000.00	-	100 = 1
03.06	FB A reference 2	Real	-10000.00…100000.00	-	100 = 1
03.09	EFB reference 1	Real	-30000.00…30000.00	-	100 = 1
03.10	EFB reference 2	Real	-30000.00…30000.00	-	100 = 1
04 Warnings and faults					
04.01	Tripping fault	Data	0x0000...0xffff	-	1 = 1
04.02	Active fault 2	Data	0x0000...0xffff	-	1 = 1
04.03	Active fault 3	Data	0x0000...0xffff	-	1 = 1
04.06	Active warning 1	Data	0x0000...0xffff	-	1 = 1
04.07	Active warning 2	Data	0x0000...0xffff	-	1 = 1
04.08	Active warning 3	Data	0x0000...0xffff	-	1 = 1
04.11	Latest fault	Data	0x0000...0xffff	-	1 = 1
04.12	2nd latest fault	Data	0x0000...0xffff	-	1 = 1
04.13	3rd latest fault	Data	0x0000...0xffff	-	1 = 1
04.16	Latest warning	Data	0x0000...0xffff	-	1 = 1
04.17	2nd latest warning	Data	0x0000...0xffff	-	1 = 1
04.18	3rd latest warning	Data	0x0000...0xffff	-	1 = 1
04.40	Event word 1	PB	0000h…FFFFh	-	1 = 1
04.41	Event word 1 bit 0 code	Data	0x2310…FFFFh	-	1 = 1
04.43	Event word 1 bit 1 code	Data	0x3210…FFFFh	-	1 = 1
04.45, 04,47, 04,49, …	…	…	…	…	
04.71	Event word 1 bit 15 code	Data	0x2330…FFFFh	-	1 = 1

No.	Name	Type	Range	Unit	FbEq32
05 Diagnostics					
05.01	On-time counter	Real	0…65535	d	1 = 1
05.02	Run-time counter	Real	0…65535	d	1 = 1
05.03	Pump run hours	Real	0.0...429496729.5	h	1 = 1
05.04	Fan on-time counter	Real	0…65535	d	1 = 1
05.10	Control board temperature	Real	-100…300	°C	10 = 1
05.11	Inverter temperature	Real	-40.0…160.0	%	10 = 1
05.20	Diagnostic word 1	PB	0b0000...0b1111	-	0b0000
05.21	Diagnostic word 2	PB	0b0000...0b1111	-	0b0000
05.22	Diagnostic word 3	PB	0b0000...0b1111	-	-
05.80	Motor speed at fault	Real	-30000.00…30000.00	rpm	100 = 1 rpm
05.81	Output frequency at fault	Real	-500.00…500.00	Hz	100 = 1 Hz
05.82	DC voltage at fault	Real	0.00…2000.00	V	100 = 1 V
05.83	Motor current at fault	Real	0.00…30000.00	A	100 = 1 A
05.84	Motor torque at fault	Real	-1600.0…1600.0	%	10 = 1%
05.85	Main status word at fault	PB	0000h…FFFFh	-	1 = 1
05.86	DI delayed status at fault	PB	0b0000...0b1111	-	1 = 1
05.87	Inverter temperature at fault	PB	-40.0…160.0	°C	10 = 1°C
05.88	Reference used at fault	Real	-500.00...500.00 Hz/ -1600.0…1600.0%/ 30000.00...30000.00 rpm	Hz/ %/ rpm	100 = 1 Hz/ 10 = 1%/ 100 = 1 rpm
06 Control and status words					
06.01	Main control word	PB	0x0000...0xffff	-	1 = 1
06.11	Main status word	PB	0x0000...0xffff	-	1 = 1
06.16	Drive status word 1	PB	0b0000...0b1111	-	1 = 1
06.17	Drive status word 2	PB	0b0000...0b1111	-	1 = 1
06.18	Start inhibit status word	PB	0b0000...0b1111	-	1 = 1
06.19	Speed control status word	PB	0b0000...0b1111	-	1 = 1
06.29	MSW bit 10 selection	Binary src	0...2	-	1 = 1
06.30	MSW bit 11 selection	Binary src	0...2	-	1 = 1

No.	Name	Type	Range	Unit	FbEq32
06.31	MSW bit 12 selection	Binary src	0…2	-	1 = 1
06.32	MSW bit 13 selection	Binary src	0…1	-	1 = 1
06.33	MSW bit 14 selection	Binary src	0…1	-	1 = 1
07 System info					
07.03	Drive rating id	List	-	-	1 = 1
07.04	Firmware name	List	-	-	1 = 1
07.05	Firmware version	Data	0.00.0.0… 255.255.255.255	-	1 = 1
07.06	Loading package name	List	-	-	1 = 1
07.07	Loading package version	Data	0.00.0.0… 255.255.255.255	-	1 = 1
07.11	Cpu usage	Real	0…100	%	1 = 1%
07.30	Adaptive program status	PB	0000h…FFFFh	-	1 = 1
07.31	AP sequence state	Data	0…20	-	1 = 1

Parameter groups 10…99

No.	Name	Type	Range	Unit	FbEq32
10 Standard DI, RO					
10.02	DI delayed status	PB	0b0000...0b1111	-	1 = 1
10.03	DI force selection	PB	0b0000...0b1111	-	1 = 1
10.04	DI forced data	PB	0b0000...0b1111	-	1 = 1
10.21	RO status	PB	0b0000...0b1111	-	1 = 1
10.22	RO force selection	PB	0b0000...0b1111	-	1 = 1
10.23	RO forced data	PB	0b0000...0b1111	-	1 = 1
10.24	RO1 source	Binary src	-	-	1 = 1
10.25	RO1 ON delay	Real	0.0…3000.0	s	10 = 1 s
10.26	RO1 OFF delay	Real	0.0…3000.0	s	10 = 1 s
10.27	RO2 source	Binary src	-	-	1 = 1
10.28	RO2 ON delay	Real	0.0…3000.0	s	10 = 1 s
10.29	RO2 OFF delay	Real	0.0…3000.0	s	10 = 1 s
10.30	RO3 source	Binary src	-	-	1 = 1
10.31	RO3 ON delay	Real	0.0…3000.0	s	10 = 1 s
10.32	RO3 OFF delay	Real	0.0…3000.0	s	10 = 1 s
10.99	RO/DIO control word	PB	0b0000...0b1111	-	1 = 1
10.101	RO1 toggle counter	Real	0…4294967000	-	1 = 1
10.102	RO2 toggle counter	Real	0…4294967000	-	1 = 1
10.103	RO3 toggle counter	Real	0…4294967000	-	1 = 1
11 Standard DIO, FI, FO					
11.05	DIO1 configuration	List	0...2	-	1 = 1
11.21	DI5 configuration	List	0…1	-	1 = 1
11.38	Freq in 1 actual value	Real	0…16000	Hz	1 = 1 Hz
11.39	Freq in 1 scaled value	Real	-32768.000…32767.000	-	1000 = 1
11.42	Freq in 1 min	Real	0…16000	Hz	1 = 1 Hz
11.43	Freq in 1 max	Real	0…16000	Hz	1 = 1 Hz
11.44	Freq in 1 at scaled min	Real	-32768.000…32767.000	-	1000 = 1
11.45	Freq in 1 at scaled max	Real	-32768.000…32767.000	-	1000 = 1
12 Standard AI					
12.02	AI force selection	PB	0b000...0b1111	-	1 = 1
12.03	AI supervision function	List	0…2	-	1 = 1

No.	Name	Type	Range	Unit	FbEq32
12.04	AI supervision selection	PB	0b000...0b1111	-	1 = 1
12.05	AI supervision force	PB	0b000...0b1111	-	1 = 1
12.11	AI1 actual value	Real	0.000…11.000 V	V	1000 = 1 unit
12.12	AI1 scaled value	Real	-32768.000…32767.000	-	1000 = 1
12.13	AI1 forced value	Real	0.000…11.000 V	V	1000 = 1 unit
12.15	AI1 unit selection	List	2, 10	-	1 = 1
12.16	AI1 filter time	Real	0.000…30.000	s	1000 = 1 s
12.17	AI1 min	Real	0.000…11.000 V	V	1000 = 1 unit
12.18	AI1 max	Real	0.000…11.000 V	V	1000 = 1 unit
12.19	AI1 scaled at AI1 min	Real	-32768.000…32767.000	-	1000 = 1
12.20	AI1 scaled at AI1 max	Real	-32768.000…32767.000	-	1000 = 1
12.21	AI2 actual value	Real	0.000…22.000	mA	1000 = 1 unit
12.22	AI2 scaled value	Real	-32768.000…32767.000	-	1000 = 1
12.23	AI2 forced value	Real	0.000…22.000	mA	1000 = 1 unit
12.25	AI2 unit selection	List	2, 10	-	1 = 1
12.26	AI2 filter time	Real	0.000…30.000	s	1000 = 1 s
12.27	AI2 min	Real	0.000…22.000	mA	1000 = 1 unit
12.28	AI2 max	Real	0.000…22.000	mA	1000 = 1 unit
12.29	AI2 scaled at AI2 min	Real	-32768.000…32767.000	-	1000 = 1
12.30	AI2 scaled at AI2 max	Real	-32768.000…32767.000	-	1000 = 1
12.101	AI1 percent value	Real	0.00…100.00	%	100 = 1%
12.102	AI2 percent value	Real	0.00…100.00	%	100 = 1%
12.110	AI dead band	Real	0.00...100.00	%	1 = 1%
13 Standard AO					
13.02	AO force selection	PB	0b0000…0b1111	-	1 = 1
13.11	AO1 actual value	Real	0.000…22.000 or 0.000…11000 V	mA	1000 = 1 mA

No.	Name	Type	Range	Unit	FbEq32
13.12	AO1 source	Analog src	-	-	1 = 1
13.13	AO1 forced value	Real	0.000…22.000 or 0.000…11000 V	mA	1000 = 1 mA
13.15	AO1 unit selection	List	2, 10	-	1 = 1
13.16	AO1 filter time	Real	0.000…30.000	s	1000 = 1 s
13.17	AO1 source min	Real	-32768.0…32767.0	-	10 = 1
13.18	AO1 source max	Real	-32768.0…32767.0	-	10 = 1
13.19	AO1 out at AO1 src min	Real	0.000…22.000 or 0.000…11000 V	mA	1000 = 1 mA
13.20	AO1 out at AO1 src max	Real	0.000…22.000 or 0.000…11000 V	mA	1000 = 1 mA
13.21	AO2 actual value	Real	0.000…22.000	mA	1000 = 1 mA
13.22	AO2 source	Analog src	-	-	1 = 1
13.23	AO2 forced value	Real	0.000…22.000	mA	1000 = 1 mA
13.26	AO2 filter time	Real	0.000…30.000	s	1000 = 1 s
13.27	AO2 source min	Real	-32768.0…32767.0	-	10 = 1
13.28	AO2 source max	Real	-32768.0…32767.0	-	10 = 1
13.29	AO2 out at AO2 src min	Real	0.000…22.000	mA	1000 = 1 mA
13.30	AO2 out at AO2 src max	Real	0.000…22.000	mA	1000 = 1 mA
13.91	AO1 data storage	Real	-327.68…327.67	-	100 = 1
13.92	AO2 data storage	Real	-327.68…327.67	-	100 = 1
21 Start/stop mode					
21.01	Start mode	List	0…2	-	1 = 1
21.02	Magnetization time	Real	0…10000	ms	1 = 1 ms
21.03	Stop mode	List	0…1	-	1 = 1
21.04	Emergency stop mode	List	0…2	-	1 = 1
21.05	Emergency stop source	Binary src	-	-	1 = 1
21.19	Scalar start mode	List	0…4	-	1 = 1
21.22	Start delay	Real	0.00…60.00	s	100 = 1 s
21.23	Smooth start	Real	0...2	-	1 = 1
21.24	Smooth start current	Real	0.0…100.0	%	100 = 1
21.25	Smooth start speed	Real	2.0…100.0	%	100 = 1
21.27	Torque boost time	Real	0.0...60.0	s	10 = 1 s

No.	**Name**	**Type**	**Range**	**Unit**	**FbEq32**
23 Speed reference ramp					
23.01	Speed ref ramp input	Real	-30000.00…30000.00	rpm	100 = 1 rpm
23.02	Speed ref ramp output	Real	-30000.00…30000.00	rpm	100 = 1 rpm
23.12	Acceleration time 1	Real	0.000…1800.000	s	1000 = 1 s
23.13	Deceleration time 1	Real	0.000…1800.000	s	1000 = 1 s
23.23	Emergency stop time	Real	0.000…1800.000	s	1000 = 1 s
24 Speed reference conditioning					
24.01	Used speed reference	Real	-30000.00…30000.00	rpm	100 = 1 rpm
24.02	Used speed feedback	Real	-30000.00…30000.00	rpm	100 = 1 rpm
24.03	Speed error filtered	Real	-30000.0…30000.0	rpm	100 = 1 rpm
24.12	Speed error filter time	Real	0…10000	ms	1 = 1 ms
25 Speed control					
25.01	Torque reference speed control	Real	-1600.0…1600.0	%	10 = 1%
25.02	Speed proportional gain	Real	0.00…250.00	-	100 = 1
25.03	Speed integration time	Real	0.00…1000.00	s	100 = 1 s
25.04	Speed derivation time	Real	0.000…10.000	s	1000 = 1 s
25.05	Derivation filter time	Real	0…10000	ms	1 = 1 ms
25.15	Proportional gain em stop	Real	1.00…250.00	-	100 = 1
25.30	Flux adaptation enable	List	0...1	-	-
25.33	Speed controller auto tune	Binary src	-	-	1 = 1
25.34	Auto tune control preset	List	0…2	-	1 = 1
25.37	Mechanical time constant	Real	0.00…1000.00	s	100 = 1 s
25.38	Auto tune torque step	Real	0.00…20.00	%	100 = 1%
25.39	Auto tune speed step	Real	0.00…20.00	%	100 = 1%
25.40	Auto tune repeat times	Real	0…10	-	1 = 1
25.53	Torque prop reference	Real	-30000.0…30000.0	%	10 = 1%
25.54	Torque integral reference	Real	-30000.0…30000.0	%	10 = 1%
25.55	Torque deriv reference	Real	-30000.0…30000.0	%	10 = 1%

No.	Name	Type	Range	Unit	FbEq32
28 Frequency reference chain					
28.01	Frequency ref ramp input	Real	-500.00…500.00	Hz	100 = 1 Hz
28.02	Frequency ref ramp output	Real	-500.00…500.00	Hz	100 = 1 Hz
28.72	Freq acceleration time 1	Real	0.000…1800.000	s	1000 = 1 s
28.73	Freq deceleration time 1	Real	0.000…1800.000	s	1000 = 1 s
30 Limits					
30.01	Limit word 1	PB	0b0000…0b1111	-	1 = 1
30.02	Torque limit status	PB	0b0000…0b1111	-	1 = 1
30.09	Cur Lim Monitor Time	Real	0.00...120.00	s	-
30.10	Current Limit Actions	List	0...2	-	1=1
30.11	Minimum speed	Real	-30000.00…30000.00	rpm	100 = 1 rpm
30.12	Maximum speed	Real	-30000.00…30000.00	rpm	100 = 1 rpm
30.13	Minimum frequency	Real	-500.00…500.00	Hz	100 = 1 Hz
30.14	Maximum frequency	Real	-500.00…500.00	Hz	100 = 1 Hz
30.17	Maximum current	Real	0.00…7.20	A	100 = 1 A
30.19	Minimum torque 1	Real	-1600.0…0.0	%	10 = 1%
30.20	Maximum torque 1	Real	0.0…1600.0	%	10 = 1%
30.35	Thermal current limitation	List	0...1	-	1 = 1
30.36	Speed limit selection	Binary src	-	-	1 = 1
30.37	Min speed source	Analog src	-	-	1 = 1
30.38	Max speed source	Analog src	-	-	1 = 1
31 Fault functions					
31.01	External event 1 source	Binary src	-	-	1 = 1
31.02	External event 1 type	List	0…1	-	1 = 1
31.03	External event 2 source	Binary src	-	-	1 = 1
31.04	External event 2 type	List	0…1	-	1 = 1
31.05	External event 3 source	Binary src	-	-	1 = 1
31.06	External event 3 type	List	0…1	-	1 = 1

No.	Name	Type	Range	Unit	FbEq32
31.07	External event 4 source	Binary src	-	-	1 = 1
31.08	External event 4 type	List	0…1	-	1 = 1
31.09	External event 5 source	Binary src	-	-	1 = 1
31.10	External event 5 type	List	0…1	-	1 = 1
31.11	Fault reset selection	Binary src	-	-	1 = 1
31.19	Motor phase loss	List	0…1	-	1 = 1
31.20	Earth fault	List	0…2	-	1 = 1
31.21	Supply phase loss	Not applicable.			
31.22	STO indication run/stop	List	0…5	-	1 = 1
31.23	Wiring or earth fault	List	0…1	-	1 = 1
31.24	Stall function	List	0…2	-	1 = 1
31.25	Stall current limit	Real	0.0…1600.0	%	10 = 1%
31.26	Stall speed limit	Real	0.00…10000.00	rpm	100 = 1 rpm
31.27	Stall frequency limit	Real	0.00…1000.00	Hz	100 = 1 Hz
31.28	Stall time	Real	0…3600	s	1 = 1 s
31.30	Overspeed trip margin	Real	0.00…10000.00	rpm	100 = 1 rpm
31.31	Frequency trip margin	Real	0.00...10000.00	Hz	100 = 1 Hz
31.40	Disable warning messages	PBList	0000h…FFFFh	-	1 = 1
31.54	Fault action	List	0…1	-	1 = 1
32 Supervision					
32.01	Supervision status	PB	0b0000…0b1111	-	1 = 1
32.05	Supervision 1 function	List	0…9	-	1 = 1
32.06	Supervision 1 action	List	0…3	-	1 = 1
32.07	Supervision 1 signal	Analog src	-	-	1 = 1
32.08	Supervision 1 filter time	Real	0.000…30.000	s	1000 = 1 s
32.09	Supervision 1 low	Real	-21474836.00… 21474836.00	-	-
32.10	Supervision 1 high	Real	-21474836.00… 21474836.00	-	-
32.11	Supervision 1 hysteresis	Real	0.00…100000.00	-	100 = 1
32.15	Supervision 2 function	List	0…9	-	1 = 1
32.16	Supervision 2 action	List	0…3	-	1 = 1

No.	Name	Type	Range	Unit	FbEq32
32.17	Supervision 2 signal	Analog src	-	-	1 = 1
32.18	Supervision 2 filter time	Real	0.000…30.000	s	1000 = 1 s
32.19	Supervision 2 low	Real	-21474836.00… 21474836.00	-	100 = 1
32.20	Supervision 2 high	Real	-21474836.00… 21474836.00	-	100 = 1
32.21	Supervision 2 hysteresis	Real	0.00…100000.00	-	100 = 1
32.25	Supervision 3 function	List	0…9	-	1 = 1
32.26	Supervision 3 action	List	0…3	-	1 = 1
32.27	Supervision 3 signal	Analog src	-	-	1 = 1
32.28	Supervision 3 filter time	Real	0.000…30.000	s	1000 = 1 s
32.29	Supervision 3 low	Real	-21474836.00… 21474836.00	-	100 = 1
32.30	Supervision 3 high	Real	-21474836.00… 21474836.00	-	100 = 1
32.31	Supervision 3 hysteresis	Real	0.00…100000.00	-	100 = 1
32.35	Supervision 4 function	List	0…9	-	1 = 1
32.36	Supervision 4 action	List	0…3	-	1 = 1
32.37	Supervision 4 signal	Analog src	-	-	1 = 1
32.38	Supervision 4 filter time	Real	0.000…30.000	s	1000 = 1 s
32.39	Supervision 4 low	Real	-21474836.00… 21474836.00	-	100 = 1
32.40	Supervision 4 high	Real	-21474836.00… 21474836.00	-	100 = 1
32.41	Supervision 4 hysteresis	Real	0.00…100000.00	-	100 = 1
32.45	Supervision 5 function	List	0…9	-	1 = 1
32.46	Supervision 5 action	List	0…3	-	1 = 1
32.47	Supervision 5 signal	Analog src	-	-	1 = 1
32.48	Supervision 5 filter time	Real	0.000…30.000	s	1000 = 1 s
32.49	Supervision 5 low	Real	-21474836.00… 21474836.00	-	100 = 1
32.50	Supervision 5 high	Real	-21474836.00… 21474836.00	-	100 = 1
32.51	Supervision 5 hysteresis	Real	0.00…100000.00	-	100 = 1
32.55	Supervision 6 function	List	0…9	-	1 = 1
32.56	Supervision 6 action	List	0…3	-	1 = 1

No.	Name	Type	Range	Unit	FbEq32
32.57	Supervision 6 signal	Analog src	-	-	1 = 1
32.58	Supervision 6 filter time	Real	0.000…30.000	s	1000 = 1 s
32.59	Supervision 6 low	Real	-21474836.00… 21474836.00	-	100 = 1
32.60	Supervision 6 high	Real	-21474836.00… 21474836.00	-	100 = 1
32.61	Supervision 6 hysteresis	Real	0.00…100000.00	-	100 = 1
34 Timed functions					
34.01	Timed functions status	PB	0000h…FFFFh	-	1 = 1
34.02	Timer status	PB	0000h…FFFFh	-	1 = 1
34.04	Season/exception day status	PB	0000h…FFFFh	-	1 = 1
34.10	Timed functions enable	Binary src	-	-	1 = 1
34.11	Timer 1 configuration	PB	0000h…FFFFh	-	1 = 1
34.12	Timer 1 start time	Time	00:00:00…23:59:59	s	1 = 1 s
34.13	Timer 1 duration	Duration	00 00:00…07 00:00	min	1 = 1 min
34.14	Timer 2 configuration	PB	0000h…FFFFh	-	1 = 1
34.15	Timer 2 start time	Time	00:00:00…23:59:59	s	1 = 1 s
34.16	Timer 2 duration	Duration	00 00:00…07 00:00	min	1 = 1 min
34.17	Timer 3 configuration	PB	0000h…FFFFh	-	1 = 1
34.18	Timer 3 start time	Time	00:00:00…23:59:59	s	1 = 1 s
34.19	Timer 3 duration	Duration	00 00:00…07 00:00	min	1 = 1 min
34.20	Timer 4 configuration	PB	0000h…FFFFh	-	1 = 1
34.21	Timer 4 start time	Time	00:00:00…23:59:59	s	1 = 1 s
34.22	Timer 4 duration	Duration	00 00:00…07 00:00	min	1 = 1 min
34.23	Timer 5 configuration	PB	0000h…FFFFh	-	1 = 1
34.24	Timer 5 start time	Time	00:00:00…23:59:59	s	1 = 1 s
34.25	Timer 5 duration	Duration	00 00:00…07 00:00	min	1 = 1 min
34.26	Timer 6 configuration	PB	0000h…FFFFh	-	1 = 1
34.27	Timer 6 start time	Time	00:00:00…23:59:59	s	1 = 1 s
34.28	Timer 6 duration	Duration	00 00:00…07 00:00	min	1 = 1 min
34.29	Timer 7 configuration	PB	0000h…FFFFh	-	1 = 1

