Firmware manual ACQ580 pump control program



List of related manuals

Drive manuals and guides	Code (English)
ACQ580 pump control program firmware manual	3AXD50000035867
ACQ580-01 (0.75 to 250 kW, 1.0 to 350 hp) hardware manual	3AXD50000035866
ACQ580-01 quick installation and start-up guide for frames R0 to R5	3AXD50000035755
ACQ580-01 quick installation and start-up guide for frames R6 to R9	3AXD50000037301
ACP-AP-x assistant control panels user's manual	3AUA0000085685
Option manuals and guides	
CDPI-01 communication adapter module user's manual	3AXD50000009929
DPMP-01 mounting platform for ACP-AP control panel	3AUA0000100140
DPMP-02/03 mounting platform for ACP-AP control panel	3AUA0000136205
FDNA-01 DeviceNet™ adapter module user's manual	3AFE68573360
FENA-01/-11/-21 Ethernet adapter module user's manual	3AUA0000093568
FPBA-01 PROFIBUS DP adapter module user's manual	3AFE68573271
FSCA-01 RS-485 adapter module user's manual	3AUA0000109533
Flange mounting kit installation supplement	3AXD50000019100
Flange mounting kit quick installation guide for ACX580-01 frames R0 to R5	3AXD50000036610
Flange mounting kit quick installation guide for ACS880-01 and ACX580-01 frames R0 to R6	3AXD50000019099
Tool and maintenance manuals and guides	
Drive composer PC tool user's manual	3AUA0000094606
Converter module capacitor reforming instructions	3BFE64059629
NETA-21 remote monitoring tool user's manual	3AUA00000969391
NETA-21 remote monitoring tool installation and start-up	3AUA0000096881

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.



guide

ACQ580-01 manuals



1. Introduction to the manual

Start-up, control with I/O and ID run



- 3. Control panel
- 4. Default configuration
- 5. Program features
- 6. Parameters
- 7. Additional parameter data
- 8. Fault tracing
- 9. Fieldbus control through the embedded fieldbus interface (EFB)
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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

This manual applies to the ACQ580 pump control program (version 2.01.100.12). The control program supports the multipump program feature with option code +N845.

To check the firmware version of the control program in use, see system information (select Menu - System info - Drive) or parameter 07.05 Firmware version (see page 109) on the control panel.

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 93.

Target audience

The reader is expected to know the fundamentals of electricity, wiring, electrical components and electrical schematic symbols.

The manual is written for readers worldwide. Both SI and imperial units are shown. Special US instructions for installations in the United States are given.

Purpose of the manual

This manual provides information needed for designing, commissioning, or operating the 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.
- Start-up, control with I/O and ID run (page 17) describes how to start up the drive as well as how to start, change the direction of the motor rotation and adjust the motor speed through the I/O interface.
- Control panel (page 29) contains instructions for removing and reinstalling the assistant control panel and briefly describes its display, keys and key shortcuts.
- Default configuration (page 35) contains the connection diagram of the Water default configuration together with a connection diagram. The predefined default configuration will save the user time when configuring the drive.
- Program features (page 39) describes program features with lists of related user settings, actual signals, and fault and warning messages.
- Parameters (page 93) describes the parameters used to program the drive.
- Additional parameter data (page 283) contains further information on the parameters.
- Fieldbus control through the embedded fieldbus interface (EFB) (page 335) describes the communication to and from a fieldbus network using the embedded fieldbus interface of the drive.
- Fieldbus control through a fieldbus adapter (page 363) describes the communication to and from a fieldbus network using an optional fieldbus adapter module
- Fault tracing (page 315) lists the warning and fault messages with possible causes and remedies.
- · Control chain diagrams (page 375) describes the parameter structure within the drive.
- Further information (inside of the back cover, page 387) 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

See List of related manuals on page 2 (inside of the front cover).

Categorization by frame (size)

The ACQ580 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 chapter Operation principle and hardware description, section Type designation label in the Hardware manual of the drive.

Terms and abbreviations

Term/abbreviation	Explanation
ACS-AP-x	Assistant control panel, advanced operator keypad for communication with the drive.
	The dedicated assistant control panel for the ACQ580 is ACH-AP-H (Hand-Off-Auto panel).
	The ACQ580 offers limited support of ACS-AP-I and ACS-AP-W. The Start, Stop, Loc/Rem buttons on these panels act as Hand, Auto and Off buttons, respectively, when used with the ACQ580. You can use parameters and Primary settings menus with ACS-AP-I and parameters and I/O with ACS-AP-W.
Al	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.
CDPI-01	Communication adapter module
CCA-01	Configuration adapter
CHDI-01	Optional 115/230 V digital input extension module
CMOD-01	Optional multifunction extension module (external 24 V AC/DC and digital I/O extension)
CMOD-02	Optional multifunction extension module (external 24 V AC/DC and isolated PTC interface)
CRC	Cyclic redundancy check. The IPC checks the parameter group validity in terms of CRC.
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
DO	Digital output; interface for digital output signals
DPMP-01	Mounting platform for ACS-AP control panel (flange mounting)
DPMP-02/03	Mounting platform for ACS-AP control