No.	Name	Type	Range	Unit	FbEq32
34.30	Timer 7 start time	Time	00:00:00…23:59:59	s	1 = 1 s
34.31	Timer 7 duration	Duration	00 00:00…07 00:00	min	1 = 1 min
34.32	Timer 8 configuration	PB	0000h…FFFFh	-	1 = 1
34.33	Timer 8 start time	Time	00:00:00…23:59:59	s	1 = 1 s
34.34	Timer 8 duration	Duration	00 00:00…07 00:00	min	1 = 1 min
34.35	Timer 9 configuration	PB	0000h…FFFFh	-	1 = 1
34.36	Timer 9 start time	Time	00:00:00…23:59:59	s	1 = 1 s
34.37	Timer 9 duration	Duration	00 00:00…07 00:00	min	1 = 1 min
34.38	Timer 10 configuration	PB	0000h…FFFFh	-	1 = 1
34.39	Timer 10 start time	Time	00:00:00…23:59:59	s	1 = 1 s
34.40	Timer 10 duration	Duration	00 00:00…07 00:00	min	1 = 1 min
34.41	Timer 11 configuration	PB	0000h…FFFFh	-	1 = 1
34.42	Timer 11 start time	Time	00:00:00…23:59:59	s	1 = 1 s
34.43	Timer 11 duration	Duration	00 00:00…07 00:00	min	1 = 1 min
34.44	Timer 12 configuration	PB	0000h…FFFFh	-	1 = 1
34.45	Timer 12 start time	Time	00:00:00…23:59:59	s	1 = 1 s
34.46	Timer 12 duration	Duration	00 00:00…07 00:00	min	1 = 1 min
34.60	Season 1 start date	Date	01.01…31.12	d	1 = 1 d
34.61	Season 2 start date	Date	01.01…31.12	d	1 = 1 d
34.62	Season 3 start date	Date	01.01…31.12	d	1 = 1 d
34.63	Season 4 start date	Date	01.01…31.12	d	1 = 1 d
34.70	Number of active exceptions	Real	0…16	-	1 = 1
34.71	Exception types	PB	0000h…FFFFh	-	1 = 1
34.72	Exception 1 start	Date	01.01…31.12	d	1 = 1 d
34.73	Exception 1 length	Real	0…60	d	1 = 1 d
34.74	Exception 2 start	Date	01.01…31.12	d	1 = 1 d
34.75	Exception 2 length	Real	0…60	d	1 = 1 d
34.76	Exception 3 start	Date	01.01…31.12	d	1 = 1 d
34.77	Exception 3 length	Real	0…60	d	1 = 1 d
34.78	Exception day 4	Date	01.01…31.12	d	1 = 1 d
34.79	Exception day 5	Date	01.01…31.12	d	1 = 1 d
34.80	Exception day 6	Date	01.01…31.12	d	1 = 1 d

No.	Name	Type	Range	Unit	FbEq32
34.81	Exception day 7	Date	01.01…31.12	d	1 = 1 d
34.82	Exception day 8	Date	01.01…31.12	d	1 = 1 d
34.83	Exception day 9	Date	01.01…31.12	d	1 = 1 d
34.84	Exception day 10	Date	01.01…31.12	d	1 = 1 d
34.85	Exception day 11	Date	01.01…31.12	d	1 = 1 d
34.86	Exception day 12	Date	01.01…31.12	d	1 = 1 d
34.87	Exception day 13	Date	01.01…31.12	d	1 = 1 d
34.88	Exception day 14	Date	01.01…31.12	d	1 = 1 d
34.89	Exception day 15	Date	01.01…31.12	d	1 = 1 d
34.90	Exception day 16	Date	01.01…31.12	d	1 = 1 d
34.100	Timed function 1	PB	0000h…FFFFh	-	1 = 1
34.101	Timed function 2	PB	0000h…FFFFh	-	1 = 1
34.102	Timed function 3	PB	0000h…FFFFh	-	1 = 1
34.110	Boost time function	PB	0000h…FFFFh	-	1 = 1
34.111	Boost time activation source	Binary src	-	-	1 = 1
34.112	Boost time duration	Duration	00 00:00…07 00:00	min	1 = 1 min
35 Motor thermal protection					
35.01	Motor estimated temperature	Real	-60…1000 °C or -76…1832 °F	°C or °F	1 = 1 °
35.02	Measured temperature 1	Real	-60…5000 °C or -76…9032 °F	°C, °F	1 = 1 unit
35.03	Measured temperature 2	Real	-60…5000 °C or -76…9032 °F	°C, °F	1 = 1 unit
35.05	Motor overload level	Real	0.0...300.0 %	%	
35.11	Temperature 1 source	List	-	-	1 = 1
35.12	Temperature 1 fault limit	Real	-60…5000 °C or -76…9032 °F	°C, °F	1 = 1 unit
35.13	Temperature 1 warning limit	Real	-60…5000 °C or -76…9032 °F	°C, °F	1 = 1 unit
35.14	Temperature 1 AI source	Analog src	-	-	1 = 1
35.21	Temperature 2 source	List	0…2, 5…78, 11…16, 19	-	1 = 1
35.22	Temperature 2 fault limit	Real	-60…5000 °C or -76…9032 °F	°C, °F	1 = 1 unit
35.23	Temperature 2 warning limit	Real	-60…5000 °C or -76…9032 °F	°C, °F	1 = 1 unit
35.24	Temperature 2 AI source	Analog src	-	-	1 = 1

No.	Name	Type	Range	Unit	FbEq32
35.50	Motor ambient temperature	Real	-60…100 °C or -76 … 212 °F	°C, °F	1 = 1 °
35.51	Motor load curve	Real	50…150	%	1 = 1%
35.52	Zero speed load	Real	50…150	%	1 = 1%
35.53	Break point	Real	1.00 … 500.00	Hz	100 = 1 Hz
35.54	Motor nominal temperature rise	Real	0…300 °C or 32…572 °F	°C or °F	1 = 1 °
35.55	Motor thermal time const	Real	100…10000	s	1 = 1 s
35.56	Motor overload action	List	0...2	-	1 = 1
35.57	Motor overload class	List	0...4	-	1 = 1
36 Load analyzer					
36.01	PVL signal source	Analog src	-	-	1 = 1
36.02	PVL filter time	Real	0.00…120.00	s	100 = 1 s
36.06	AL2 signal source	Analog src	-	-	1 = 1
36.07	AL2 signal scaling	Real	0.00…32767.00	-	100 = 1
36.09	Reset loggers	List	0…3	-	1 = 1
36.10	PVL peak value	Real	-32768.00…32767.00	-	100 = 1
36.11	PVL peak date	Data	1/1/1980...6/5/2159	-	1 = 1
36.12	PVL peak time	Data	-	-	1 = 1
36.13	PVL current at peak	Real	-32768.00…32767.00	A	100 = 1 A
36.14	PVL DC voltage at peak	Real	0.00…2000.00	V	100 = 1 V
36.15	PVL speed at peak	Real	-30000… 30000	rpm	100 = 1 rpm
36.16	PVL reset date	Data	1/1/1980...6/5/2159	-	1 = 1
36.17	PVL reset time	Data	-	-	1 = 1
36.20	AL1 0 to 10%	Real	0.00…100.00	%	100 = 1%
36.21	AL1 10 to 20%	Real	0.00…100.00	%	100 = 1%
36.22	AL1 20 to 30%	Real	0.00…100.00	%	100 = 1%
36.23	AL1 30 to 40%	Real	0.00…100.00	%	100 = 1%
36.24	AL1 40 to 50%	Real	0.00…100.00	%	100 = 1%
36.25	AL1 50 to 60%	Real	0.00…100.00	%	100 = 1%
36.26	AL1 60 to 70%	Real	0.00…100.00	%	100 = 1%
36.27	AL1 70 to 80%	Real	0.00…100.00	%	100 = 1%
36.28	AL1 80 to 90%	Real	0.00…100.00	%	100 = 1%
36.29	AL1 over 90%	Real	0.00…100.00	%	100 = 1%
36.40	AL2 0 to 10%	Real	0.00…100.00	%	100 = 1%

No.	Name	Type	Range	Unit	FbEq32
36.41	AL2 10 to 20%	Real	0.00…100.00	%	100 = 1%
36.42	AL2 20 to 30%	Real	0.00…100.00	%	100 = 1%
36.43	AL2 30 to 40%	Real	0.00…100.00	%	100 = 1%
36.44	AL2 40 to 50%	Real	0.00…100.00	%	100 = 1%
36.45	AL2 50 to 60%	Real	0.00…100.00	%	100 = 1%
36.46	AL2 60 to 70%	Real	0.00…100.00	%	100 = 1%
36.47	AL2 70 to 80%	Real	0.00…100.00	%	100 = 1%
36.48	AL2 80 to 90%	Real	0.00…100.00	%	100 = 1%
36.49	AL2 over 90%	Real	0.00…100.00	%	100 = 1%
36.50	AL2 reset date	Data	1/1/1980...6/5/2159	-	1 = 1
36.51	AL2 reset time	Data	-	-	1 = 1
40 Process PID set 1					
40.01	Process PID output actual	Real	-200000.00... 200000.00	%	100 = 1 PID customer unit
40.02	Process PID feedback actual	Real	-200000.00... 200000.00	PID customer units	100 = 1 PID customer unit
40.03	Process PID setpoint actual	Real	-200000.00... 200000.00	PID customer units	100 = 1 PID customer unit
40.04	Process PID deviation actual	Real	-200000.00... 200000.00	PID customer units	100 = 1 PID customer unit
40.06	Process PID status word	PB	0b0000…0b1111	-	1 = 1
40.07	Process PID operation mode	List	0…2	-	1 = 1
40.08	Set 1 feedback 1 source	Analog src	-	-	1 = 1
40.11	Set 1 feedback filter time	Real	0.000…30.000	s	1000 = 1 s
40.14	Set 1 setpoint scaling	Real	-200000.00... 200000.00	-	-
40.16	Set 1 setpoint 1 source	Analog src	-	-	1 = 1
40.24	Set 1 internal setpoint 0	Real	-200000.00... 200000.00	PID customer units	100 = 1 PID customer unit

No.	Name	Type	Range	Unit	FbEq32
40.26	Set 1 setpoint min	Real	-200000.00… 200000.00	-	100 = 1
40.27	Set 1 setpoint max	Real	-200000.00… 200000.00	-	100 = 1
40.28	Set 1 setpoint increase time	Real	0.0…1800.0	s	10 = 1 s
40.29	Set 1 setpoint decrease time	Real	0.0…1800.0	s	10 = 1 s
40.30	Set 1 setpoint freeze enable	Binary src	-	-	1 = 1
40.31	Set 1 deviation inversion	Binary src	0…1	-	1 = 1
40.32	Set 1 gain	Real	0.01…100.00	-	100 = 1
40.33	Set 1 integration time	Real	0.0…9999.0	s	10 = 1 s
40.34	Set 1 derivation time	Real	0.000…10.000	s	1000 = 1 s
40.35	Set 1 derivation filter time	Real	0.0…10.0	s	10 = 1 s
40.36	Set 1 output min	Real	-100.00…100.00	-	10 = 1
40.37	Set 1 output max	Real	-100.00…100.00	-	10 = 1
40.38	Set 1 output freeze enable	Binary src	-	-	1 = 1
40.39	Set 1 deadband range	Real	0.00…200000.00	-	100 = 1
40.40	Set 1 deadband delay	Real	0.0…3600.0	s	10 = 1 s
40.43	Set 1 sleep level	Real	0.0…200000.00	-	10 = 1
40.44	Set 1 sleep delay	Real	0.0…3600.0	s	10 = 1 s
40.45	Set 1 sleep boost time	Real	0.0…3600.0	s	10 = 1 s
40.46	Set 1 sleep boost step	Real	0.00…200000.00	PID customer units	100 = 1 PID customer unit
40.47	Set 1 wake-up deviation	Real	-200000.00… 200000.00	PID customer units	100 = 1 PID customer unit
40.48	Set 1 wake-up delay	Real	0.00…60.00	s	100 = 1 s
40.49	Set 1 tracking mode	Binary src	-	-	1 = 1
40.50	Set 1 tracking ref selection	Analog src	0…4	-	1 = 1
40.58	Set 1 increase prevention	Binary src	0…1	-	1 = 1

No.	Name	Type	Range	Unit	FbEq32
40.59	Set 1 decrease prevention	Binary src	0...1	-	1 = 1
40.60	Set 1 PID activation source	List	-	-	1 = 1
40.61	Setpoint scaling actual	Real	-200000.00... 200000.00	-	100 = 1
40.62	PID internal setpoint actual	Real	-200000.00... 200000.00	PID customer units	100 = 1 PID customer unit
40.70	Compensated setpoint	Real	-21474836.48… 21474835.20	PID unit 1	100 = 1 PID unit 1
40.71	Set 1 compensation input source	List	0…4, 5...9, 10…12, 15…16, 19…20, 24	-	1 = 1
40.72	Set 1 compensation input 1	Real	-200000.00… 200000.00	-	100 = 1
40.73	Set 1 compensated output 1	Real	-200000.00… 200000.00	-	100 = 1
40.74	Set 1 compensation input 2	Real	-200000.00… 200000.00	-	100 = 1
40.75	Set 1 compensated output 2	Real	-200000.00… 200000.00	-	100 = 1
40.76	Set 1 compensation non-linearity	Real	0…100	%	1= 1%
40.79	Set 1 units	List	0...31	Depends on selection	-
40.89	Set 1 setpoint multiplier	Real	-200000.00... 200000.00	-	-
40.90	Set 1 feedback multiplier	Real	-200000.00... 200000.00	-	100 = 1
40.91	Feedback data storage	Real	-327.68…327.67	-	100 = 1
40.92	Setpoint data storage	Real	-327.68…327.67	-	100 = 1
40.96	Process PID output%	Real	-100.00...100.00	%	-
40.97	Process PID feedback%	Real	-100.00...100.00	%	-
40.98	Process PID setpoint%	Real	-100.00...100.00	%	-
40.99	Process PID deviation%	Real	-100.00...100.00	%	-
46 Monitoring/scaling settings					
46.01	Speed scaling	Real	0.00…30000.00	rpm	100 = 1 rpm
46.02	Frequency scaling	Real	0.10…1000.00	Hz	100 = 1 Hz

No.	Name	Type	Range	Unit	FbEq32
46.03	Torque scaling	Real	0.1…1000.0	%	10 = 1%
46.04	Power scaling	Real	0.10…30000.00 kW or 0.10…40200.00 hp	kW or hp	10 = 1 unit
46.05	Current scaling	Real	0…30000	A	1 = 1 A
46.06	Speed ref zero scaling	Real	0.00 … 30000.00	rpm	100 = 1 rpm
46.07	Frequency ref zero scaling	Real	0.00 … 1000.00	Hz	100 = 1 Hz
46.11	Filter time motor speed	Real	2…20000	ms	1 = 1 ms
46.12	Filter time output frequency	Real	2…20000	ms	1 = 1 ms
46.13	Filter time motor torque	Real	2…20000	ms	1 = 1 ms
46.14	Filter time power	Real	2…20000	ms	1 = 1 ms
46.21	At speed hysteresis	Real	0.00…30000.00	rpm	100 = 1 rpm
46.22	At frequency hysteresis	Real	0.00…1000.00	Hz	100 = 1 Hz
46.31	Above speed limit	Real	0.00…30000.00	rpm	100 = 1 rpm
46.32	Above frequency limit	Real	0.00…1000.00	Hz	100 = 1 Hz
46.41	kWh pulse scaling	Real	0.001…1000.000	kWh	1000 = 1 kWh
46.43	Power decimals	Real	0...3	-	1 = 1
46.44	Current decimals	Real	0...3	-	1 = 1
49 Panel port communication					
49.01	Node ID number	Real	1…32	-	1 = 1
49.03	Baud rate	List	1…5	-	1 = 1
49.04	Communication loss time	Real	0.3…3000.0	s	10 = 1 s
49.05	Communication loss action	List	0…1	-	1 = 1
49.06	Refresh settings	List	0…1	-	1 = 1
50 Fieldbus adapter (FBA)					
50.01	FBA A enable	List	0…1	-	1 = 1
50.02	FBA A comm loss func	List	0, 1, 4, 5	-	1 = 1
50.03	FBA A comm loss t out	Real	0.3…6553.5	s	10 = 1 s
50.04	FBA A ref1 type	List	0...2, 4, 5	-	1 = 1
50.05	FBA A ref2 type	List	Not applicable		
50.06	FBA A SW sel	List	0…1	-	1 = 1
50.07	FBA A actual 1 type	List	-	-	1 = 1
50.08	FBA A actual 2 type	List	Not applicable		

No.	Name	Type	Range	Unit	FbEq32
50.09	FBA A SW transparent source	Analog src	-	-	1 = 1
50.10	FBA A act1 transparent source	Analog src	-	-	1 = 1
50.11	FBA A act2 transparent source	Analog src	Not applicable		
50.12	FBA A debug mode	List	0…1	-	1 = 1
50.13	FBA A control word	Data	0.0.0.0.0…FF.FF.FF.FF	-	1 = 1
50.14	FBA A reference 1	Real	-2147483648… 2147483647	-	1 = 1
50.15	FBA A reference 2	Real	Not applicable		
50.16	FBA A status word	Data	0.0.0.0.0…FF.FF.FF.FF	-	1 = 1
50.17	FBA A actual value 1	Real	-2147483648… 2147483647	-	1 = 1
50.18	FBA A actual value 2	Real	Not applicable		
51 FBA A settings					
51.01	FBA A type	List	-	-	1 = 1
51.02	FBA A Par2	Real	0…65535	-	1 = 1
…	…	…	…	…	
51.26	FBA A Par26	Real	0…65535	-	1 = 1
51.27	FBA A par refresh	List	0…1	-	1 = 1
51.28	FBA A par table ver	Data	0x0000…0xffff	-	1 = 1
51.29	FBA A drive type code	Real	0…65535	-	1 = 1
51.30	FBA A mapping file ver	Real	0…65535	-	1 = 1
51.31	D2FBA A comm status	List	0…6	-	1 = 1
51.32	FBA A comm SW ver	Data	0x0000…0xffff	-	1 = 1
51.33	FBA A appl SW ver	Data	0x0000…0xffff	-	1 = 1
52 FBA A data in					
52.01	FBA A data in1	List	-	-	1 = 1
…	…	…	…	…	
52.12	FBA A data in12	List	-	-	1 = 1
53 FBA A data out					
53.01	FBA A data out1	List	-	-	1 = 1
…	…	…	…	…	
53.12	FBA A data out12	List	-	-	1 = 1
58 Embedded fieldbus					
58.01	Protocol enable	List	0…1	-	1 = 1
58.02	Protocol ID	Real	0000h…FFFFh	-	1 = 1
58.03	Node address	Real	0…255	-	1 = 1

No.	Name	Type	Range	Unit	FbEq32
58.04	Baud rate	List	0…7	-	1 = 1
58.05	Parity	List	0…3	-	1 = 1
58.06	Communication control	List	0…2	-	1 = 1
58.07	Communication diagnostics	PB	0000h…FFFFh	-	1 = 1
58.08	Received packets	Real	0…4294967295	-	1 = 1
58.09	Transmitted packets	Real	0…4294967295	-	1 = 1
58.10	All packets	Real	0…4294967295	-	1 = 1
58.11	UART errors	Real	0…4294967295	-	1 = 1
58.12	CRC errors	Real	0…4294967295	-	1 = 1
58.14	Communication loss action	List	0, 1, 4, 5	-	1 = 1
58.15	Communication loss mode	List	1…2	-	1 = 1
58.16	Communication loss time	Real	0.0…6000.0	s	10 = 1 s
58.17	Transmit delay	Real	0…65535	ms	1 = 1 ms
58.18	EFB control word	PB	0000h…FFFFh	-	1 = 1
58.19	EFB status word	PB	0000h…FFFFh	-	1 = 1
58.25	Control profile	List	0, 5	-	1 = 1
58.26	EFB ref1 type	List	0…5	-	1 = 1
58.27	EFB ref2 type	List	Not applicable		
58.28	EFB act1 type	List	0…5	-	1 = 1
58.29	EFB act2 type	List	Not applicable		
58.31	EFB act1 transparent source	Analog src	-	-	1 = 1
58.32	EFB act2 transparent source	Analog src	Not applicable		
58.33	Addressing mode	List	0…2	-	1 = 1
58.34	Word order	List	0…1	-	1 = 1
58.101	Data I/O 1	Analog src	-	-	1 = 1
58.102	Data I/O 2	Analog src	-	-	1 = 1
58.103	Data I/O 3	Analog src	-	-	1 = 1
58.104	Data I/O 4	Analog src	-	-	1 = 1
58.105	Data I/O 5	Analog src	-	-	1 = 1

No.	Name	Type	Range	Unit	FbEq32
58.106	Data I/O 6	Analog src	-	-	1 = 1
58.107	Data I/O 7	Analog src	-	-	1 = 1
…	…	…	…	…	
58.114	Data I/O 14	Analog src	-	-	1 = 1
79 Solar pump control					
79.01	Solar status word1	PB	0b0000…0b1111	-	1 = 1
79.02	Solar status word2	PB	0b0000…0b1111	-	1 = 1
79.10	Operating mode	List	0, 1, 2, 3, 4, 5	-	1 = 1
79.11	Manual input source 1	List	0…10	-	1 = 1
79.12	Manual input source 2	List	See parameter 79.11	-	1 = 1
79.15	Enable tank level operation	Binary src	0…7	-	1 = 1
79.17	Tank low sensor	Binary src	0…7	-	1 = 1
79.18	Tank high sensor	Binary src	0…7	-	1 = 1
79.39	Pump start interlock	Binary src	0…7	-	1 = 1
79.41	Start DC voltage	Real	225…800	V	-
79.42	PV cell min voltage	Real	225…800	V	-
79.43	PV cell max voltage	Real	225…800	V	-
79.51	Pump minimum speed	Real	0…30000	rpm	-
79.52	Pump maximum speed	Real	0…30000	rpm	-
79.56	Boost voltage	Real	225…600	V	-
79.57	Boost factor	Real	0.75…1.50	-	-
79.61	Fault reset time	Real	1.0…1200.0	s	1 = 1
80 Flow calculation					
80.01	Calculated flow	Real	-200000.00…200000.00	m^3/h	100 = 1
80.02	Actual flow percentage	Real	-100.00…100.00	%	100 = 1
80.03	Total flow	Real	0.00…21474836.00	m^3/	100 = 1
80.04	Specific energy	Real	0.00…32767.95	m^3//kWh	100 = 1
80.05	Estimated pump head	Real	0.00…32767.00	m	100 = 1
80.06	Today’s flow	Real	0.00…21474836.00	m^3	100 = 1
80.07	Sensored flow	Real	0…2147483648	-	100 = 1

No.	Name	Type	Range	Unit	FbEq32
80.11	Flow feedback 1 source	List	0…3, 8…10	-	1 = 1
80.12	Flow feedback 2 source	List	0…3, 8…10	-	1 = 1
80.13	Flow function	List	0…1, 8…9, 100…101	-	1 = 1
80.14	Flow calc gain	Real	0.50...2.00	-	100 = 1
80.15	Maximum flow	Real	-200000.00… 200000.00	-	100 = 1
80.16	Minimum flow	Real	-200000.00… 200000.00	m^3/h	100 = 1
80.17	Maximum flow protection	List	0...2	-	1 = 1
80.18	Minimum flow protection	List	0...2	-	1 = 1
80.19	Flow check delay	Real	0.00...3600.00	s	100 = 1
80.22	Pump inlet diameter	Real	0.010...32767.000	m	100 = 1
80.23	Pump outlet diameter	Real	0.010...32767.000	m	100 = 1
80.26	Calc low speed	Real	0.00...32767.00	Hz	100 = 1
80.28	Density	Real	0.00...32767.00	kg/m^3	100 = 1
80.29	Total flow reset	List	0, 1	-	1 = 1
80.40	HQ curve H1	Real	0.00...32767.00	m	100 = 1
80.41	HQ curve H2	Real	0.00...32767.00	m	100 = 1
80.42	HQ curve H3	Real	0.00...32767.00	m	100 = 1
80.43	HQ curve H4	Real	0.00...32767.00	m	100 = 1
80.44	HQ curve H5	Real	0.00...32767.00	m	100 = 1
80.50	PQ curve P1	Real	0.00...32767.00	kW	100 = 1
80.51	PQ curve P2	Real	0.00...32767.00	kW	100 = 1
80.52	PQ curve P3	Real	0.00...32767.00	kW	100 = 1
80.53	PQ curve P4	Real	0.00...32767.00	kW	100 = 1
80.54	PQ curve P5	Real	0.00...32767.00	kW	100 = 1
80.60	Q value Q1	Real	0.00...200000.00	m^3/h	100 = 1
80.61	Q value Q2	Real	0.00...200000.00	m^3/h	100 = 1
80.62	Q value Q3	Real	0.00...200000.00	m^3/h	100 = 1
80.63	Q value Q4	Real	0.00...200000.00	m^3/h	100 = 1
80.64	Q value Q5	Real	0.00...200000.00	m^3/h	100 = 1
81 Sensor settings					
81.01	Actual inlet pressure	Real	0.00...32767.00	bar	100 = 1
81.02	Actual outlet pressure	Real	0.00...32767.00	bar	100 = 1
81.10	Inlet pressure source	Analog src	-	-	1 = 1

No.	Name	Type	Range	Unit	FbEq32
81.11	Outlet pressure source	Analog src	-	-	1 = 1
81.12	Sensors height difference	Real	0.00…32767.00	m	100 = 1
81.20	Pressure unit	List	0…3	-	1 = 1
81.21	Flow unit	List	0…1	-	1 = 1
81.22	Length unit	List	69, 72, 73, 27	-	1 = 1
81.23	Density unit	List	0…2	-	1 = 1
82 Pump protections					
82.02	Dry run source	List	0…8	-	1 = 1
82.30	Outlet minimum pressure protection	List	0…3	-	1 = 1
82.31	Outlet minimum pressure warning level	Real	0.00…32767.00	bar	100 = 1
82.32	Outlet minimum pressure fault level	Real	0.00…32767.00	bar	100 = 1
82.35	Outlet maximum pressure protection	List	0…3	-	1 = 1
82.37	Outlet maximum pressure warning level	Real	0.00…32767.00	bar	100 = 1
82.38	Outlet maximum pressure fault level	Real	0.00…32767.00	bar	100 = 1
82.40	Inlet minimum pressure protection	List	0…3	-	1 = 1
82.41	Inlet minimum pressure warning level	Real	0.00…32767.00	bar	100 = 1
82.42	Inlet minimum pressure fault level	Real	0.00…32767.00	bar	100 = 1
82.45	Pressure check delay	Real	0.00…3600.00	s	100 = 1
82.46	Dry run current limit	Real	0.00…3000.00	A	100 = 1
82.47	Dry run trip monitor time	Real	1.0…300.0	s	10 = 1
82.48	Dry run reset time	Real	1.0…18000.0	s	10 = 1
83 Pump cleaning					
83.01	Pump cleaning status	List	1…4	-	1 = 1
83.02	Pump cleaning progress	Real	0…100	%	1 = 1
83.03	Total cleaning count	Real	0…1000000	-	1 = 1
83.10	Pump cleaning action	Binary src	-	-	-
83.11	Pump cleaning triggers	PB	0000h…FFFFh	-	1 = 1

No.	Name	Type	Range	Unit	FbEq32
83.12	Start pump cleaning	Binary src	0...4	-	1 = 1
83.15	Fixed time interval	Time	00:00:00…45:12:15	s	1 = 1
83.16	Cycles in cleaning program	Real	1...65535	-	1 = 1
83.20	Cleaning speed step	Real	0...3000	rpm	1 = 1
83.25	Time to cleaning speed	Real	0.000...60.000	s	1 = 1
83.26	Time to zero-speed	Real	0.000...60.000	s	1 = 1
83.27	Cleaning on time	Real	0.000...1000.000	s	1 = 1
83.28	Cleaning off time	Real	0.000...1000.000	s	1 = 1
83.35	Cleaning count fault	Binary src	-	-	1 = 1
83.36	Cleaning count time	Time	00:00:00...45:23:59	s	1 = 1
83.37	Maximum cleaning count	Real	0...30	-	1 = 1
83.41	Pump cleaning time 1	Time	00:00:00...23:59:59	-	1 = 1
83.42	Pump cleaning time 2	Time	00:00:00...23:59:59	-	1 = 1
83.43	Pump cleaning time 3	Time	00:00:00...23:59:59	-	1 = 1
83.44	Pump cleaning time 4	Time	00:00:00...23:59:59	-	1 = 1
83.45	Pump cleaning time 5	Time	00:00:00...23:59:59	-	1 = 1
95 HW configuration					
95.01	Supply voltage	List	0, 2	-	1 = 1
95.02	Adaptive voltage limits	List	0…1	-	1 = 1
95.03	Estimated AC supply voltage	Real	0…65535	V	1 = 1 V
95.04	Control board supply	List	0…1	-	1 = 1
95.15	Special HW settings	PB	0b0000…0b1111	-	1 = 1
95.20	HW options word 1	PB	0b0000…0b1111	-	1 = 1
95.26	Motor disconnect switch	List	0, 1	-	1 = 1
95.200	Cooling fan mode	List	0, 1	-	1 = 1
96 System					
96.01	Language	List	0, 1033, 2052	-	1 = 1
96.02	Pass code	Data	-	-	1 = 1
96.03	Access level status	PB	0b0000...0b1111	-	1 = 1
96.04	Macro select	List	0, 1, 13...27	-	1 = 1
96.05	Macro active	List	0, 1, 13...27	-	1 = 1
96.06	Parameter restore	List	-	-	1 = 1

No.	Name	Type	Range	Unit	FbEq32
96.07	Parameter save manually	List	0, 1	-	1 = 1
96.08	Control board boot	List	0, 1	-	1 = 1
96.10	User set status	List	0...11	-	1 = 1
96.11	User set save/load	List	0...5, 18...21	-	1 = 1
96.12	User set I/O mode in1	Binary src	-	-	1=1
96.13	User set I/O mode in2	Binary src	-	-	1=1
96.16	Unit selection	PB	0b0000...0b1111	-	1 = 1
96.20	Time sync primary source	List	-	-	1 = 1
96.24	Full days since 1st Jan 1980	Real	1…59999	-	1 = 1
96.25	Time in minutes within 24 h	Real	0…1439	-	1 = 1
96.26	Time in ms within one minute	Real	0…59999	-	1 = 1
96.51	Clear fault and event logger	Real	0…1	-	1 = 1
(Parameters 96.100…96.102 only visible when enabled by parameter 96.02)					
96.70	Disable adaptive program	List	0...1	-	1 = 1
96.78	Legacy Modbus mapping	List	0...1	-	1 = 1
96.79	Legacy control profile	List	0...3	-	1 = 1
96.100	Change user pass code	Data	10000000…99999999	-	1 = 1
96.101	Confirm user pass code	Data	10000000…99999999	-	1 = 1
96.102	User lock functionality	PB	0000h…FFFFh	-	1 = 1
97 Motor control					
97.01	Switching frequency reference	List	-	kHz	1 = 1 kHz
97.02	Minimum switching frequency	List	-	kHz	1 = 1 kHz
97.13	IR compensation	Real	0.00…50.00	%	100 = 1%
97.20	U/F ratio	List	0…20	-	1 = 1
97.48	Udc stabilizer	List	0, 50, 100, 300, 500, 800	-	1 = 1
97.49	Slip gain for scalar	Real	0...200	%	1 = 1%
97.94	IR comp max frequency	Real	1.0...200.0	%	10 = 1%
97.135	Udc ripple	Real	0.0...200.0	V	10 = 1 V

No.	Name	Type	Range	Unit	FbEq32
98 User motor parameters					
98.01	User motor model mode	List	0…1	-	1 = 1
98.02	Rs user	Real	0.0000…0.50000	p.u.	100000 = 1 p.u.
98.03	Rr user	Real	0.0000…0.50000	p.u.	100000 = 1 p.u.
98.04	Lm user	Real	0.00000…10.00000	p.u.	100000 = 1 p.u.
98.05	SigmaL user	Real	0.00000…1.00000	p.u.	100000 = 1 p.u.
98.06	Ld user	Real	0.00000…10.00000	p.u.	100000 = 1 p.u.
98.07	Lq user	Real	0.00000…10.00000	p.u.	100000 = 1 p.u.
98.08	PM flux user	Real	0.00000…2.00000	p.u.	100000 = 1 p.u.
98.09	Rs user SI	Real	0.00000…100.00000	ohm	100000 = 1 p.u.
98.10	Rr user SI	Real	0.00000…100.00000	ohm	100000 = 1 p.u.
98.11	Lm user SI	Real	0.00…100000.00	mH	100 = 1 mH
98.12	SigmaL user SI	Real	0.00…100000.00	mH	100 = 1 mH
98.13	Ld user SI	Real	0.00…100000.00	mH	100 = 1 mH
98.14	Lq user SI	Real	0.00…100000.00	mH	100 = 1 mH
99 Motor data					
99.03	Motor type	List	0...2	-	1 = 1
99.04	Motor control mode	List	0…1	-	1 = 1
99.06	Motor nominal current	Real	0...32767.0	A	10 = 1 A
99.07	Motor nominal voltage	Real	0...32767.0	V	10 = 1 V
99.08	Motor nominal frequency	Real	0.0 … 500.0	Hz	10 = 1 Hz
99.09	Motor nominal speed	Real	0 … 30000	rpm	1 = 1 rpm
99.10	Motor nominal power	Real	0.00…10000.00 kW or 0.00 … 13404.83 hp	kW or hp	100 = 1 unit
99.11	Motor nominal cos ?	Real	0.00 … 1.00	-	100 = 1
99.12	Motor nominal torque	Real	0.000… 4000000.000 N·m or 0.000… 2950248.597 lb·ft	N·m or lb·ft	1000 = 1 unit
99.13	ID run requested	List	-	-	1 = 1

No.	Name	Type	Range	Unit	FbEq32
99.14	Last ID run performed	List	-	-	1 = 1
99.15	Motor polepairs calculated	Real	0…1000	-	1 = 1
99.16	Motor phase order	List	0…1	-	1 = 1

8

Fault tracing

What this chapter contains

The chapter lists the warning and fault messages including possible causes and corrective actions. The causes of most warnings and faults can be identified and corrected using the information in this chapter. If not, contact an ABB service representative. If you have a possibility to use the Drive composer PC tool, send the Support package created by the Drive composer to the ABB service representative.

Warnings and faults are listed below in separate tables. Each table is sorted by warning/fault code.

Safety

WARNING! Only qualified electricians are allowed to service the drive. Read the instructions in chapter Safety instructions at the beginning of the *Hardware manual* of the drive before working on the drive.

Indications

Warnings and faults

Warnings and faults indicate an abnormal drive status. The codes of active warnings and faults are displayed on the control panel of the drive as well as in the Drive composer PC tool with warning and fault names. Only the codes of warnings and faults are available over fieldbus.

Warnings do not need to be reset; they stop showing when the cause of the warning ceases. Warnings do not latch and the drive will continue to operate the motor.

Faults latch inside the drive and cause the drive to trip, and the motor stops. After the cause of a fault has been removed, the fault can be reset from a selectable source (parameter 31.11 Fault reset selection) such as the control panel, Drive composer PC tool, the digital inputs of the drive, or fieldbus. Reseting the fault creates an event 64FF Fault reset. After the reset, the drive can be restarted.

Note that some faults require a reboot of the control unit either by switching the power off and on, or using parameter 96.08 Control board boot – this is mentioned in the fault listing wherever appropriate.

Pure events

In addition to warnings and faults, there are pure events that are only recorded in the event log of the drive. The codes of these events are included in the Warning messages table on page (306).

Editable messages

For external events, the action (fault or warning), name and the message text can be edited. To specify external events, use parameter 31 Fault functions.

Warning/fault history

Event log

All indications are stored in the event log with a time stamp and other information. The event log stores information on

- the last 8 fault recordings, that is, faults that tripped the drive or fault resets
- the last 10 warnings or pure events that occurred.

See section Viewing warning/fault information on page 304.

Auxiliary codes

Some events generate an auxiliary code that often helps in pinpointing the problem. On the control panel, the auxiliary code is stored as part of the details of the event; in the Drive composer PC tool, the auxiliary code is shown in the event listing.

Viewing warning/fault information

The drive is able to store a list of the active faults actually causing the drive to trip at the present time. The drive also stores a list of faults and warnings that have previously occurred.

For active faults and warnings, see

- **Menu** ≡ **- Diagnostics** 🩺 **- Active faults** ⊗ 0
- **Menu** ≡ **- Diagnostics** 🩺 **- Active warnings** ⚠ 0
- parameters in group 04 Warnings and faults (page 89).

For previously occurred faults, see

- **Menu** ≡ **- Diagnostics** 🩺 **- Fault history** ⊗☰
- parameters in group 04 Warnings and faults (page 89).

The event log can also be accessed (and reset) using the Drive composer PC tool. See *Drive composer PC tool user's manual* (3AUA0000094606 [English]).

Warning messages

Note: The list also contains events that only appear in the Event log.

Code (hex)	**Warning / Aux. code** (*aux code visible only on assistant control panel and drive composer*)	**Cause**	**What to do**
64FF	Fault reset	A fault has been reset from the panel, Drive composer PC tool, fieldbus or I/O.	Event. Informative only.
A2A1	Current calibration	Current offset and gain measurement calibration will occur at next start.	Informative warning. (See parameter 99.13 ID run requested).
A2B1	Overcurrent	Output current has exceeded internal fault limit. In addition to an actual overcurrent situation, this warning may also be caused by an earth fault or supply phase loss.	Check motor load. Check acceleration times in parameter group 23 Speed reference ramp (speed control) (torque control) or 28 Frequency reference chain (frequency control). Also check parameter 46.03 Torque scaling. Check motor and motor cable (including phasing and delta/star connection). Check for an earth fault in motor or motor cables by measuring the insulation resistances of motor and motor cable. See chapter *Electrical installation*, section Checking the insulation of the assembly in the *Hardware manual* of the drive. Check there are no contactors opening and closing in motor cable. Check that the startup data in parameter group 99 Motor data corresponds to the motor rating plate. Check that there are no power factor correction capacitors or surge absorbers in motor cable.

Code (hex)	**Warning / Aux. code** (*aux code visible only on assistant control panel and drive composer*)	**Cause**	**What to do**
A2B3	Earth leakage	Drive has detected load unbalance typically due to earth fault in motor or motor cable.	Check there are no power factor correction capacitors or surge absorbers in motor cable. Check for an earth fault in motor or motor cables by measuring the insulation resistances of motor and motor cable. See chapter *Electrical installation*, section Checking the insulation of the assembly in the *Hardware manual* of the drive. If an earth fault is found, fix or change the motor cable and/or motor. If no earth fault can be detected, contact your local ABB representative.
A2B4	Short circuit	Short-circuit in motor cable(s) or motor.	Check motor and motor cable for cabling errors. Check motor and motor cable (including phasing and delta/star connection). Check for an earth fault in motor or motor cables by measuring the insulation resistances of motor and motor cable. See chapter *Electrical installation*, section Checking the insulation of the assembly in the *Hardware manual* of the drive. Check there are no power factor correction capacitors or surge absorbers in motor cable.
	01	a short circuit in the upper IGBT of the U-phase	
	02	a short circuit in the lower IGBT of the U-phase	
	04	a short circuit in the upper IGBT of the V-phase	
	08	a short circuit in the lower IGBT of the V-phase	
	10	a short circuit in the upper IGBT of the W-phase	
	20	a short circuit in the lower IGBT of the W-phase	
	40	DC capacitor short circuit	

Code (hex)	**Warning / Aux. code** (*aux code visible only on assistant control panel and drive composer*)	**Cause**	**What to do**
A2BA	IGBT overload	Excessive IGBT junction to case temperature. This warning protects the IGBT(s) and can be activated by a short circuit in the motor cable.	Check motor cable. Check ambient conditions. Check air flow and fan operation. Check heatsink fins for dust pick-up. Check motor power against drive power.
A3A1	DC link overvoltage	Intermediate circuit DC voltage too high (when the drive is stopped).	Check the supply voltage setting (parameter 95.01 Supply voltage). Note that the wrong setting of the parameter may cause the motor to rush uncontrollably. Check the supply voltage. If the problem persists, contact your local ABB representative.
A3A2	DC link undervoltage	Intermediate circuit DC voltage too low (when the drive is stopped).	
A3AA	DC not charged	The voltage of the intermediate DC circuit has not yet risen to operating level.	
A490	Incorrect temperature sensor setup	Sensor type mismatch	Check the settings of temperature source parameters 35.11 and 35.21 against 91.21 and 91.25.
A491	External temperature 1 (Editable message text)	Measured temperature 1 has exceeded warning limit.	Check the value of parameter 35.02 Measured temperature 1. Check the cooling of the motor (or other equipment whose temperature is being measured). Check the value of 35.13 Temperature 1 warning limit.
A492	External temperature 2 (Editable message text)	Measured temperature 2 has exceeded warning limit.	Check the value of parameter 35.03 Measured temperature 2. Check the cooling of the motor (or other equipment whose temperature is being measured). Check the value of 35.23 Temperature 2 warning limit.
A4A0	Control board temperature.	Control board temperature is excessive. 1 – Sensor fault.	Check the sensor and change the control board.

Code (hex)	**Warning / Aux. code** (*aux code visible only on assistant control panel and drive composer*)	**Cause**	**What to do**
A4A1	IGBT overtemperature	Estimated drive IGBT temperature is excessive.	Check ambient conditions. Check air flow and fan operation. Check heatsink fins for dust pick-up. Check motor power against drive power.
A4A9	Cooling	Drive module temperature is excessive.	Check ambient temperature. If it exceeds 40%/104 °F (frames R4…R8) or if it exceeds 50% /122 °F (frames R0…R8), ensure that load current does not exceed derated load capacity of drive. See chapter *Technical data*, section Derating in the *Hardware manual* of the drive. Check drive module cooling air flow and fan operation. Check inside of cabinet and heatsink of drive module for dust pick-up. Clean whenever necessary.
A4B0	Excess temperature	Power unit module temperature is excessive.	Check ambient conditions. Check air flow and fan operation. Check heatsink fins for dust pick-up. Check motor power against drive power.
A4B1	Excess temperature difference	High temperature difference between the IGBTs of different phases.	Check the motor cabling. Check cooling of drive module(s).
A4F6	IGBT temperature	Drive IGBT temperature is excessive.	Check ambient conditions. Check air flow and fan operation. Check heatsink fins for dust pick-up. Check motor power against drive power.

Code (hex)	Warning / Aux. code (*aux code visible only on assistant control panel and drive composer*)	Cause	What to do
A580	PU communication	Communication errors between drive control unit and power unit.	Check connections between drive control unit and power unit and value of parameter 95.04 Control board supply.
A581	Fan	Cooling fan feedback missing.	Check the auxiliary code to identify the fan. Code 0 denotes main fan 1. Other codes (format XYZ): “X” specifies state code (1: ID run, 2: normal). “Y” = 0, “Z” specifies the index of the fan (1: Main fan 1, 2: Main fan 2, 3: Main fan 3). Check fan operation and connection. Replace fan if faulty.
A582	Auxiliary fan missing	An auxiliary cooling fan (connected to the fan connectors on the control board) is stuck or disconnected.	Check the auxiliary code. Check auxiliary fan(s) and connection(s). Replace faulty fan. Make sure the front cover of the drive is in place and tightened. If the commissioning of the drive requires that the cover is off, this warning will be generated even if the corresponding fault is defeated. See fault 5081 Auxiliary fan broken (page 327).
	0001	Auxiliary fan 1 missing.	
	0002	Auxiliary fan 2 missing.	
A591	Drive HW initialization.	Drive hardware setup is initializing. 1 - Initializing HW settings for the first time.	See auxiliary code.
A5A0	Safe torque off Programmable warning: 31.22 STO indication run/stop	Safe torque off function is active, ie safety circuit signal(s) connected to connector STO is lost.	Check safety circuit connections. For more information, chapter The Safe torque off function in the *Hardware manual* of the drive and description of parameter 31.22 STO indication run/stop (page 146). Check the value of parameter 95.04 Control board supply.

Code (hex)	**Warning / Aux. code** (*aux code visible only on assistant control panel and drive composer*)	**Cause**	**What to do**
A5EA	Measurement circuit temperature	Problem with internal temperature measurement of the drive.	Contact your local ABB representative.
A5EB	PU board powerfail	Power unit power supply failure.	Contact your local ABB representative.
A5ED	Measurement circuit ADC	Measurement circuit fault.	Contact your local ABB representative.
A5EE	Measurement circuit DFF	Measurement circuit fault.	Contact your local ABB representative.
A5EF	PU state feedback	State feedback from output phases does not match control signals.	Contact your local ABB representative.
A5F0	Charging feedback	Charging feedback signal missing.	Check the feedback signal coming from the charging system.
A5F1	Redundant measurement	Duplicated measurements are beyond limits.	Contact your local ABB representative.
A5F2	Overtemperature hw	Excessive hardware temperature.	Contact your local ABB representative.
A682	Flash erase speed	The flash memory (in the memory unit) has been erased too frequently, compromising the lifetime of the memory.	Avoid forcing unnecessary parameter saves by parameter 96.07 Parameter save manually or cyclic parameter writes (such as user logger triggering through parameters). Check the auxiliary code (format XYYY YZZZ). "X" specifies the source of warning (1: generic flash erase supervision). "ZZZ" specifies the flash subsector number that generated the warning.
A6A4	Motor nominal value	The motor parameters are set incorrectly. The drive is not dimensioned correctly.	Check the auxiliary code. See actions for each code below.

Code (hex)	Warning / Aux. code (*aux code visible only on assistant control panel and drive composer*)	Cause	What to do
	1	Slip frequency is too small.	Check the settings of the motor configuration parameters in groups 98 and 99. Check that the drive is sized correctly for the motor.
	2	Synchronous and nominal speeds differ too much.	
	3	Nominal speed is higher than synchronous speed with 1 pole pair.	
	4	Nominal current is outside limits	
	5	Nominal voltage is outside limits.	
	6	Nominal power is higher than apparent power.	
	7	Nominal power not consistent with nominal speed and torque.	
A6A5	No motor data	Parameters in group 99 have not been set.	Check that all the required parameters in group 99 have been set. **Note:** It is normal for this warning to appear during the startup and continue until the motor data is entered.
A6A6	Voltage category unselected	The voltage category has not been defined.	Set voltage category in parameter 95.01 Supply voltage.
A6A7	System time not set	System time is not set.	
A6B0	User lock is open	The user lock is open, ie. user lock configuration parameters 96.100…96.102 are visible.	Close the user lock by entering an invalid pass code in parameter 96.02 Pass code. See section User lock (page 69).
A6B1	User pass code not confirmed	A new user pass code has been entered in parameter 96.100 but not confirmed in 96.101.	Confirm the new pass code by entering the same code in 96.101. To cancel, close the user lock without confirming the new code. See section User lock (page 69).

Code (hex)	**Warning / Aux. code** (*aux code visible only on assistant control panel and drive composer*)	**Cause**	**What to do**
A6D1	FBA A parameter conflict	The drive does not have a functionality requested by a PLC, or requested functionality has not been activated.	Check PLC programming. Check settings of parameter groups 50 Fieldbus adapter (FBA).
A6E5	AI parametrization	The current/voltage hardware setting of an analog input does not correspond to parameter settings.	Check the event log for an auxiliary code. The code identifies the analog input whose settings are in conflict. Adjust either the hardware setting (on the drive control unit) or parameter 12.15/12.25. **Note:** Control board reboot (either by cycling the power or through parameter 96.08 Control board boot) is required to validate any changes in the hardware settings.
A780	Motor stall (Programmable warning: 31.24 Stall function)	Motor is operating in stall region.	Check motor load, drive ratings and fault function parameters.
A783	Motor overload	Motor current is too high.	Check for overloaded motor Adjust the parameters used for the motor overload function. (35.51…35.53, 35.55, 35.56)
A784	Motor disconnect	All three output phases are disconnected from motor.	Check if parameter 95.26 enables the use of a motor disconnect switch. If not, check the following: • All switches between drive and motor are closed. • All cables between drive and motor are connected and secured. If no issue was detected and drive output was actually connected to motor, contact ABB.

Code (hex)	**Warning / Aux. code** (*aux code visible only on assistant control panel and drive composer*)	**Cause**	**What to do**
A7AB	Built in/Extension I/O configuration failure	The I/O built in/extension module is not connected to the device properly.	Make sure that the I/O built in/extension module is connected to the device.
A7AC	I/O Module internal error	Calibration data is not stored in the I/O module. Analog signals are not working with full accuracy.	Replace I/O module.
A7C1	FBA A communication Programmable warning: 50.02 FBA A comm loss func	Cyclical communication between drive and fieldbus adapter module A or between PLC and fieldbus adapter module A is lost.	Check status of fieldbus communication. See user documentation of fieldbus interface. Check settings of parameter groups 50 Fieldbus adapter (FBA), 51 FBA A settings, 52 FBA A data in and 53 FBA A data out. Check cable connections. Check if communication master is able to communicate.
A7CE	EFB comm loss Programmable warning: 58.14 Communication loss action	Communication break in embedded fieldbus (EFB) communication.	Check the status of the fieldbus master (online/offline/error etc.). Check cable connections to the EIA-485/X5 terminals 29, 30 and 31 on the control unit.
A7EE	Panel loss Programmable warning: 49.05 Communication loss action	Control panel or PC tool selected as active control location for drive has ceased communicating.	Check PC tool or control panel connection. Check control panel connector. Check mounting platform if being used. Disconnect and reconnect the control panel.
A88F	Cooling fan		Replace the drive cooling fan.
	RO life warning	The relay has changed states more than the recommended number of times.	Change the control board or stop using the relay output.
	0001	Relay output 1	Change the control board or stop using relay output 1.

Code (hex)	**Warning / Aux. code** (*aux code visible only on assistant control panel and drive composer*)	**Cause**	**What to do**
	0002	Relay output 2	Change the control board or stop using relay output 2.
	0003	Relay output 3	Change the control board or stop using relay output 3.
A8A0	AI supervision	Analog signal is beyond limits.	Check the signal level, input wiring, and the defined limits.
	1 – AI1 less minimum 2 – AI1 greater maximum	3 – AI2 less minimum 4 – AI2 greater maximum	
A8A1	RO life warning	The relay has changed states more than the recommended number of times.	Change the control board or stop using the relay output.
	0001	Relay output 1	Change the control board or stop using relay output 1.
	0002	Relay output 2	Change the control board or stop using relay output 2.
	0003	Relay output 3	Change the control board or stop using relay output 3.
A8A2	RO toggle warning	The relay output is changing states faster than recommended, eg. if a fast changing frequency signal is connected to it. The relay lifetime will be exceeded shortly.	Replace the signal connected to the relay output source with a less frequently changing signal.
	0001	Relay output 1	Select a different signal with parameter 10.24 RO1 source.
	0002	Relay output 2	Select a different signal with parameter 10.27 RO2 source.
	0003	Relay output 3	Select a different signal with parameter 10.30 RO3 source.
A8B0	Signal supervision 1 (Editable message text) Programmable warning: 32.06 Supervision 1 action	Warning generated by the signal supervision function 1.	Check the source of the warning (parameter 32.07 Supervision 1 signal).

Code (hex)	**Warning / Aux. code** (*aux code visible only on assistant control panel and drive composer*)	**Cause**	**What to do**
A8B1	Signal supervision 2 (Editable message text) Programmable warning: 32.16 Supervision 2 action	Warning generated by the signal supervision function 2.	Check the source of the warning (parameter 32.17 Supervision 2 signal).
A8B2	Signal supervision 3 (Editable message text) Programmable warning: 32.26 Supervision 3 action	Warning generated by the signal supervision function 3.	Check the source of the warning (parameter 32.27 Supervision 3 signal).
A8B3	Signal supervision 4 (Editable message text) Programmable warning: 32.36 Supervision 4 action	Warning generated by the signal supervision function 4.	Check the source of the warning (parameter 32.37 Supervision 4 signal).
A8B4	Signal supervision 5 (Editable message text) Programmable warning: 32.46 Supervision 5 action	Warning generated by the signal supervision function 5.	Check the source of the warning (parameter 32.47 Supervision 5 signal).
A8B5	Signal supervision 6 (Editable message text) Programmable warning: 32.56 Supervision 6 action	Warning generated by the signal supervision function 6.	Check the source of the warning (parameter 32.57 Supervision 6 signal).
A8B6	Current limit warning	Motor actual current exceeded the limit defined in parameter 30.17 Maximum current.	Reduce the motor load. Check for any jam or stall in motor.

Code (hex)	**Warning / Aux. code** (*aux code visible only on assistant control panel and drive composer*)	**Cause**	**What to do**
A981	External warning 1 (Editable message text) Programmable warning: 31.01 External event 1 source 31.02 External event 1 type	Fault in external device 1.	Check the external device. Check setting of parameter 31.01 External event 1 source.
A982	External warning 2 (Editable message text) Programmable warning: 31.03 External event 2 source 31.04 External event 2 type	Fault in external device 2.	Check the external device. Check setting of parameter 31.03 External event 2 source.
A983	External warning 3 (Editable message text) Programmable warning: 31.05 External event 3 source 31.06 External event 3 type	Fault in external device 3.	Check the external device. Check setting of parameter 31.05 External event 3 source.
A984	External warning 4 (Editable message text) Programmable warning: 31.07 External event 4 source 31.08 External event 4 type	Fault in external device 4.	Check the external device. Check setting of parameter 31.07 External event 4 source.
A985	External warning 5 (Editable message text) Programmable warning: 31.09 External event 5 source 31.10 External event 5 type	Fault in external device 5.	Check the external device. Check setting of parameter 31.09 External event 5 source.
AFAA	Autoreset	A fault is about to be autoreset.	Informative warning. See the settings in parameter group 31 Fault functions.

Code (hex)	**Warning / Aux. code** (*aux code visible only on assistant control panel and drive composer*)	**Cause**	**What to do**
AFE1	Emergency stop (off2)	Emergency stop (mode selection off2) command.	Check that it is safe to continue operation. Then return emergency stop push button to normal position. Restart drive.
AFE2	Emergency stop (off1 or off3)	Emergency stop (mode selection off1 or off3) command.	
AFE9	Start delay	The start delay is active and the drive will start the motor after a predefined delay.	Informative warning. See parameter 21.22 Start delay.
AFEC	External power signal missing	95.04 Control board supply is set to *External 24V* but no voltage is connected to the control unit.	Check the external 24 V DC power supply to the control unit, or change the setting of parameter 95.04.
AFF5	Override new start required	The Safe torque off function was active and has been reset while in Override.	A new start signal is required to start the drive again.
AFF6	Identification run	Motor ID run will occur at next start.	Informative warning.
AF90	Speed controller autotuning	The speed controller autotune routine did not complete successfully.	Check the auxiliary code. See actions for each code below.
	0000	Drive was stopped before the autotune was complete.	Start the drive and repeat autotune until successful.
	0001	The drive was started and it was not ready to follow the autotune command.	Make sure the prerequisites of the autotune run are fulfilled.
	0002	Required torque reference could not be reached before the drive reached maximum speed.	Decrease the torque step (parameter 25.38) or increase the speed step (parameter 25.39).
	0003	Motor could not accelerate/ to maximum speed.	Increase the torque step (parameter 25.38) or decrease the speed step (parameter 25.39).
	0004	Motor could not decelerate to minimum speed.	Increase the torque step (parameter 25.38) or decrease the speed step (parameter 25.39).

Code (hex)	**Warning / Aux. code** (*aux code visible only on assistant control panel and drive composer*)	**Cause**	**What to do**
	0005	Motor could not decelerate with full autotune torque.	Decrease the torque step (parameter 25.38) or the speed step (parameter 25.39).
	0006	Autotune could not write a parameter.	Run the drive one more time.
	0007	Drive was ramping down when the autotune was activated.	Run the drive to the set point and start the autotune one more time.
	0008	Drive was ramping up when the autotune was activated.	Wait until the drive reaches the set point and start autotune.
	0009	Drive was running outside of autotune speed limits during the autotune activation.	Check the limits, set the correct setpoint and repeat the autotune.
B5F6	Identification run	Motor ID run completed successfully.	Informative warning.
B5A0	STO event Programmable event:31.22 STO indication run/stop	Safe torque off function is active, ie. safety circuit signal(s) connected to connector STO is lost.	Check safety circuit connections. For more information, see chapter The Safe torque off function in the *Hardware manual* of the drive and description of parameter 31.22 STO indication run/stop (page 146).
D505	Max cleaning warning Programmable warning: 83.35 Cleaning count fault	Maximum number of cleanings are reached in defined time. The Pump cleaning is unable to clean the pump and hence, manual cleaning is required.	Check the pump for blockages. Clean the pump manually if needed. Check parameters 83.35 Cleaning count fault to 83.37 Maximum cleaning count.
D506	Pump cleaning not possible	Pump cleaning not started as the drive is not in remote control.	Set the drive to remote control mode.
D507	Pump cleaning needed	Dirt detection indicates that the pump needs cleaning but automatic pump cleaning is not allowed.	Perform pump cleaning manually. Start pump cleaning by changing parameter 83.12 Start pump cleaning to Start cleaning now.

Code (hex)	**Warning / Aux. code** (*aux code visible only on assistant control panel and drive composer*)	**Cause**	**What to do**
D50C	Maximum flow protection Programmable warning:80.17 Maximum flow protection	Actual flow is exceeded the defined warning level.	Check the system for leakages. Check flow protection settings in parameters 80.15 Maximum flow, 80.17 Maximum flow protection, and 80.19 Flow check delay.
D50D	Minimum flow protection Programmable warning: 80.18 Minimum flow protection	Actual flow is below the defined warning level.	Check that the inlet and outlet valves are open. Check flow protection settings in parameters 80.16 Maximum flow, 80.18 Minimum flow protection, and 80.19 Flow check delay.
D50E	Outlet minimum pressure Programmable warning: 82.30 Outlet minimum pressure protection	Measured outlet pressure is below the defined warning limit.	Check the pump outlet for leakages. Check the configuration of outlet pressure protection. See parameters 82.30 Outlet minimum pressure protection and 82.31 Outlet minimum pressure warning level.
D50F	Outlet maximum pressure Programmable warning: 82.35 Outlet maximum pressure protection	Measured outlet pressure is above the defined warning limit.	Check the pump outlet for blockages or closed valve. Check the configuration of outlet pressure protection. See parameters 82.35 Outlet maximum pressure protection and 82.37 Outlet maximum pressure warning level
D510	Inlet minimum pressure Programmable warning: 82.40 Inlet minimum pressure protection	Measured inlet pressure is below the defined warning level.	Check the pump inlet for blockages or closed valve. Check the configuration of inlet pressure protection. See parameters 82.40 Inlet minimum pressure protection and 82.41 Inlet minimum pressure warning level

Code (hex)	**Warning / Aux. code** (*aux code visible only on assistant control panel and drive composer*)	**Cause**	**What to do**
D5B0	Pump min speed	This alarm occurs when the start command is provided and the actual speed of the motor (01.01) is not increasing above 79.51 Pump minimum speed within the time calculated by the drive software internally. The warning resets automatically after the time defined in 79.61 Fault reset time elapses and if start command is active, the drive restarts automatically. This alarm is disabled during ramp stop condition.	Check the pump minimum speed set in 79.51 Pump minimum speed.
D5B1	Start delay active	This alarm occurs if more than three start occurs within one minute.	This warning resets automatically after five minutes and if start command is present, drive starts automatically.
FA90	STO diagnostics failure	The software is not working properly.	Restart the control unit.

Fault messages

Code (hex)	Fault / Aux. code (*aux code visible only on assistant control panel and drive composer*)	Cause	What to do
1080	Backup/Restore timeout	Panel or PC tool has failed to communicate with the drive when backup was being made or restored.	Request backup or restore again.
1081	Rating ID fault	Drive software is not able to read the rating ID of the drive.	Reset the fault to make the drive try to reread the rating ID. If the fault reappears, cycle the power to the drive. You may have to be repeat this. If the fault persists, contact your local ABB representative.
2281	Calibration	Measured offset of output phase current measurement or difference between output phase U2 and W2 current measurement is too great (the values are updated during current calibration).	Try performing the current calibration again. If the fault persists, contact your local ABB representative.

Code (hex)	**Fault / Aux. code** (*aux code visible only on assistant control panel and drive composer*)	**Cause**	**What to do**
2310	Overcurrent	Output current has exceeded internal fault limit. In addition to an actual overcurrent situation, this fault may also be caused by an earth fault or supply phase loss.	Check motor load. Check acceleration times in parameter group 23 Speed reference ramp (speed control) or 28 Frequency reference chain (frequency control). Also check parameter 46.03 Torque scaling. Check motor and motor cable (including phasing and delta/star connection). Check there are no contactors opening and closing in motor cable. Check that the startup data in parameter group 99 corresponds to the motor rating plate. Check that there are no power factor correction capacitors or surge absorbers in motor cable. Check for an earth fault in motor or motor cables by measuring the insulation resistances of motor and motor cable. See chapter *Electrical installation*, section Checking the insulation of the assembly in the *Hardware manual* of the drive.
2330	Earth leakage Programmable fault: 31.20 Earth fault	Drive has detected load unbalance typically due to earth fault in motor or motor cable.	Check there are no power factor correction capacitors or surge absorbers in motor cable. Check for an earth fault in motor or motor cables by measuring the insulation resistances of motor and motor cable. Try running the motor in scalar control mode if allowed. (See parameter 99.04 Motor control mode.) If no earth fault can be detected, contact your local ABB representative.

Code (hex)	**Fault / Aux. code** (*aux code visible only on assistant control panel and drive composer*)	**Cause**	**What to do**
2340	Short circuit	Short-circuit in motor cable(s) or motor Aux code 0x0080 indicates that the state feedback from output phases does not match the control signals.	Check motor and motor cable for cabling errors. Check there are no power factor correction capacitors or surge absorbers in motor cable. Cycle the power to the drive.
	01	a short circuit in the upper IGBT of the U-phase	
	02	a short circuit in the lower IGBT of the U-phase	
	04	a short circuit in the upper IGBT of the V-phase	
	08	a short circuit in the lower IGBT of the V-phase	
	10	a short circuit in the upper IGBT of the W-phase	
	20	a short circuit in the lower IGBT of the W-phase	
	40	DC capacitor short circuit	
2381	IGBT overload	Excessive IGBT junction to case temperature. This fault protects the IGBT(s) and can be activated by a short circuit in the motor cable.	Check motor cable. Check ambient conditions. Check air flow and fan operation. Check heatsink fins for dust pick-up. Check motor power against drive power.
2392	BU earth leakage	Total earth leakage of inverter modules is excessive.	Check there are no power factor correction capacitors or surge absorbers in motor cable. Measure insulation resistances of motor cables and motor. Contact your local ABB representative.

Code (hex)	**Fault / Aux. code** (*aux code visible only on assistant control panel and drive composer*)	**Cause**	**What to do**
3130	Input phase loss Programmable fault: 31.21 Supply phase loss	Intermediate circuit DC voltage is oscillating due to missing input power line phase or blown fuse.	Check input power line fuses. Check for loose power cable connections. Check for input power supply imbalance.
3181	Wiring or earth fault Programmable fault: 31.23 Wiring or earth fault	Incorrect input power and motor cable connection (i.e. input power cable is connected to drive motor connection).	Check input power connections.
3210	DC link overvoltage	Excessive intermediate circuit DC voltage.	Check that the supply voltage matches the nominal input voltage of the drive. Check the supply line for static or transient overvoltage. Check brake chopper and resistor (if present). Check deceleration time. Use coast-to-stop function (if applicable). Retrofit drive with brake chopper and brake resistor. Check that the brake resistor is dimensioned properly and the resistance is between acceptable range for the drive.
3220	DC link undervoltage	Intermediate circuit DC voltage is not sufficient because of a missing supply phase, blown fuse or fault in the rectifier bridge.	Check supply cabling, fuses and switchgear.
3291	DC voltage difference	Difference in DC voltages between parallel-connected inverter modules.	Contact your local ABB representative
3293	DC unbalance fault	DC unbalance.	Contact your local ABB representative
3381	Output phase loss Programmable fault: 31.19 Motor phase loss	Motor circuit fault due to missing motor connection (all three phases are not connected).	Connect motor cable.

Code (hex)	**Fault / Aux. code** (*aux code visible only on assistant control panel and drive composer*)	**Cause**	**What to do**
4110	Control board temperature	Control board temperature is too high.	Check proper cooling of the drive. Check the auxiliary cooling fan.
4210	IGBT overtemperature	Estimated drive IGBT temperature is excessive.	Check ambient conditions. Check air flow and fan operation. Check heatsink fins for dust pick-up. Check motor power against drive power.
4290	Cooling	Drive module temperature is excessive.	Check ambient temperature. If it exceeds 40%/104 °F (frames R4…R8) or if it exceeds 50% /122 °F (frames R0…R8), ensure that load current does not exceed derated load capacity of drive. See chapter *Technical data*, section Derating in the *Hardware manual* of the drive. Check drive module cooling air flow and fan operation. Check inside of cabinet and heatsink of drive module for dust pick-up. Clean whenever necessary.
42F1	IGBT temperature	Drive IGBT temperature is excessive.	Check ambient conditions. Check air flow and fan operation. Check heatsink fins for dust pick-up. Check motor power against drive power.
4310	Excess temperature	Power unit module temperature is excessive.	Check ambient conditions. Check air flow and fan operation. Check heatsink fins for dust pick-up. Check motor power against drive power.
4380	Excess temperature difference	High temperature difference between the IGBTs of different phases.	Check the motor cabling. Check cooling of drive module(s).

Code (hex)	**Fault / Aux. code** (*aux code visible only on assistant control panel and drive composer*)	**Cause**	**What to do**
4981	External temperature 1	Measured temperature 1 has exceeded fault limit.	Check the value of parameter 35.02 Measured temperature 1. Check the cooling of the motor (or other equipment whose temperature is being measured).
4982	External temperature 2	Measured temperature 2 has exceeded fault limit.	Check the value of parameter 35.03 Measured temperature 2. Check the cooling of the motor (or other equipment whose temperature is being measured).
4991	Safe motor temperature	The CPTC-02 module indicates overtemperature: • motor temperature is too high, or • the thermistor is in shortcircuit.	Check the cooling of the motor. Check the motor load and drive ratings. Check the wiring of the temperature sensor. Repair wiring if faulty. Measure the resistance of the sensor. Replace the sensor if faulty.
5080	Fan	Cooling fan is stuck or disconnected.	Check fan operation and connection. Replace fan if faulty.
5081	Auxiliary fan broken	An auxiliary cooling fan is stuck or disconnected. 1 – Auxiliary fan 1 broken 2 – Auxiliary fan 2 broken	Check auxiliary fan(s) and connection(s). Replace fan if faulty.
5089	SMT circuit malfunction	Safe motor temperature fault is generated and STO event/fault/warning is not generated.	Check connection between the relay output of the module and the STO terminal.
	0001	Auxiliary fan 1 broken.	
	0002	Auxiliary fan 2 broken.	
5090	STO hardware failure	STO hardware diagnostics has detected hardware failure.	Contact your local ABB representative for hardware replacement.

Code (hex)	**Fault / Aux. code** (*aux code visible only on assistant control panel and drive composer*)	**Cause**	**What to do**
5091	Safe torque off Programmable fault: 31.22 STO indication run/stop	Safe torque off function is active, i.e. safety circuit signal(s) connected to connector STO is broken during start or run.	Check safety circuit connections. For more information, see chapter The Safe torque off function in the *Hardware manual* of the drive and description of parameter 31.22 STO indication run/stop (page 146). Check the value of parameter 95.04 Control board supply.
5092	PU logic error	Power unit memory has cleared.	Contact your local ABB representative.
5093	Rating ID mismatch	The hardware of the drive does not match the information stored in the memory. This may occur eg. after a firmware update.	Cycle the power to the drive. You may have to be repeat this.
5094	Measurement circuit temperature	Problem with internal temperature measurement of the drive.	Contact your local ABB representative.
5095	Redundant measurement	Duplicated measurements are beyond limits.	Contact ABB.
5096	Overtemperature hw	Excessive hardware temperature.	Contact your local ABB representative.
5098	I/O communication loss	Communication failure to standard I/O.	Try resetting the fault or cycle the power to the drive.
5681	PU communication	Communication errors detected between the drive control unit and the power unit.	Check the connection between the drive control unit and the power unit. Check the value of parameter 95.04 Control board supply.
5682	Power unit lost	Connection between the drive control unit and the power unit is lost.	Check the connection between the control unit and the power unit.
5690	PU communication internal	Internal communication error.	Contact your local ABB representative.
5691	Measurement circuit ADC	Measurement circuit fault.	Contact your local ABB representative.

Code (hex)	**Fault / Aux. code** (*aux code visible only on assistant control panel and drive composer*)	**Cause**	**What to do**
5692	PU board powerfail	Power unit power supply failure.	Contact your local ABB representative.
5693	Measurement circuit DFF	Measurement circuit fault.	Contact your local ABB representative.
5695	Reduced run	Configured power units not found.	Configure the power units.
5697	Charging feedback	Charging feedback signal missing.	Check the feedback signal coming from the charging system
5698	Unknown PU fault	The power unit logic generated a fault which is not known by software.	Check the logic and software compatibility.
50A0	Fan	Cooling fan stuck or disconnected.	Check fan operation and connection. Replace fan if faulty.
6181	FPGA version incompatible	Firmware and FPGA versions are incompatible.	Reboot the control unit (using parameter 96.08 Control board boot) or by cycling power. If the problem persists, contact your local ABB representative
6306	FBA A mapping file	Fieldbus adapter A mapping file read error.	Contact your local ABB representative.
6481	Task overload	Internal fault.	Reboot the control unit (using parameter 96.08 Control board boot) or by cycling power. If the problem persists, contact your local ABB representative
6487	Stack overflow	Internal fault.	Reboot the control unit (using parameter 96.08 Control board boot) or by cycling power. If the problem persists, contact your local ABB representative
64A1	Internal file load	File read error.	Reboot the control unit (using parameter 96.08 Control board boot) or by cycling power. If the problem persists, contact your local ABB representative
64A3	Application loading	Application file incompatible or corrupted.	Check the auxiliary code. See actions for each code below.

Code (hex)	**Fault / Aux. code** (*aux code visible only on assistant control panel and drive composer*)	**Cause**	**What to do**
	8006	Not enough memory for the application.	Reduce the size of the application. Reduce the number of parameter mappings. See the drive-specific log generated by Automation Builder.
	8007	The application contains the wrong system library version.	Update the system library or reinstall Automation Builder. See the drive-specific log generated by Automation Builder.
	8008	The application is empty.	In Automation Builder, give a “Clean” command and reload the application.
	8009	The application contains invalid tasks.	In Automation Builder, check application task configuration, give a “Clean all” command, and reload the application.
	800A	The application contains an unknown target (system) library function.	Update the system library or reinstall Automation Builder. See the drive-specific log generated by Automation Builder.
64A4	Rating ID fault	Rating ID load error.	Contact ABB.
64A6	Adaptive program	Error running the adaptive program.	Check the auxiliary code (format XXYY ZZZZ). “XX” specifies the number of the state (00=base program) and “YY” specifies the number of the function block (0000=generic error). ”ZZZZ” indicates the problem.
	000A	Program corrupted or block non-existent	Restore the template program or download the program to the drive.
	000C	Required block input missing	Check the inputs of the block.
	000E	Program corrupted or block non-existent	Restore the template program or download the program to the drive.
	0011	Program too large.	Remove blocks until the error stops.
	0012	Program is empty.	Correct the program and download it to the drive.

Code (hex)	**Fault / Aux. code** (*aux code visible only on assistant control panel and drive composer*)	**Cause**	**What to do**
	001C	A non-existing parameter or block is used in the program.	Edit the program to correct the parameter reference, or to use an existing block.
	001D	Parameter type invalid for selected pin.	Edit the program to correct the parameter reference.
	001E	Output to parameter failed because the parameter was write-protected.	Check the parameter reference in the program. Check for other sources affecting the target parameter.
	0023	Program file incompatible with current firmware version.	Adapt the program to current block library and firmware version.
	0024		
	Other	-	Contact your local ABB representative, quoting the auxiliary code.
64B1	Internal SSW fault	A fatal error in the power-up phase of System Software (SSW).	SSW runs in partial functionality mode.
	1 – Starting OS time tick failed 2 – Creating system tasks failed 3 – Initializing file system failed 4 – Checking file system failed	5 – Initializing WoRm volumes failed 6 – Loading FPGA configuration failed 7 – Loading application program failed	
64B2	User set fault	Loading of user parameter set failed because • requested set does not exist • set is not compatible with control program • drive was switched off during loading.	Ensure that a valid user parameter set exists. Reload if uncertain.
64B3	Macro parameterization error	Macro parameterization failed, eg. Parameter default value that cannot be changed has been attempted to write.	
64E1	Kernel overload	Operating system error.	Reboot the control unit (using parameter 96.08 Control board boot) or by cycling power. If the problem persists, contact your local ABB representative

Code (hex)	**Fault / Aux. code** (*aux code visible only on assistant control panel and drive composer*)	**Cause**	**What to do**
6581	Parameter system	Parameter load or save failed.	Try forcing a save using parameter 96.07 Parameter save manually. Retry.
6591	Backup/Restore timeout	During backup creating or restoring operation a panel or PC-tool has failed to communicate with the drive as part of this operation.	Check panel or PC-tool communication and if it is still in backup or restore state.
65A1	FBA A parameter conflict	The drive does not have a functionality requested by PLC, or requested functionality has not been activated.	Check PLC programming. Check settings of parameter groups 50 Fieldbus adapter (FBA) and 51 FBA A settings.
6681	EFB comm loss Programmable fault: 58.14 Communication loss action	Communication break in embedded fieldbus (EFB) communication.	Check the status of the fieldbus master (online/offline/error etc.). Check cable connections to the EIA-485/X5 terminals 29, 30 and 31 on the control unit.
6682	EFB config file	Embedded fieldbus (EFB) configuration file could not be read.	Contact your local ABB representative.
6683	EFB invalid parameterization	Embedded fieldbus (EFB) parameter settings inconsistent or not compatible with selected protocol.	Check the settings in parameter group 58 Embedded fieldbus.
6684	EFB load fault	Embedded fieldbus (EFB) protocol firmware could not be loaded. Version mismatch between EFB protocol firmware and drive firmware.	Contact your local ABB representative.
6685	EFB fault 2	Fault reserved for the EFB protocol application.	Check the documentation of the protocol.
6686	EFB fault 3	Fault reserved for the EFB protocol application.	Check the documentation of the protocol.
6882	Text 32-bit table overflow	Internal fault.	Reset the fault. Contact your local ABB representative if the fault persists.

Code (hex)	**Fault / Aux. code** (*aux code visible only on assistant control panel and drive composer*)	**Cause**	**What to do**
6885	Text file overflow	Internal fault.	Reset the fault. Contact your local ABB representative if the fault persists.
7081	Control panel loss Programmable fault: 49.05 Communication loss action	Control panel or PC tool selected as active control location for drive has ceased communicating.	Check PC tool or control panel connection. Check control panel connector. Disconnect and reconnect the control panel.
7082	I/O module comm loss	Communication between IO module and drive is not working properly.	Check installation of IO module.
7085	Incompatible option module	Fieldbus option module not supported.	Replace the module with a supported type.
7086	I/O module AI overvoltage	Overvoltage detected in AI. AI is changed to voltage mode from mA mode. AI will return automatically back to mA mode when the AI signal level is within acceptable limits.	Check AI signal levels.
7100	Excitation current	Excitation current feedback low or missing	Contact your local ABB representative.
7121	Motor stall Programmable fault: 31.24 Stall function	Motor is operating in stall region because of e.g. excessive load or insufficient motor power.	Check motor load and drive ratings. Check fault function parameters.
7122	Motor overload	Motor current is too high.	Check for overloaded motor Adjust the parameters used for the motor overload function. (35.51…35.53, 35.55,35.56)
7181	Brake resistor	Brake resistor broken or not connected.	Check that a brake resistor has been connected. Check the condition of the brake resistor. Check the dimensioning of the brake resistor.

Code (hex)	**Fault / Aux. code** (*aux code visible only on assistant control panel and drive composer*)	**Cause**	**What to do**
7310	Overspeed	Motor is turning faster than highest allowed speed due to incorrectly set minimum/maximum speed, insufficient braking torque or changes in load when using torque reference.	Check minimum/maximum speed settings, parameters 30.11 Minimum speed and 30.12 Maximum speed. Check adequacy of motor braking torque. Check applicability of torque control. Check need for brake chopper and resistor(s).
73F0	Overfrequency	Maximum allowed output frequency exceeded.	Check the auxiliary code.
	00FA	Motor is turning faster than the highest allowed frequency due to incorrectly set minimum/maximum frequency or the motor rushes because of too high supply voltage or incorrect supply voltage selection in parameter 95.01 Supply voltage.	Check minimum/maximum frequency settings, parameters 30.13 Minimum frequency and 30.14 Maximum frequency. Check used supply voltage and voltage selection parameter 95.01 Supply voltage.
	Other	-	Contact your local ABB representative, quoting the auxiliary code.
7510	FBA A communication Programmable fault: 50.02 FBA A comm loss func	Cyclical communication between drive and fieldbus adapter module A or between PLC and fieldbus adapter module A is lost.	Check status of fieldbus communication. See user documentation of fieldbus interface. Check settings of parameter groups 50 Fieldbus adapter (FBA), 51 FBA A settings, 52 FBA A data in and 53 FBA A data out. Check cable connections. Check if communication master is able to communicate.
8000	Unicos system error	System fault.	Power cycle.
8009	Current limit	Motor actual current exceeded the limit defined in parameter 30.17 Maximum current.	Reduce the motor load. Check for any jam or stall in motor. See parameter 30.17 Maximum current.

Code (hex)	**Fault / Aux. code** (*aux code visible only on assistant control panel and drive composer*)	**Cause**	**What to do**
80A0	AI supervision Programmable fault: 12.03 AI supervision function	An analog signal is outside the limits specified for the analog input	Check signal level at the analog input. Check the auxiliary code. Check the wiring connected to the input. Check the minimum and maximum limits of the input in parameter group 12 Standard AI.
	1 – AI1LessMIN	3 – AI2LessMIN	
	2 – AI1GreaterMAX	4 – AI2GreaterMAX	
80B0	Signal supervision 1 (Editable message text) Programmable fault: 32.06 Supervision 1 action	Fault generated by the signal supervision function 1.	Check the source of the fault (parameter 32.07 Supervision 1 signal).
80B1	Signal supervision 2 (Editable message text) Programmable fault: 32.16 Supervision 2 action	Fault generated by the signal supervision function 2.	Check the source of the fault (parameter 32.17 Supervision 2 signal).
80B2	Signal supervision 3 (Editable message text) Programmable fault: 32.26 Supervision 3 action	Fault generated by the signal supervision function 3.	Check the source of the fault (parameter 32.27 Supervision 3 signal).
80B3	Signal supervision 4 (Editable message text) Programmable fault: 32.36 Supervision 4 action	Fault generated by the signal supervision function 4.	Check the source of the fault (parameter 32.37 Supervision 4 signal).
80B4	Signal supervision 5 (Editable message text) Programmable fault: 32.46 Supervision 5 action	Fault generated by the signal supervision function 5.	Check the source of the fault (parameter 32.47 Supervision 5 signal).

Code (hex)	**Fault / Aux. code** (*aux code visible only on assistant control panel and drive composer*)	**Cause**	**What to do**
80B5	Signal supervision 6 (Editable message text) Programmable fault: 32.56 Supervision 6 action	Fault generated by the signal supervision function 6.	Check the source of the fault (parameter 32.57 Supervision 6 signal).
9081	External fault 1 (Editable message text) Programmable fault: 31.01 External event 1 source 31.02 External event 1 type	Fault in external device 1.	Check the external device. Check setting of parameter 31.01 External event 1 source.
9082	External fault 2 (Editable message text) Programmable fault: 31.03 External event 2 source 31.04 External event 2 type	Fault in external device 2.	Check the external device. Check setting of parameter 31.03 External event 2 source.
9083	External fault 3 (Editable message text) Programmable fault: 31.05 External event 3 source 31.06 External event 3 type	Fault in external device 3.	Check the external device. Check setting of parameter 31.05 External event 3 source.
9084	External fault 4 (Editable message text) Programmable fault: 31.07 External event 4 source 31.08 External event 4 type	Fault in external device 4.	Check the external device. Check setting of parameter 31.07 External event 4 source.
9085	External fault 5 (Editable message text) Programmable fault: 31.09 External event 5 source 31.10 External event 5 type	Fault in external device 5.	Check the external device. Check setting of parameter 31.09 External event 5 source.

Code (hex)	**Fault / Aux. code** (*aux code visible only on assistant control panel and drive composer*)	**Cause**	**What to do**
FA81	Safe torque off 1 loss	Safe torque off function is active, ie. STO circuit 1 is broken.	Check safety circuit connections. For more information, see chapter The Safe torque off function in the *Hardware manual* of the drive and description of parameter 31.22 STO indication run/stop (page 146). Check the value of parameter 95.04 Control board supply.
FA82	Safe torque off 2 loss	Safe torque off function is active, ie. STO circuit 2 is broken.	
D401	Max cleaning fault Programmable fault: 83.35 Cleaning count fault	The maximum number of cleanings are reached in the defined time. The pump cleaning is unable to clean the pump and hence, manual cleaning is required.	Check the pump for blockages. Clean the pump manually if needed. Check parameters 83.35 Cleaning count fault to 83.37 Maximum cleaning count.
D406	Maximum flow protection Programmable fault: 80.17 Maximum flow protection	Actual flow is exceeded the defined fault level.	Check the system for leakages. Check flow protection settings in parameters 80.15 Maximum flow, 80.17 Maximum flow protection, and 80.19 Flow check delay.
D407	Minimum flow protection Programmable fault: 80.18 Minimum flow protection	Actual flow is below the defined fault level.	Check that the inlet and outlet valves are open. Check flow protection settings in parameters 80.16 Maximum flow, 80.18 Minimum flow protection, and 80.19 Flow check delay.
D408	Outlet minimum pressure Programmable fault: 82.30 Outlet minimum pressure protection	The measured outlet pressure is below the defined fault limit.	Check the pump outlet for leakages. Check the configuration of outlet pressure protection. See parameters 82.30 Outlet minimum pressure protection and 82.32 Outlet minimum pressure fault level.
D409	Outlet maximum pressure Programmable fault: 82.35 Outlet maximum pressure protection	The measured outlet pressure is above the defined fault limit.	Check the pump outlet for blockages or closed valve. Check the configuration of outlet pressure protection. See parameters 82.35 Outlet maximum pressure protection and 82.38 Outlet maximum pressure fault level

Code (hex)	**Fault / Aux. code** (*aux code visible only on assistant control panel and drive composer*)	**Cause**	**What to do**
D40A	Inlet minimum pressure Programmable fault: 82.40 Inlet minimum pressure protection	The measured inlet pressure is below the defined fault level.	Check the pump inlet for blockages or closed valve. Check the configuration of inlet pressure protection. See parameters 82.40 Inlet minimum pressure protection and 82.42 Inlet minimum pressure fault level.
D4B0	Running dry	Dry run protection is activated.	Check the pump inlet for sufficient water level. Check dry run protection settings in parameter group 82 Pump protections.
D4B1	PV max volt	The DC bus voltage in the inverter is above the voltage set in 79.43 PV cell max voltage.	• Check the number of PV cells connected in series. • Ensure that voltage is less than the voltage set in 79.43 PV cell max voltage.
FF61	ID run	Motor ID run was not completed successfully.	Check the nominal motor values in parameter group 99 Motor data. Check that no external control system is connected to the drive. Cycle the power to the drive (and its control unit, if powered separately). Check that no operation limits prevent the completion of the ID run. Restore parameters to default settings and try again. Check that the motor shaft is not locked.
	0001	Maximum current limit too low.	Check settings of parameters 99.06 Motor nominal current and 30.17 Maximum current. Make sure that 30.17 is greater than 99.06. Check that the drive is dimensioned correctly according to the motor.

Code (hex)	**Fault / Aux. code** (*aux code visible only on assistant control panel and drive composer*)	**Cause**	**What to do**
	0002	Maximum speed limit or calculated field weakening point too low.	Check settings of parameters • 30.11 Minimum speed • 30.12 Maximum speed • 99.07 Motor nominal voltage • 99.08 Motor nominal frequency • 99.09 Motor nominal speed. Make sure that • 30.12 > (0.55 × 99.09) > (0.50 × synchronous speed) • 30.11 ≤ 0, and • supply voltage ≥ (0.66 × 99.07).
	0003	Maximum torque limit too low.	Check settings of parameter 99.12 Motor nominal torque, and the torque limits in group 30 Limits. Make sure that the maximum torque limit in force is greater than 100%.
	0004	Current measurement calibration did not finish within reasonable time	Contact your local ABB representative.
	0005…0008	Internal error.	Contact your local ABB representative.
	0009	(Asynchronous motors only) Acceleration did not finish within reasonable time.	Contact your local ABB representative.
	000A	(Asynchronous motors only) Deceleration did not finish within reasonable time.	Contact your local ABB representative.
	000B	(Asynchronous motors only) Speed dropped to zero during ID run.	Contact your local ABB representative.
	000C	(Permanent magnet motors only) First acceleration did not finish within reasonable time.	Contact your local ABB representative.

Code (hex)	**Fault / Aux. code** (*aux code visible only on assistant control panel and drive composer*)	**Cause**	**What to do**
	000D	(Permanent magnet motors only) Second acceleration did not finish within reasonable time.	Contact your local ABB representative.
	000E…0010	Internal error.	Contact your local ABB representative.
	0011	(Synchronous reluctance motors only) Pulse test error.	Contact your local ABB representative.
	0012	Motor too large for advanced standstill ID run.	Check that the motor and drive sizes are compatible. Contact your local ABB representative.
	0013	(Asynchronous motors only) Motor data error.	Check that the motor nominal value settings in the drive are the same as in the motor nameplate. Contact your local ABB representative.
FF63	STO diagnostics failure.	SW internal malfunction.	Reboot the control unit (using parameter 96.08 Control board boot or by cycling power.
FF81	FB A force trip	A fault trip command has been received through fieldbus adapter A.	Check the fault information provided by the PLC.
FF8E	EFB force trip	A fault trip command has been received through the embedded fieldbus interface.	Check the fault information provided by the PLC.

9

Fieldbus control through the embedded fieldbus interface (EFB)

What this chapter contains

The chapter describes how the drive can be controlled by external devices over a communication network (fieldbus) using the embedded fieldbus interface.

System overview

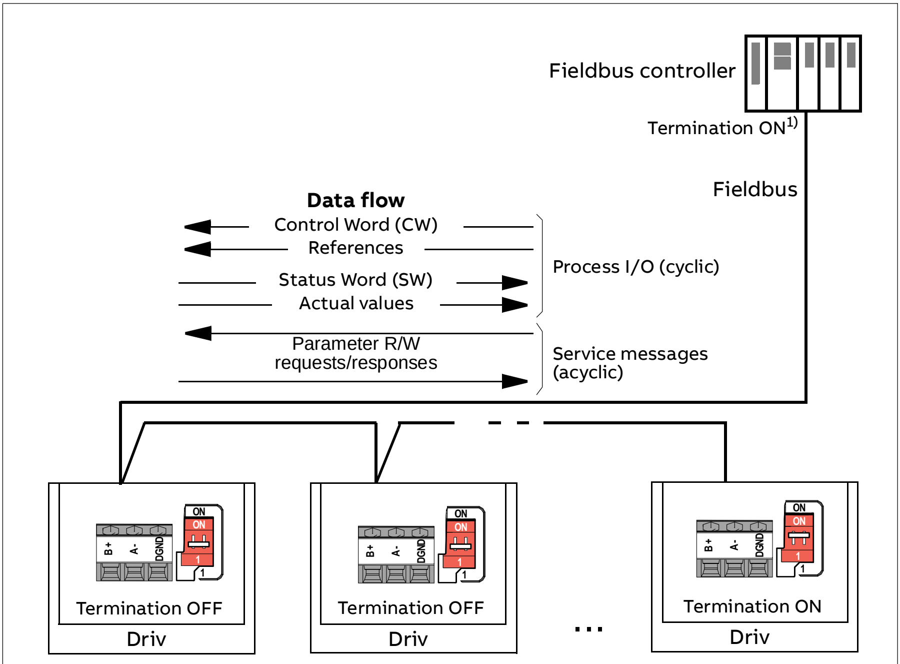
The drive can be connected to an external control system through a communication link using either a fieldbus adapter or the embedded fieldbus interface.

The embedded fieldbus interface supports the Modbus RTU protocol. The drive control program can handle 10 Modbus registers in a 10-millisecond time level. For example, if the drive receives a request to read 20 registers, it will start its response within 22 ms of receiving the request – 20 ms for processing the request and 2 ms overhead for handling the bus. The actual response time depends on other factors as well, such as the baud rate (a parameter setting in the drive).

The drive can be set to receive all of its control information through the fieldbus interface, or the control can be distributed between the embedded fieldbus interface and other available sources, for example, digital and analog inputs.

Connecting EIA-485 Modbus RTU terminal to the drive

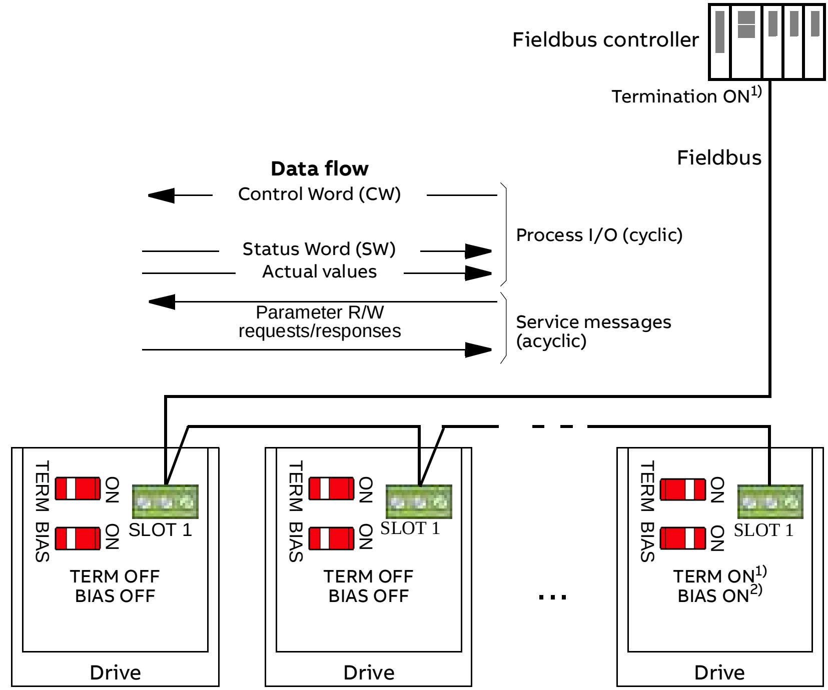
Connect the fieldbus to the EIA-485 Modbus RTU terminal on the RIIO-01 module which is attached on the control unit of the drive. The connection diagram is shown below.



[1] The device at both ends on the fieldbus must have termination set to ON.

Connecting the fieldbus to the drive

Connect the fieldbus to terminal slot, which is attached on the control unit of the drive. The connection diagram is shown below.



1) The device at both ends on the fieldbus must have termination on.
2) One device, preferably at the end on the fieldbus must have bias on.

The AC500 PLC has a free version library called ‘PS553 drives’ which help user to communicate and control between PLC and drives easily.

Setting up the embedded fieldbus interface

Set the drive up for the embedded fieldbus communication with the parameters shown in the table below. The **Setting for fieldbus control** column gives either the value to use or the default value. The **Function/Information column** gives a description of the parameter.

Parameter		**Setting for fieldbus control**	**Function/Information**
COMMUNICATION INITIALIZATION			
58.01	Protocol enable	Modbus RTU [1]	Initializes embedded fieldbus communication.
EMBEDDED MODBUS CONFIGURATION			
58.03	Node address	1 (default)	Node address. There must be no two nodes with the same node address online.
58.04	Baud rate	19.2 kbps (default) [3]	Defines the communication speed of the link. Use the same setting as in the master station.
58.05	Parity	8 EVEN 1 (default) [2]	Selects the parity and stop bit setting. Use the same setting as in the master station.
58.14	Communication loss action	Fault (default) [1]	Defines the action taken when a communication loss is detected.
58.15	Communication loss mode	Cw / Ref1 / Ref2 (default) [2]	Enables/disables communication loss monitoring and defines the means for resetting the counter of the communication loss delay.
58.16	Communication loss time	3.0 s (default)	Defines the timeout limit for the communication monitoring.
58.17	Transmit delay	0 ms (default)	Defines a response delay for the drive.
58.25	Control profile	ABB Drives [0] (default)	Selects the control profile used by the drive. See section Basics of the embedded fieldbus interface (page 347).
58.26 58.27	EFB ref1 type EFB ref2 type	Not applicable. Speed reference is provided by MPPT. For more information, see chapter Flow calculation on page 45.	
58.28 58.29	EFB act1 type EFB act2 type	Speed or frequency (default for 58.28) [0], Transparent (default for 58.29) [1], General [2], Torque [3],Speed [4], Frequency [5]	Defines the types of actual values 1 and 2.

Parameter		**Setting for fieldbus control**	**Function/Information**
58.31 58.32	EFB act1 transparent source EFB act2 transparent source	Other	Defines the source of actual values 1 and 2 when the 58.26 EFB ref1 type (58.27 EFB ref2 type) is set to Transparent.
58.33	Addressing mode	Mode 0 (default) [0]	Defines the mapping between parameters and holding registers in the 400001…465536 (100…65535) Modbus register range.
58.34	Word order	LO-HI (default) [1]	Defines the order of the data words in the Modbus message frame.
58.101 … 58.114	Data I/O 1 … Data I/O 14	For example, the default settings (I/Os 1…6 contain the control word, the status word, two references and two actual values)	Defines the address of the drive parameter which the Modbus master accesses when it reads from or writes to the register address corresponding to Modbus In/Out parameters. Select the parameters that you want to read or write through the Modbus I/O words.
		RO/DIO control word [31], AO1 data storage [32], AO2 data storage [33], Feedback data storage [40], Setpoint data storage [41]	These settings write the incoming data into storage parameters 10.99 RO/DIO control word, 13.91 AO1 data storage, 13.92 AO2 data storage, 40.91 Feedback data storage or 40.92 Setpoint data storage.
58.06	Communication control	Refresh settings	Validates the settings of the configuration parameters.

The new settings will take effect when the drive is powered up the next time, or when they are validated by parameter 58.06 Communication control (Refresh settings).

Setting the drive control parameters

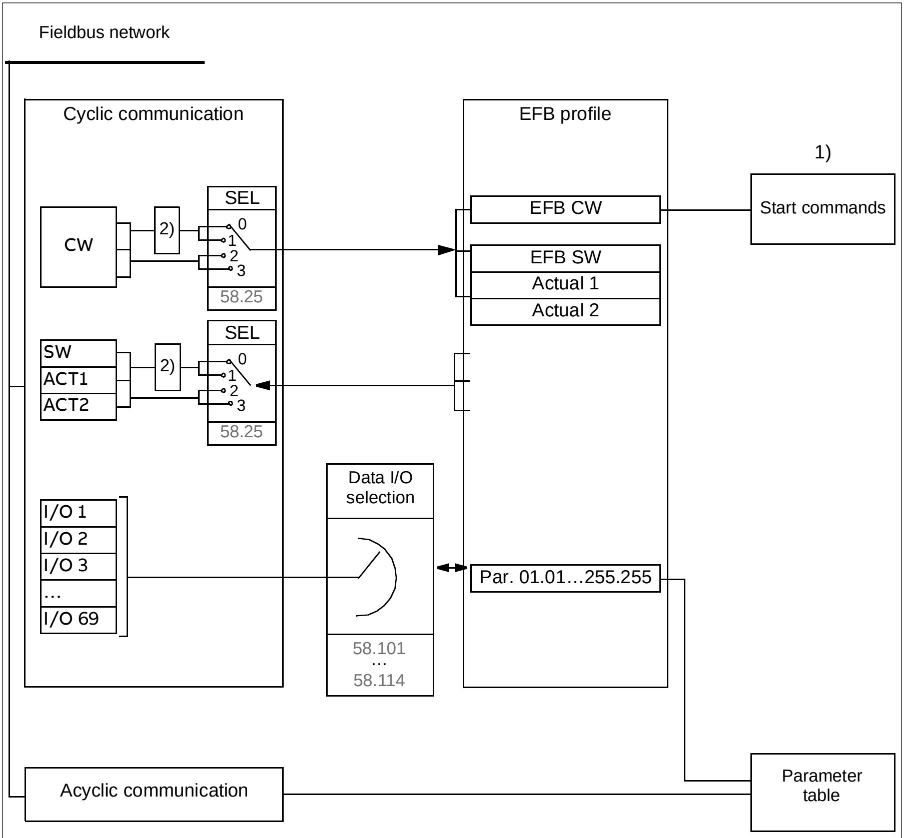
After the embedded fieldbus interface has been set up, check and adjust the drive control parameters listed in the table below. The **Setting for fieldbus control** column gives the value or values to use when the embedded fieldbus signal is the desired source or destination for that particular drive control signal. The **Function/Information** column gives a description of the parameter.

Parameter	**Setting for fieldbus control**	**Function/Information**
CONTROL COMMAND SOURCE SELECTION		
79.10 Operating mode	Embedded fieldbus	Selects fieldbus as the source for the start and stop commands.
OTHER SELECTIONS		
EFB references can be selected as the source at virtually any signal selector parameter by selecting Other, then either 03.09 EFB reference 1 or 03.10 EFB reference 2.		
SYSTEM CONTROL INPUTS		
96.07 Parameter save manually	Save (reverts to Done)	Saves parameter value changes (including those made through fieldbus control) to permanent memory.

Basics of the embedded fieldbus interface

The cyclic communication between a fieldbus system and the drive consists of 16-bit data words or 32-bit data words (with a transparent control profile).

The diagram below illustrates the operation of the embedded fieldbus interface. The signals transferred in the cyclic communication are explained further below the diagram.



1. See also other parameters which can be controlled through fieldbus.
2. Data conversion if parameter 58.25 Control profile is set to ABB Drives. See section About the control profiles (page 350).

Control word and Status word

The Control Word (CW) is a 16-bit or 32-bit packed boolean word. It is the principal means of controlling the drive from a fieldbus system. The CW is sent by the fieldbus controller to the drive. With drive parameters, the user selects the EFB CW as the source of drive control commands (such as start/stop, emergency stop, selection between external control locations 1/2, or fault reset). The drive switches between its states according to the bit-coded instructions of the CW.

The fieldbus CW is either written to the drive as it is or the data is converted. See section About the control profiles (page 350).

The fieldbus Status Word (SW) is a 16-bit or 32-bit packed boolean word. It contains status information from the drive to the fieldbus controller. The drive SW is either written to the fieldbus SW as it is or the data is converted. See section About the control profiles (page 350).

References

The references are provided by MPPT and does not depend on any user settings. For more information on MPPT, see chapter Flow calculation on page 45.

Actual values

Fieldbus actual signals (ACT1 and ACT2) are 16-bit or 32-bit signed integers. They convey selected drive parameter values from the drive to the master. Whether the actual values are scaled or not depends on the settings of 58.28 EFB act1 type and 58.29 EFB act2 type. See section About the control profiles (page 350).

Data input/outputs

Data input/outputs are 16-bit or 32-bit words containing selected drive parameter values. Parameters 58.101 Data I/O 1 … 58.114 Data I/O 14 define the addresses from which the master either reads data (input) or to which it writes data (output).

Register addressing

The address field of Modbus requests for accessing holding registers is 16 bits. This allows the Modbus protocol to support addressing of 65536 holding registers.

Historically, Modbus master devices used 5-digit decimal addresses from 40001 to 49999 to represent holding register addresses. The 5-digit decimal addressing limited to 9999 the number of holding registers that could be addressed.

Modern Modbus master devices typically provide a means to access the full range of 65536 Modbus holding registers. One of these methods is to use 6-digit decimal addresses from 400001 to 465536. This manual uses 6-digit decimal addressing to represent Modbus holding register addresses.

Modbus master devices that are limited to the 5-digit decimal addressing may still access registers 400001 to 409999 by using 5-digit decimal addresses 40001 to 49999. Registers 410000-465536 are inaccessible to these masters.

See parameter 58.33 Addressing mode.

Note: Register addresses of 32-bit parameters cannot be accessed by using 5-digit register numbers.

About the control profiles

A control profile defines the rules for data transfer between the drive and the fieldbus master, for example:

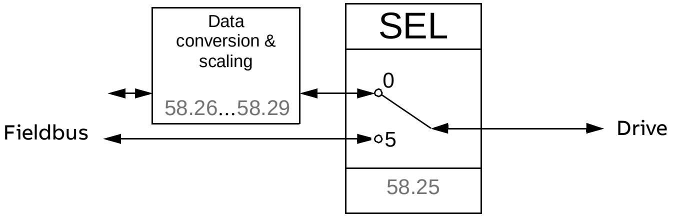
- if packed boolean words are converted and how
- if signal values are scaled and how
- how drive register addresses are mapped for the fieldbus master.

You can configure the drive to receive and send messages according to one of the two profiles:

- ABB Drives
- DCU Profile.

For the ABB Drives profile, the embedded fieldbus interface of the drive converts the fieldbus data to and from the native data used in the drive. The DCU Profile involves no data conversion or scaling. The figure below illustrates the effect of the profile selection.

Profile selection



Control profile selection with parameter 58.25 Control profile is:

- (0) ABB Drives
- (5) DCU Profile.

Control Word

Control Word for the ABB Drives profile

The table below shows the contents of the fieldbus Control Word for the ABB Drives control profile. The embedded fieldbus interface converts this word to the form in which it is used in the drive. The upper case boldface text refers to the states shown in State transition diagram for the ABB Drives profile on page 358.

Bit	Name	Value	STATE/Description
0	OFF1_ CONTROL	1	Proceed to READY TO OPERATE.
		0	Stop along currently active deceleration ramp. Proceed to **OFF1 ACTIVE**; proceed to **READY TO SWITCH ON** unless other interlocks (OFF2, OFF3) are active.
1	OFF2_ CONTROL	1	Continue operation (OFF2 inactive).
		0	Emergency OFF, coast to stop. Proceed to **OFF2 ACTIVE**, proceed to **SWITCH-ON INHIBITED**.
2	OFF3_ CONTROL	1	Continue operation (OFF3 inactive).
		0	Emergency stop, stop within time defined by drive parameter. Proceed to **OFF3 ACTIVE**; proceed to **SWITCH-ON INHIBITED**. **Warning:** Ensure that the motor and driven machine can be stopped using this stop mode.
3	INHIBIT_ OPERATION	1	Proceed to **OPERATION D**. **Note:** Run enable signal must be active; see the drive documentation. If the drive is set to receive the Run enable signal from the fieldbus, this bit activates the signal.
		0	Inhibit operation. Proceed to **OPERATION INHIBITED**.
4	RAMP_OUT_ ZERO	1	Normal operation. Proceed to **RAMP FUNCTION GENERATOR: OUTPUT D**.
		0	Force Ramp Function Generator output to zero. Drive ramps to stop (current and DC voltage limits in force).
5	RAMP_HOLD	1	ramp function. Proceed to **RAMP FUNCTION GENERATOR: ACCELERATOR D**.
		0	Halt ramping (Ramp Function Generator output held).
6	RAMP_IN_ ZERO	1	Normal operation. Proceed to **OPERATING**. **Note:** This bit is effective only if the fieldbus interface is set as the source for this signal by drive parameters.
		0	Force Ramp Function Generator input to zero.

Bit	Name	Value	STATE/Description
7	RESET	0=>1	Fault reset if an active fault exists. Proceed to **SWITCH-ON INHIBITED**. **Note:** This bit is effective only if the fieldbus interface is set as the source for this signal by drive parameters.
		0	Continue normal operation.
8…9	Reserved		
10	REMOTE_ CMD	1	Fieldbus control d.
		0	Control Word <> 0 or Reference <> 0: Retain last Control Word and Reference. Control Word = 0 and Reference = 0: Fieldbus control d. Reference and deceleration/acceleration ramp are locked.
11	EXT_CTRL_ LOC	1	Select External Control Location EXT2. Effective if the control location is parameterized to be selected from the fieldbus.
		0	Select External Control Location EXT1. Effective if the control location is parameterized to be selected from the fieldbus.
12	USER_0		Writable control bits that can be combined with drive logic for application-specific functionality.
13	USER_1		
14	USER_2		
15	USER_3		

Control Word for the DCU Profile

The embedded fieldbus interface writes the fieldbus Control Word as is to the drive Control Word bits 0 to 15. Bits 16 to 32 of the drive Control Word are not in use.

Bit	Name	Value	State/Description
0	STOP	1	Stop according to the Stop Mode parameter or the stop mode request bits (7…9).
		0	(no op)
1	START	1	Start the drive.
		0	(no op)

<table>
<tr><th>Bit</th><th>Name</th><th>Value</th><th>State/Description</th></tr>
<tr><td rowspan="2">2</td><td rowspan="2">REVERSE</td><td>1</td><td>Reverse direction of motor rotation. See in the table below how this bit and sign of the reference effect the direction of the motor direction.
<table>
<tr><th></th><th colspan="2">Sign of the reference</th></tr>
<tr><th></th><th>Positive (+)</th><th>Negative (-)</th></tr>
<tr><td>Bit REVERSE = 0</td><td>Forward</td><td>Reverse</td></tr>
<tr><td>Bit REVERSE = 1</td><td>Reverse</td><td>Forward</td></tr>
</table></td></tr>
<tr><td>0</td><td>(no op)</td></tr>
<tr><td>3</td><td>Reserved</td><td></td><td></td></tr>
<tr><td rowspan="2">4</td><td rowspan="2">RESET</td><td>0=>1</td><td>Fault reset if an active fault exists.</td></tr>
<tr><td>0</td><td>(no op)</td></tr>
<tr><td rowspan="2">5</td><td rowspan="2">EXT2</td><td>1</td><td>Select External control location EXT2. Effective if the control location is parameterized to be selected from the fieldbus.</td></tr>
<tr><td>0</td><td>Select External control location EXT1. Effective if the control location is parameterized to be selected from the fieldbus.</td></tr>
<tr><td rowspan="2">6</td><td rowspan="2">RUN_DISABLE</td><td>1</td><td>Run disable. If the drive is set to receive the run enable signal from the fieldbus, this bit deactivates the signal.</td></tr>
<tr><td>0</td><td>Run enable. If the drive is set to receive the run enable signal from the fieldbus, this bit activates the signal.</td></tr>
<tr><td rowspan="2">7</td><td rowspan="2">STOPMODE_RAMP</td><td>1</td><td>Normal ramp stop mode</td></tr>
<tr><td>0</td><td>(no op) Default to parameter stop mode if bits 7…9 are all 0.</td></tr>
<tr><td rowspan="2">8</td><td rowspan="2">STOPMODE_EMERGENCY_RAMP</td><td>1</td><td>Emergency ramp stop mode.</td></tr>
<tr><td>0</td><td>(no op) Default to parameter stop mode if bits 7…9 are all 0.</td></tr>
<tr><td rowspan="2">9</td><td rowspan="2">STOPMODE_COAST</td><td>1</td><td>Coast stop mode.</td></tr>
<tr><td>0</td><td>(no op) Default to parameter stop mode if bits 7…9 are all 0.</td></tr>
<tr><td rowspan="2">10</td><td rowspan="2">RAMP_PAIR _2</td><td>1</td><td>Not applicable.</td></tr>
<tr><td>0</td><td>Not applicable.</td></tr>
<tr><td rowspan="2">11</td><td rowspan="2">RAMP_OUT_ZERO</td><td>1</td><td>Force Ramp Function Generator output to zero. Drive ramps to stop (current and DC voltage limits in force).</td></tr>
<tr><td>0</td><td>Normal operation.</td></tr>
<tr><td rowspan="2">12</td><td rowspan="2">RAMP_HOLD</td><td>1</td><td>Halt ramping (Ramp Function Generator output held).</td></tr>
<tr><td>0</td><td>Normal operation.</td></tr>
</table>

Bit	**Name**	**Value**	**State/Description**
13	RAMP_IN_ZERO	1	Force Ramp Function Generator input to zero.
		0	Normal operation.
14	REQ_LOCAL_LOCK	1	Drive does not switch to local control mode
		0	Drive can switch between local and remote control modes.
15	Reserved		
16	FB_LOCAL_CTL	1	Local mode for control from the fieldbus is requested. Steal control from the active source.
		0	(no op)
17	FB_LOCAL_REF	1	Local mode for reference from the fieldbus is requested. Steal reference from the active source.
		0	(no op)
18	Reserved for RUN_DISABLE_1		Not yet implemented.
19	Reserved		
20	Reserved		
21	Reserved		
22	USER_0		Writable control bits that can be combined with drive logic for application-specific functionality.
23	USER_1		
24	USER_2		
25	USER_3		
26…31	Reserved		

Status Word

Status Word for the ABB Drives profile

The table below shows the fieldbus Status Word for the ABB Drives control profile. The embedded fieldbus interface converts the drive Status Word into this form for the fieldbus. The upper case boldface text refers to the states shown in State transition diagram for the ABB Drives profile on page 358.

Bit	Name	Value	STATE/Description
0	RDY_ON	1	**READY TO SWITCH ON**.
		0	**NOT READY TO SWITCH ON**.
1	RDY_RUN	1	**READY TO OPERATE**.
		0	**OFF1 ACTIVE**.
2	RDY_REF	1	**OPERATION D**.
		0	**OPERATION INHIBITED**.
3	TRIPPED	1	**FAULT**.
		0	No fault.
4	OFF_2_STATUS	1	OFF2 inactive.
		0	**OFF2 ACTIVE**.
5	OFF_3_STATUS	1	OFF3 inactive.
		0	**OFF3 ACTIVE**.
6	SWC_ON_INHIB	1	**SWITCH-ON INHIBITED**.
		0	–
7	ALARM	1	Warning/Alarm.
		0	No warning/alarm.
8	AT_SETPOINT	1	**OPERATING**. Actual value equals Reference (is within tolerance limits, e.g. in speed control, speed error is 10% max. of nominal motor speed).
		0	Actual value differs from Reference (is outside tolerance limits).
9	REMOTE	1	Drive control location: REMOTE (EXT1 or EXT2).
		0	Drive control location: LOCAL.
10	ABOVE_LIMIT	1	Actual frequency or speed equals or exceeds supervision limit (set by drive parameter). Valid in both directions of rotation.
		0	Actual frequency or speed within supervision limit.
11	USER_0		Status bits that can be combined with drive logic for application-specific functionality.
12	USER_1		
13	USER_2		
14	USER_3		
15	Reserved		

Status Word for the DCU Profile

The embedded fieldbus interface writes the drive Status Word bits 0 to 15 to the fieldbus Status Word as is. Bits 16 to 32 of the drive Status Word are not in use.

Bit	Name	Value	State/Description
0	READY	1	Drive is ready to receive the start command.
		0	Drive is not ready.
1	D	1	External run enable signal is active.
		0	External run enable signal is not active.
2	Reserved for D_TO_ROTATE		Not yet implemented.
3	RUNNING	1	Drive is modulating.
		0	Drive is not modulating.
4	ZERO_SPEED	1	Drive is at zero speed.
		0	Drive is not at zero speed.
5	ACCELERATING	1	Drive speed is increasing.
		0	Drive speed is not increasing.
6	DECELERATING	1	Drive speed is decreasing.
		0	Drive speed is not decreasing.
7	AT_SETPOINT	1	Drive is at setpoint.
		0	Drive is not at setpoint.
8	LIMIT	1	Drive operation is limited.
		0	Drive operation is not limited.
9	SUPERVISION	1	Actual value (speed, frequency or torque) is above a limit. Limit is set with parameters 46.31…46.33
		0	Actual value (speed, frequency or torque) is within limits.
10	REVERSE_REF	1	Drive reference is in the reverse direction.
		0	Drive reference is in the forward direction
11	REVERSE_ACT	1	Drive is running in the reverse direction
		0	Drive is running in the forward direction
12	PANEL_LOCAL	1	Panel/keypad (or PC tool) is in local control mode.
		0	Panel/keypad (or PC tool) is not in local control mode.
13	FIELDBUS_LOCAL	1	Fieldbus is in local control mode.
		0	Fieldbus is not in local control mode.
14	EXT2_ACT	1	External control location EXT2 is active.
		0	External control location EXT1 is active.

Bit	Name	Value	State/Description
15	FAULT	1	Drive is faulted.
		0	Drive is not faulted.
16	ALARM	1	Warning/Alarm is active.
		0	No warning/alarm.
17	Reserved		
18	Reserved for DIRECTION_LOCK		Not yet implemented.
19	Reserved		
20	Reserved		
21	Reserved		
22	USER_0		Status bits that can be combined with drive logic for application-specific functionality.
23	USER_1		
24	USER_2		
25	USER_3		
26	REQ_CTL	1	Control is requested in this channel.
		0	Control is not requested in this channel.
27… 31	Reserved		

State transition diagrams

State transition diagram for the ABB Drives profile

The diagram below shows the state transitions in the drive when the drive is using the ABB Drives profile and the drive is configured to follow the commands of the control word from the embedded fieldbus interface. The upper case texts refer to the states which are used in the tables representing the fieldbus Control and Status words. See sections Control Word for the ABB Drives profile on page 351 and Status Word for the ABB Drives profile on page 355.

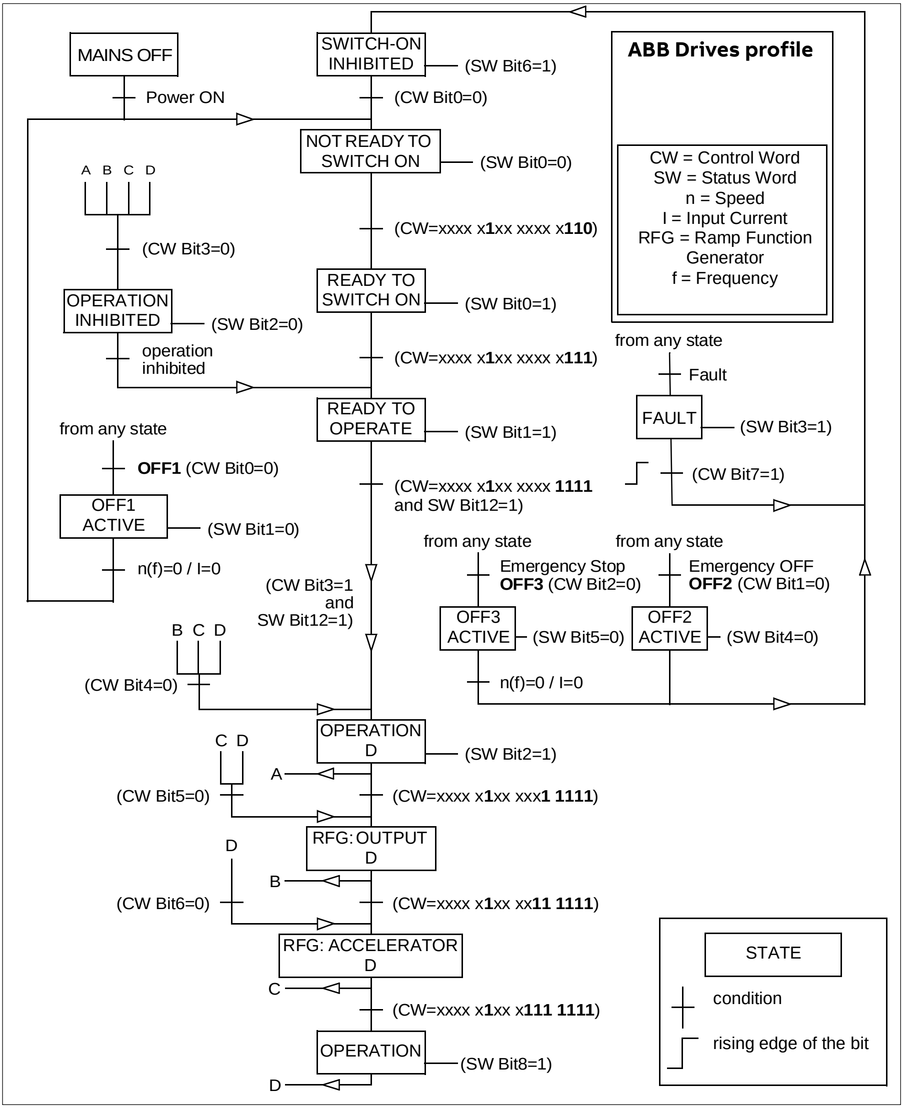


ABB Drives profile
CW = Control Word
SW = Status Word
n = Speed
I = Input Current
RFG = Ramp Function Generator
f = Frequency
MAINS OFF
Power ON
SWITCH-ON INHIBITED
(SW Bit6=1)
(CW Bit0=0)
NOT READY TO SWITCH ON
(SW Bit0=0)
A B C D
(CW=xxxx x**1**xx xxxx x**110**)
(CW Bit3=0)
READY TO SWITCH ON
(SW Bit0=1)
OPERATION INHIBITED
(SW Bit2=0)
operation inhibited
(CW=xxxx x**1**xx xxxx x**111**)
from any state
Fault
READY TO OPERATE
(SW Bit1=1)
FAULT
(SW Bit3=1)
from any state
OFF1 (CW Bit0=0)
(CW Bit7=1)
(CW=xxxx x**1**xx xxxx **1111** and SW Bit12=1)
OFF1 ACTIVE
(SW Bit1=0)
from any state
from any state
n(f)=0 / I=0
Emergency Stop **OFF3** (CW Bit2=0)
Emergency OFF **OFF2** (CW Bit1=0)
(CW Bit3=1 and SW Bit12=1)
B C D
OFF3 ACTIVE
(SW Bit5=0)
OFF2 ACTIVE
(SW Bit4=0)
(CW Bit4=0)
n(f)=0 / I=0
OPERATION D
C D
(SW Bit2=1)
A
(CW Bit5=0)
(CW=xxxx x**1**xx xxx**1 1111**)
RFG: OUTPUT D
D
B
(CW Bit6=0)
(CW=xxxx x**1**xx xx**11 1111**)
RFG: ACCELERATOR D
C
(CW=xxxx x**1**xx x**111 1111**)
OPERATION
(SW Bit8=1)
D
STATE
condition
rising edge of the bit

References

References for the ABB Drives profile and DCU Profile

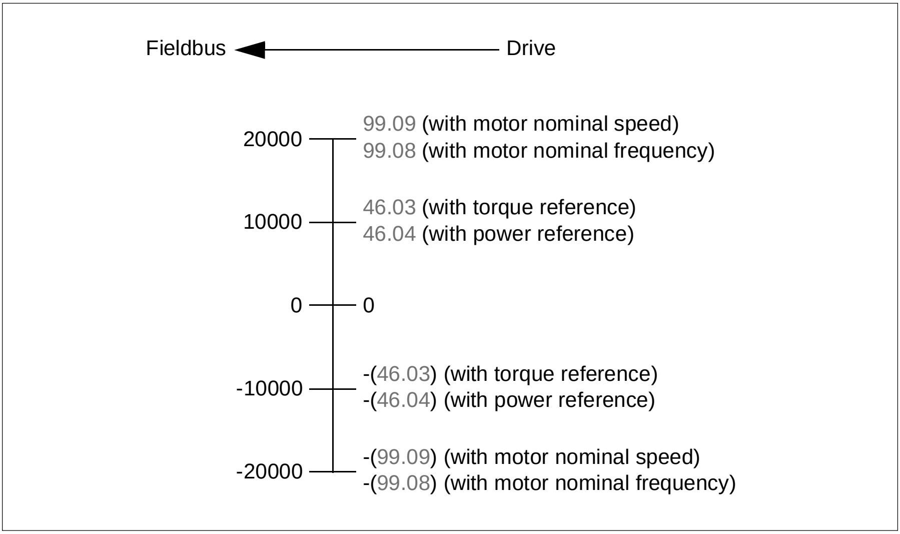
The references are provided by MPPT and does not depend on any user settings.

Actual values

Actual values for the ABB Drives profile and DCU Profile

The ABB Drives profile supports the use of two fieldbus actual values, ACT1 and ACT2. The actual values are 16-bit words each containing a sign bit and a 15-bit integer. A negative value is formed by calculating the two's complement from the corresponding positive value.

The actual values are scaled as defined by parameters 99.08, 99.09, 46.03 and 46.04; which scaling is in use depends on the setting of parameters 58.28 EFB act1 type and 58.29 EFB act2 type (see page 222).



Modbus holding register addresses

Modbus holding register addresses for the ABB Drives profile and DCU Profile

The table below shows the default Modbus holding register addresses for the drive data with the ABB Drives profile. This profile provides a converted 16-bit access to the drive data.

Note: Only the 16 least significant bits of the drive's 32-bit Control and Status Words can be accessed.

Note: Bits 16 through 32 of the DCU Control/Status word are not in use if 16-bit control/status word is used with the DCU Profile.

Register address	Register data (16-bit words)
400001	Default: Control word (CW 16bit). See sections Control Word for the ABB Drives profile (page 351) and Control Word for the DCU Profile (page 352). The selection can be changed using parameter 58.101 Data I/O 1.
400002	Default: Reference 1 (Ref1 16bit). The selection can be changed using parameter 58.104 Data I/O 4.
400003	Default: Reference 2 (Ref2 16bit). The selection can be changed using parameter 58.104 Data I/O 4.
400004	Default: Status Word (SW 16bit). See sections Status Word for the ABB Drives profile (page 355) and Status Word for the DCU Profile (page 356). The selection can be changed using parameter 58.104 Data I/O 4.
400005	Default: Actual value 1 (Act1 16bit). The selection can be changed using parameter 58.105 Data I/O 5.
400006	Actual value 2 (Act2 16bit). The selection can be changed using parameter 58.106 Data I/O 6.
400007…400014	Data in/out 7…14. Selected by parameters 58.107 Data I/O 7 …58.114 Data I/O 14.
400015...400089	Unused
400090...400100	Error code access. See section Error code registers (holding registers 400090…400100) (page 368).
400101...465536	Parameter read/write. Parameters are mapped to register addresses according to parameter 58.33 Addressing mode.

Modbus function codes

The table below shows the Modbus function codes supported by the embedded fieldbus interface.

Code	Function name	Description
01h	Read Coils	Reads the 0/1 status of coils (0X references).
02h	Read Discrete Inputs	Reads the 0/1 status of discrete inputs (1X references).
03h	Read Holding Registers	Reads the binary contents of holding registers (4X references).
05h	Write Single Coil	Forces a single coil (0X reference) to 0 or 1.
06h	Write Single Register	Writes a single holding register (4X reference).
08h	Diagnostics	Provides a series of tests for checking the communication, or for checking various internal error conditions. Supported subcodes: • 00h Return Query Data: Echo/loopback test. • 01h Restart Comm Option: Restarts and initializes the EFB, clears communications event counters. • 04h Force Listen Only Mode • 0Ah Clear Counters and Diagnostic Register • 0Bh Return Bus Message Count • 0Ch Return Bus Comm. Error Count • 0Dh Return Bus Exception Error Count • 0Eh Return Slave Message Count • 0Fh Return Slave No Response Count • 10h Return Slave NAK (negative acknowledge) Count • 11h Return Slave Busy Count • 12h Return Bus Character Overrun Count • 14h Clear Overrun Counter and Flag
0Bh	Get Comm Event Counter	Returns a status word and an event count.
0Fh	Write Multiple Coils	Forces a sequence of coils (0X references) to 0 or 1.
10h	Write Multiple Registers	Writes the contents of a contiguous block of holding registers (4X references).
16h	Mask Write Register	Modifies the contents of a 4X register using a combination of an AND mask, an OR mask, and the register's current contents.

Code	**Function name**	**Description**
17h	Read/Write Multiple Registers	Writes the contents of a contiguous block of 4X registers, then reads the contents of another group of registers (the same or different than those written) in a server device.
2Bh / 0Eh	Encapsulated Interface Transport	Supported subcodes: • 0Eh Read Device Identification: Allows reading the identification and other information. Supported ID codes (access type): • 00h: Request to get the basic device identification (stream access) • 04h: Request to get one specific identification object (individual access) Supported Object IDs: • 00h: Vendor Name (“ABB”) • 01h: Product Code (for example, “ASCLx or ASCDx”) • 02h: Major Minor Revision (combination of contents of parameters 07.05 Firmware version and 58.02 Protocol ID). • 03h: Vendor URL (“www.abb.com”) • 04h: Product name: (“ACQ80”).

Exception codes

The table below shows the Modbus exception codes supported by the embedded fieldbus interface.

Code	**Name**	**Description**
01h	ILLEGAL FUNCTION	The function code received in the query is not an allowable action for the server.
02h	ILLEGAL ADDRESS	The data address received in the query is not an allowable address for the server.
03h	ILLEGAL VALUE	The requested quantity of registers is larger than the device can handle. This error does not mean that a value written to the device is outside of the valid range.
04h	DEVICE FAILURE	An unrecoverable error occurred while the server was attempting to perform the requested action. See section Error code registers (holding registers 400090…400100) on page 368.

Coils (0xxxx reference set)

Coils are 1-bit read/write values. Control Word bits are exposed with this data type. The table below summarizes the Modbus coils (0xxxx reference set). Note that the references are 1-based index which match the address transmitted on the wire.

Reference	ABB Drives profile	DCU Profile
000001	OFF1_CONTROL	STOP
000002	OFF2_CONTROL	START
000003	OFF3_CONTROL	Reserved
000004	INHIBIT_OPERATION	Reserved
000005	RAMP_OUT_ZERO	RESET
000006	RAMP_HOLD	EXT2
000007	RAMP_IN_ZERO	RUN_DISABLE
000008	RESET	STOPMODE_RAMP
000009	Reserved	Reserved
000010	Reserved	Reserved
000011	REMOTE_CMD	Reserved
000012	EXT_CTRL_LOC	RAMP_OUT_ZERO
000013	USER_0	RAMP_HOLD
000014	USER_1	RAMP_IN_ZERO
000015	USER_2	Reserved
000016	USER_3	Reserved
000017	Reserved	FB_LOCAL_CTL
000018	Reserved	FB_LOCAL_REF
000019	Reserved	Reserved
000020	Reserved	Reserved
000021	Reserved	Reserved
000022	Reserved	Reserved
000023	Reserved	USER_0
000024	Reserved	USER_1
000025	Reserved	USER_2
000026	Reserved	USER_3
000027	Reserved	Reserved
000028	Reserved	Reserved
000029	Reserved	Reserved
000030	Reserved	Reserved
000031	Reserved	Reserved
000032	Reserved	Reserved

Reference	**ABB Drives profile**	**DCU Profile**
000033	Control for relay output RO1 (parameter 10.99 RO/DIO control word, bit 0)	Control for relay output RO1 (parameter 10.99 RO/DIO control word, bit 0)
000034	Control for relay output RO2 (parameter 10.99 RO/DIO control word, bit 1)	Control for relay output RO2 (parameter 10.99 RO/DIO control word, bit 1)
000035	Control for relay output RO3 (parameter 10.99 RO/DIO control word, bit 2)	Control for relay output RO3 (parameter 10.99 RO/DIO control word, bit 2)
000036	Control for relay output RO4 (parameter 10.99 RO/DIO control word, bit 3)	Control for relay output RO4 (parameter 10.99 RO/DIO control word, bit 3)
000037	Control for relay output RO5 (parameter 10.99 RO/DIO control word, bit 4)	Control for relay output RO5 (parameter 10.99 RO/DIO control word, bit 4)

Discrete inputs (1xxxx reference set)

Discrete inputs are 1-bit read-only values. Status Word bits are exposed with this data type. The table below summarizes the Modbus discrete inputs (1xxxx reference set). Note that the references are 1-based index which match the address transmitted on the wire.

Reference	ABB Drives profile	DCU Profile
100001	RDY_ON	READY
100002	RDY_RUN	D
100003	RDY_REF	Reserved
100004	TRIPPED	RUNNING
100005	OFF_2_STATUS	ZERO_SPEED
100006	OFF_3_STATUS	Reserved
100007	SWC_ON_INHIB	Reserved
100008	ALARM	AT_SETPOINT
100009	AT_SETPOINT	LIMIT
100010	REMOTE	SUPERVISION
100011	ABOVE_LIMIT	Reserved
100012	USER_0	Reserved
100013	USER_1	PANEL_LOCAL
100014	USER_2	FIELDBUS_LOCAL
100015	USER_3	EXT2_ACT
100016	Reserved	FAULT
100017	Reserved	ALARM
100018	Reserved	Reserved
100019	Reserved	Reserved
100020	Reserved	Reserved
100021	Reserved	Reserved
100022	Reserved	Reserved
100023	Reserved	USER_0
100024	Reserved	USER_1
100025	Reserved	USER_2
100026	Reserved	USER_3
100027	Reserved	REQ_CTL
100028	Reserved	Reserved
100029	Reserved	Reserved
100030	Reserved	Reserved
100031	Reserved	Reserved
100032	Reserved	Reserved

Reference	ABB Drives profile	DCU Profile
100033	Delayed status of digital input DI1 (parameter 10.02 DI delayed status, bit 0)	Delayed status of digital input DI1 (parameter 10.02 DI delayed status, bit 0)
100034	Delayed status of digital input DI2 (parameter 10.02 DI delayed status, bit 1)	Delayed status of digital input DI2 (parameter 10.02 DI delayed status, bit 1)
100035	Delayed status of digital input DI3 (parameter 10.02 DI delayed status, bit 2)	Delayed status of digital input DI3 (parameter 10.02 DI delayed status, bit 2)
100036	Delayed status of digital input DI4 (parameter 10.02 DI delayed status, bit 3)	Delayed status of digital input DI4 (parameter 10.02 DI delayed status, bit 3)
100037	Delayed status of digital input DI5 (parameter 10.02 DI delayed status, bit 4)	Delayed status of digital input DI5 (parameter 10.02 DI delayed status, bit 4)
100038	Delayed status of digital input DI6 (parameter 10.02 DI delayed status, bit 5)	Delayed status of digital input DI6 (parameter 10.02 DI delayed status, bit 5)

Error code registers (holding registers 400090…400100)

These registers contain information about the last query. The error register is cleared when a query has finished successfully.

Reference	**Name**	**Description**
400090	Reset Error Registers	1 = Reset internal error registers (91…95). 0 = Do nothing.
400091	Error Function Code	Function code of the failed query.
400092	Error Code	Set when exception code 04h is generated (see table above). • 00h No error • 02h Low/High limit exceeded • 03h Faulty Index: Unavailable index of an array parameter • 05h Incorrect Data Type: Value does not match the data type of the parameter • 65h General Error: Undefined error when handling query
400093	Failed Register	The last register (discrete input, coil, input register or holding register) that failed to be read or written.
400094	Last Register Written Successfully	The last register (discrete input, coil, input register or holding register) that was written successfully.
400095	Last Register Read Successfully	The last register (discrete input, coil, input register or holding register) that was read successfully.

10

Fieldbus control through a fieldbus adapter

What this chapter contains

This chapter describes how the drive can be controlled by external devices over a communication network (fieldbus) through an optional fieldbus adapter module.

The fieldbus control interface of the drive is described first, followed by a configuration example.

System overview

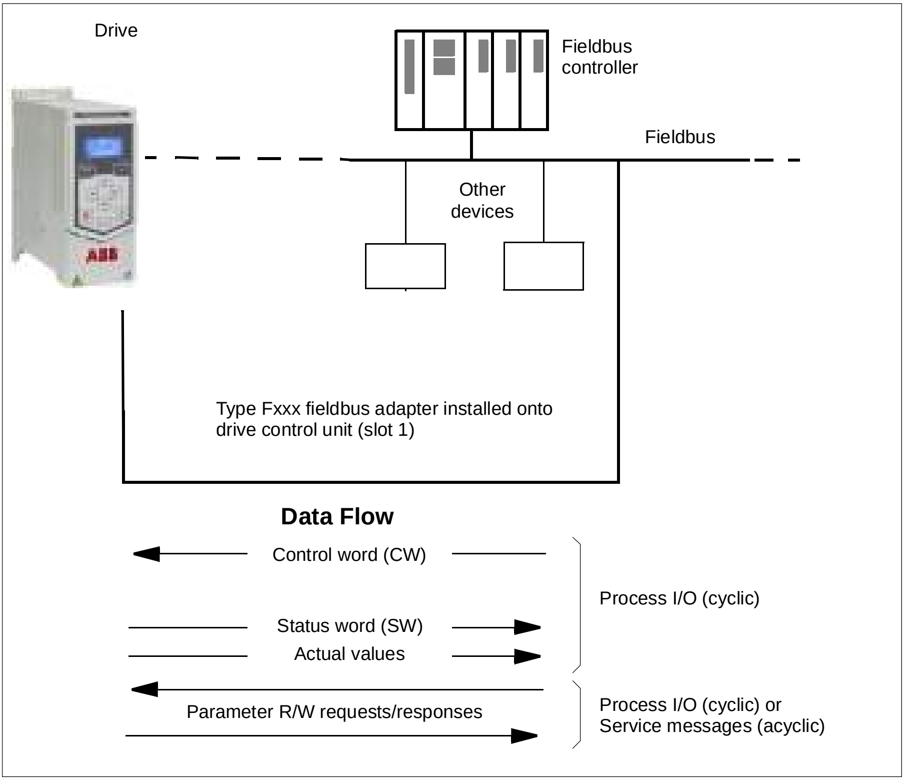
The drive can be connected to an external control system through an optional fieldbus adapter (“fieldbus adapter A” = FBA A) mounted onto the control unit of the drive. The drive can be configured to receive all of its control information through the fieldbus interface, or the control can be distributed between the fieldbus interface and other available sources such as digital and analog inputs, depending on how control locations EXT1 and EXT2 are configured.

Fieldbus adapters are available for various communication systems and protocols, for example

- Profibus (FPBA-01 adapter)
- CANopen (FCAN-01 adapter)
- Ethercat (FECA adapter)
- Ethernet IP^{TM}/Profinet/Modbus TCP(FENA-11/21 adapter)
- ModbusRTU (FSCA) (applicable only for R3...R8 frames)

Notes:

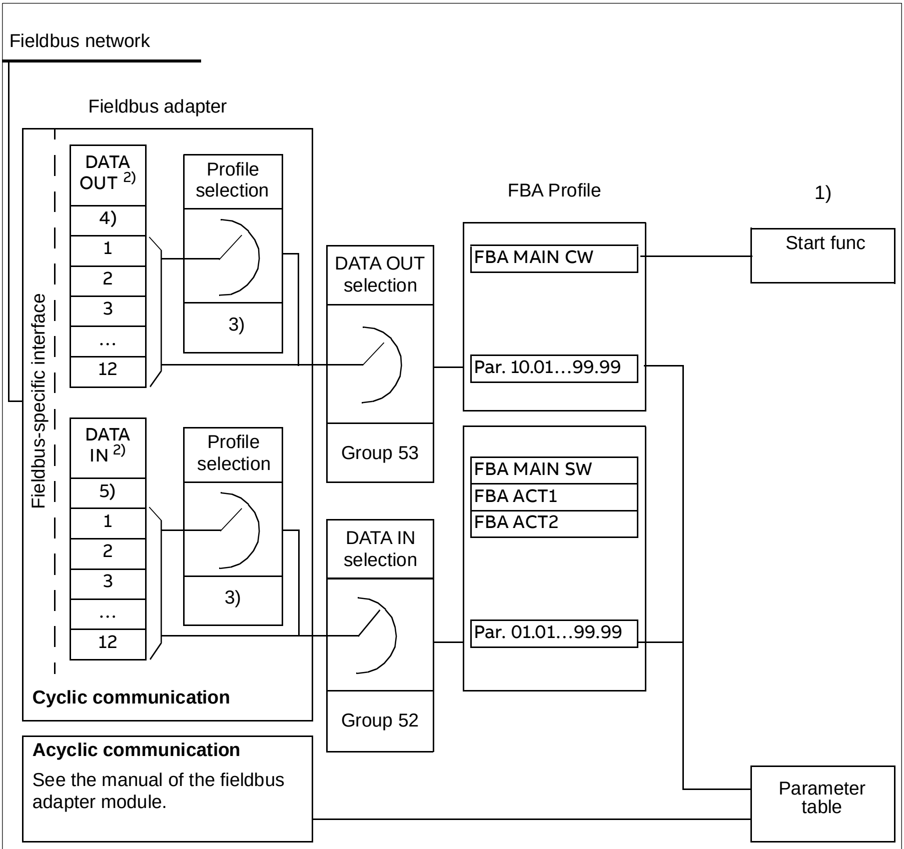
- The text and examples in this chapter describe the configuration of one fieldbus adapter (FBA A) by parameters 50.01…50.18 and parameter groups 51 FBA A settings…53 FBA A data out.
- The AC 500 PLC has a free version library called PS553 drives which helps user to communicate and control between PLC and drives easily.



Basics of the fieldbus control interface

The cyclic communication between a fieldbus system and the drive consists of 16- or 32-bit input and output data words. The drive is able to support a maximum of 12 data words (16 bits) in each direction.

Data transmitted from the drive to the fieldbus controller is defined by parameters 52.01 FBA A data in1 … 52.12 FBA A data in12. The data transmitted from the fieldbus controller to the drive is defined by parameters 53.01 FBA A data out1 53.12 FBA A data out12.



1) See also other parameters which can be controlled from fieldbus.
2) The maximum number of data words used is protocol-dependent.
3) Profile/instance selection parameters. Fieldbus module specific parameters. For more information, see the *User's manual* of the appropriate fieldbus adapter module.

Control word and Status word

The Control word is the principal means for controlling the drive from a fieldbus system. It is sent by the fieldbus master station to the drive through the adapter module. The drive switches between its states according to the bit-coded instructions in the Control word, and returns status information to the master in the Status word.

The contents of the Control word and the Status word are detailed on pages 373 and 375 respectively. The drive states are presented in the state diagram (page 376).

Debugging the network words

If parameter 50.12 FBA A debug mode is set to Fast [1], the Control word received from the fieldbus is shown by parameter 50.13 FBA A control word, and the Status word transmitted to the fieldbus network by 50.16 FBA A status word. This “raw” data is very useful to determine if the fieldbus master is transmitting the correct data before handing control to the fieldbus network.

References

The references are provided by MPPT and does not depend on any user settings. For more information on MPPT, see chapter Flow calculation on page 45.

Actual values

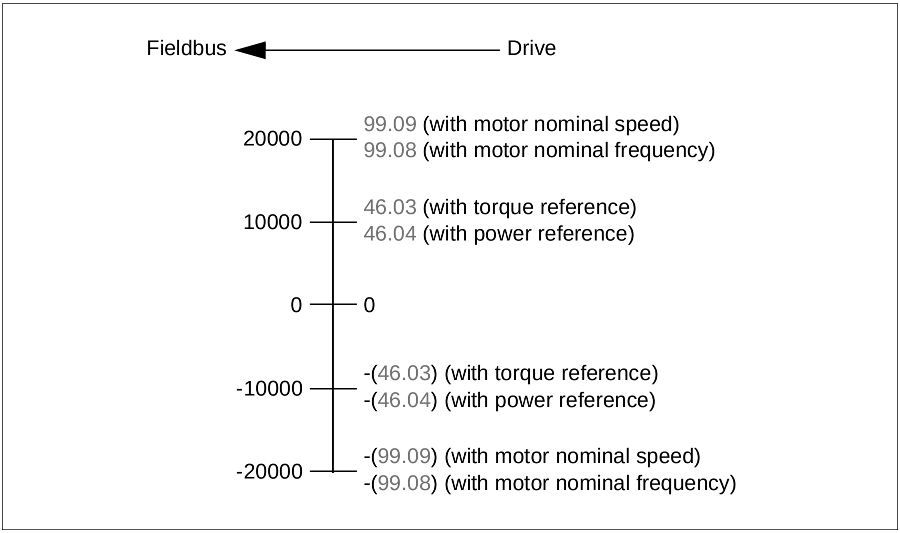
Actual values are 16-bit words containing information on the operation of the drive. The types of the monitored signals are selected by parameters 50.07 FBA A actual 1 type and 50.08 FBA A actual 2 type.

Debugging the network words

If parameter 50.12 FBA A debug mode is set to Fast [1], the actual values sent to the fieldbus are displayed by 50.17 FBA A actual value 1 and 50.18 FBA A actual value 2.

Scaling of actual values

The actual values are scaled as defined by parameters 46.03 and 46.04; which scaling is in use depends on the setting of parameters 50.07 FBA A actual 1 type and 50.08 FBA A actual 2 type (see page 211).



Contents of the fieldbus Control word

The upper case boldface text refers to the states shown in the state diagram (page 376).

Bit	Name	Value	STATE/Description
0	Off1 control	1	Proceed to **READY TO OPERATE**.
		0	Stop along currently active deceleration ramp. Proceed to **OFF1 ACTIVE**; proceed to **READY TO SWITCH ON** unless other interlocks (OFF2, OFF3) are active.
1	Off2 control	1	Continue operation (OFF2 inactive).
		0	Emergency OFF, coast to a stop. Proceed to **OFF2 ACTIVE**, proceed to **SWITCH-ON INHIBITED**.
2	Off3 control	1	Continue operation (OFF3 inactive).
		0	Emergency stop, stop within time defined by drive parameter. Proceed to **OFF3 ACTIVE**; proceed to **SWITCH-ON INHIBITED**. ⚠ **WARNING:** Ensure motor and driven machine can be stopped using this stop mode.
3	Run	1	Proceed to **OPERATION D**. **Note:** Run enable signal must be active; see drive documentation. If the drive is set to receive the Run enable signal from the fieldbus, this bit activates the signal.
		0	Inhibit operation. Proceed to **OPERATION INHIBITED**.
4	Ramp out zero	1	Normal operation. Proceed to **RAMP FUNCTION GENERATOR: OUTPUT D**.
		0	Force Ramp function generator output to zero. The drive will immediately decelerate to zero speed (observing the torque limits).

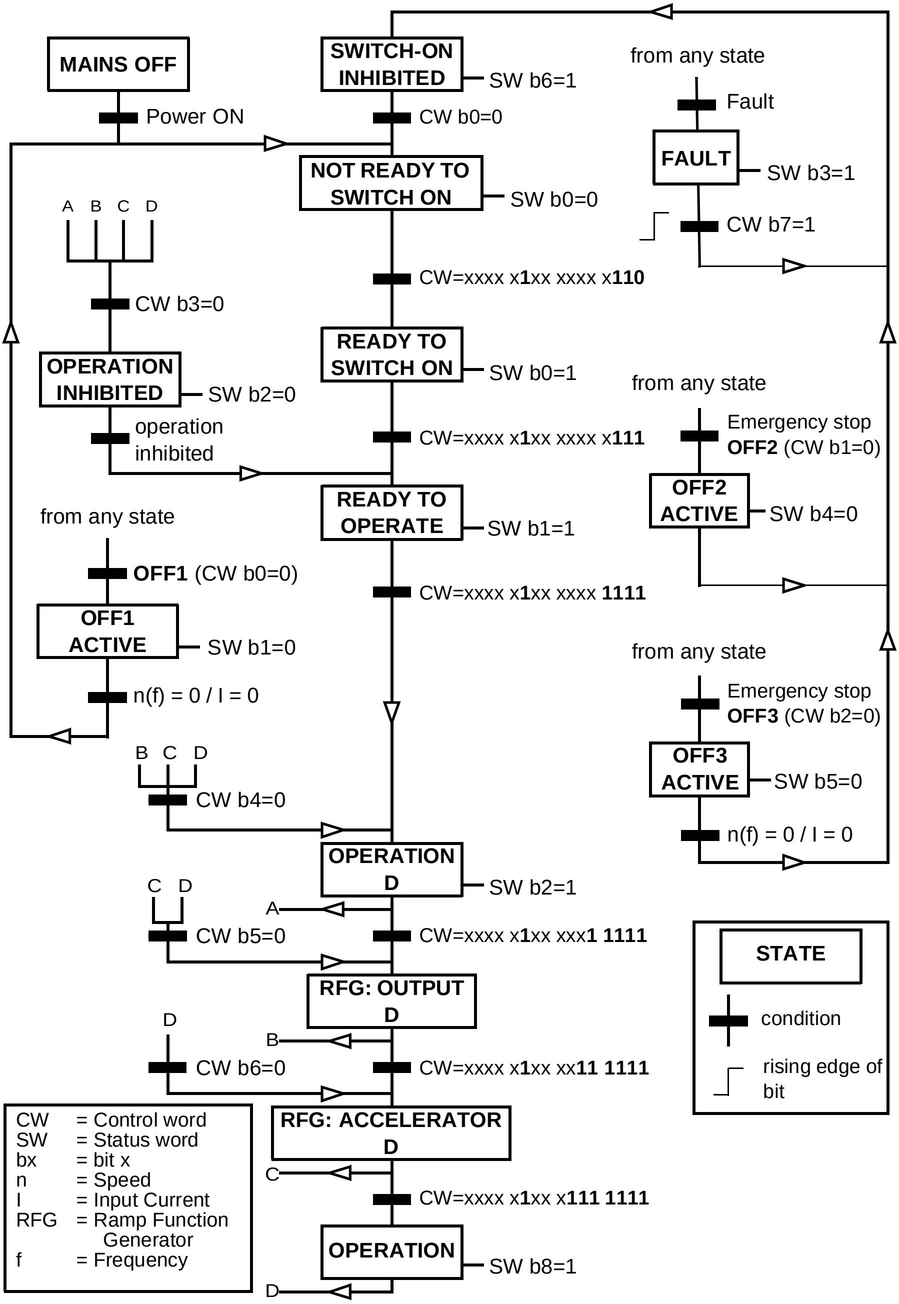
Bit	**Name**	**Value**	**STATE/Description**
5	Ramp hold	1	ramp function. Proceed to **RAMP FUNCTION GENERATOR: ACCELERATOR D**.
		0	Halt ramping (Ramp Function Generator output held).
6	Ramp in zero	1	Normal operation. Proceed to **OPERATING**. **Note:** This bit is effective only if the fieldbus interface is set as the source for this signal by drive parameters.
		0	Force Ramp function generator input to zero.
7	Reset	0=>1	Fault reset if an active fault exists. Proceed to **SWITCH-ON INHIBITED**. **Note:** This bit is effective only if the fieldbus interface is set as the source of the reset signal by drive parameters.
		0	Continue normal operation.
8...9	Reserved		
10	Remote cmd	1	Fieldbus control d.
		0	Control word and reference not getting through to the drive, except for bits 0…2.
11	Ext ctrl loc	1	Select External Control Location EXT2. Effective if control location is parameterized to be selected from fieldbus.
		0	Select External Control Location EXT1. Effective if control location is parameterized to be selected from fieldbus.
12	User bit 0	1	User configurable
		0	
13	User bit 1	1	
		0	
14	User bit 2	1	
		0	
15	User bit 3	1	
		0	

Contents of the fieldbus Status word

The upper case boldface text refers to the states shown in the state diagram (page 376).

Bit	Name	Value	STATE/Description
0	Ready to switch ON	1	**READY TO SWITCH ON**.
		0	**NOT READY TO SWITCH ON**.
1	Ready run	1	**READY TO OPERATE**.
		0	**OFF1 ACTIVE**.
2	Ready ref	1	**OPERATION D**.
		0	**OPERATION INHIBITED**.
3	Tripped	1	**FAULT**.
		0	No fault.
4	Off 2 inactive	1	OFF2 inactive.
		0	**OFF2 ACTIVE**.
5	Off 3 inactive	1	OFF3 inactive.
		0	**OFF3 ACTIVE**.
6	Switch-on inhibited	1	**SWITCH-ON INHIBITED**.
		0	–
7	Warning	1	Warning active.
		0	No warning active.
8	At setpoint	1	**OPERATING**. Actual value equals reference = is within tolerance limits
		0	Actual value differs from reference = is outside tolerance limits.
9	Remote	1	Drive control location: REMOTE (EXT1 or EXT2).
		0	Drive control location: LOCAL.
10	Above limit	-	See bit 10 of 06.17 Drive status word 2.
11	User bit 0	-	See parameter 06.30 MSW bit 11 selection.
12	User bit 1	-	See parameter 06.31 MSW bit 12 selection.
13	User bit 2	-	See parameter 06.32 MSW bit 13 selection.
14	User bit 3	-	See parameter 06.33 MSW bit 14 selection.
15	Reserved		

The state diagram



Setting up the drive for fieldbus control

1. Install the fieldbus adapter module mechanically and electrically according to the instructions given in the *User's manual* of the module.
2. Power up the drive.
3. Enable the communication between the drive and the fieldbus adapter module with parameter 50.01 FBA A enable.
4. With 50.02 FBA A comm loss func, select how the drive should react to a fieldbus communication break.
   Note: This function monitors both the communication between the fieldbus master and the adapter module and the communication between the adapter module and the drive.
5. With 50.03 FBA A comm loss t out, define the time between communication break detection and the selected action.
6. Select application-specific values for the rest of the parameters in group 50 Fieldbus adapter (FBA), starting from 50.04. Examples of appropriate values are shown in the tables below.
7. Set the fieldbus adapter module configuration parameters in group 51 FBA A settings. As a minimum, set the required node address and the communication profile.
8. Define the process data transferred to and from the drive in parameter groups 52 FBA A data in and 53 FBA A data out.
   Note: Depending on the communication protocol and profile being used, the Control word and Status word may already be configured to be sent/received by the communication system.
9. Save the valid parameter values to permanent memory by setting parameter 96.07 Parameter save manually to Save.
10. Validate the settings made in parameter groups 51, 52 and 53 by setting parameter 51.27 FBA A par refresh to Configure.
11. Configure control locations EXT1 and EXT2 to allow control and reference signals to come from the fieldbus. Examples of appropriate values are shown in the tables below.

Parameter setting example: FPBA (PROFIBUS)

This example shows how to configure a basic speed control application that uses the PROFIdrive communication profile with PPO Type 2. The start/stop commands are according to the PROFIdrive profile and speed control mode.

Direction	**PZD1**	**PZD2**	**PZD3**	**PZD4**	**PZD5**	**PZD6**
Out	Control word	Speed reference	Acc time 1		Dec time 1	
In	Status word	Speed actual value	Motor current		DC voltage	

The table below gives the recommended drive parameter settings.

Drive parameter	**Setting for ACS 560 drives**	**Description**
50.01 FBA A enable	**1** = [slot number]	Enables communication between the drive and the fieldbus adapter module.
50.04 FBA A ref1 type	**4** = Speed	Selects the fieldbus A reference 1 type and scaling.
50.07 FBA A actual 1 type	**0** = Speed or frequency	Selects the actual value type and scaling according to the currently active Ref1 mode defined in parameter 50.04.
51.01 FBA A type	**1** = FPBA 1)	Shows type of the fieldbus adapter module.
51.02 Node address	3 2)	Defines the PROFIBUS node address of the fieldbus adapter module.
51.03 Baud rate	12000 1)	Shows current baud rate on the PROFIBUS network in kbit/s.
51.04 MSG type	**1** = PPO2 1)	Shows telegram type selected by the PLC configuration tool.
51.05 Profile	**0** = PROFIdrive	Selects the Control word according to the PROFIdrive profile (speed control mode).
51.07 RPBA mode	**0** = Disabled	Disables the RPBA emulation mode.
52.01 FBA data in1	**4** = SW 16bit 1)	Status word
52.02 FBA data in2	**5** = Act1 16bit	Actual value 1
52.03 FBA data in3	01.07 2)	Motor current
52.05 FBA data in5	01.11 2)	DC voltage
53.01 FBA data out1	**1** = CW 16bit 1)	Control word
53.02 FBA data out2	**2** = Ref1 16bit	Reference 1 (speed)
53.03 FBA data out3	23.12 2)	Acceleration time 1
53.05 FBA data out5	23.13 2)	Deceleration time 1
51.27 FBA A par refresh	**1** = Configure	Validates the configuration parameter settings.

Drive parameter	**Setting for ACS 560 drives**	**Description**
79.10 Operating mode	**4** = Fieldbus A	Selects fieldbus adapter A as the source of the start and stop commands

[1] Read-only or automatically detected/set

[2] Example

The start sequence for the parameter example above is given below.

Control word:

- 477h (1143 decimal) –> READY TO SWITCH ON
- 47Fh (1151 decimal) –> OPERATING (Speed mode)

11

Parameterization with Drive Composer

Contents of this chapter

The chapter describes about the Drive Composer PC tool and how drive parameters can be managed using the PC tool.

Drive Composer overview

Drive Composer is a 32-bit PC tool used for commissioning and maintaining ABB common architecture drives.The PC tool can be connected to a drive that has the assistant control panel or a dummy panel. The full version is called Drive Composer pro and the free version is called Drive Composer entry. The free version is available for download from ABB website.

Note: The PC tool cannot be connected to the basic control panel.

You can perform following actions with Drive Composer:

- View and adjust drive parameters.
- Control a drive: start, stop, direction, speed/torque/frequency reference.
- Monitor the operation and status of a drive.
- Monitor signals in numerical and graphical (trending) format.
- Work simultaneously with multiple drives like master and follower drives (pro).
- Display control diagrams of a drive for parameter setting and diagnostic purposes (pro).
- Create user-specific workspaces by customizing parameter windows.
- Configure the optional FSO-11 and FSO-12 safety functions module (pro).
- Handle workspaces.
- Create and execute macro scripts (pro).

How to connect the Drive Composer

To establish a connection between the Drive Composer and the drive you need to meet the following requirements:

- Computer with Drive Composer installed
- Assistant control panel or Dummy panel
- Mini USB cable (assistant control panel) or BCBL-01 cable (dummy panel)

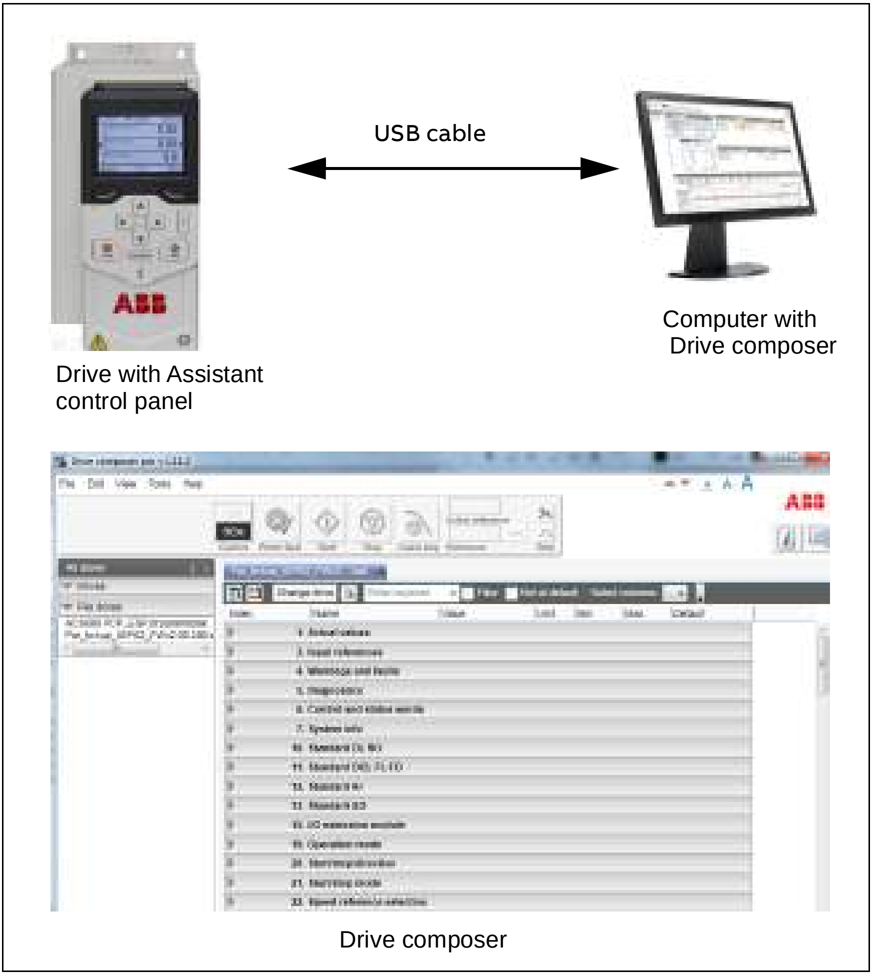
Communication devices

Use the following communication devices:

- BCBL-01 cable to connect the drive with a dummy panel. Connect BCBL-01 cable to the RJ 45 port of the panel and the other end to the USB port of your computer. You can order the BCBL-01 with order ID *3AXD50000032449.*
- Mini USB cable to connect the drive with an assistant panel.
- Ethernet-based fieldbus adapter modules for PC tool communication (one-wire solution, Profinet, Ethernet IP) (pro) or a drive-embedded Ethernet port
- OPC-based commissioning and maintenance tool (pro).

Both versions include a demo that allows testing user interface functionality, edit parameter files offline (pro) or open and analyze saved monitored files without connecting to a physical drive.

Connection Diagram (with assistant panel)



For more information, see *Drive Composer startup and maintenance PC tool user’s manual* (3AUA0000094606[English]).

12

Parameterization with Automation builder drive manager

Contents of this chapter

The chapter describes about the Automation builder drive manager application and how drive parameters can be managed with the Automation builder drive manager.

Automation builder drive manager

Automation builder drive manager is a software tool that enables you to configure ABB drives connected to the PLC through PROFIBUS or PROFINET.

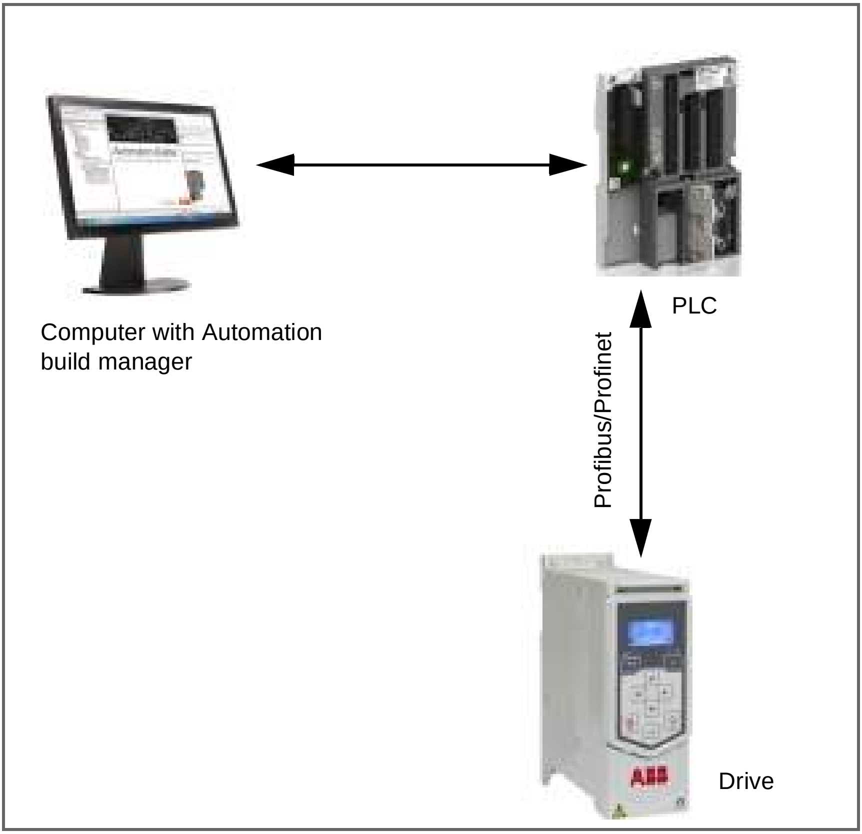
You can perform the following actions with the Automation builder drive manager:

- Monitor the drive status: running, stopped, external control locations EXT1/EXT2 and motor running direction.
- Monitor the drive parameters.
- Monitor the drive firmware version and properties.
- Monitor the drive parameter values along with the parameter attributes like parameter minimum and maximum settings, parameter units and parameter protection status.
- Edit parameters in offline view and then copy to drive when online.
- Open the offline drive parameter settings (project view) and compare to the online drive parameters. The compare function shows the parameters with

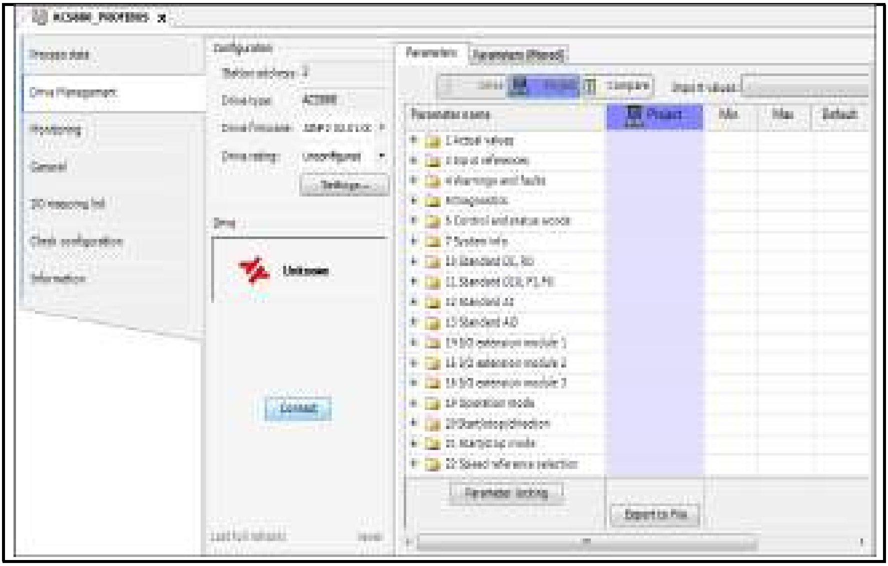
different settings in offline and online mode. You can also download the parameter values which have differences in offline and online settings.

- Export the drive parameters from Drive Manager to the respective standalone drive tool parameter file formats (*dsp, mdwp, dcparamsbak*).
- Import the drive parameters (*dsp, dwp, dcparamsbak*) to the Drive Manager and compare the parameter values of the file with the project view file.
- Update and save a group or a single parameter to the drive.

Connection diagram



Parameter view with drive manager



For more information on automation builder application download, purchase see http://new.abb.com/plc/automationbuilder/platform/software. The information about configuring automation builder with drive and other details are available in the online help of the application.

Further information

Product and service inquiries

Address any inquiries about the product to your local ABB representative, quoting the type designation and serial number of the unit in question. A listing of ABB sales, support and service contacts can be found by navigating to abb.com/searchchannels.

Product training

For information on ABB product training, navigate to new.abb.com/service/training.

Providing feedback on ABB Drives manuals

Your comments on our manuals are welcome. Navigate to new.abb.com/drives/manuals-feedback-form.

Document library on the Internet

You can find manuals and other product documents in PDF format on the Internet at abb.com/drives/documents.

abb.com/drives

3AXD50000170654C

3AXD50000170654 Rev C (EN) 2023-03-27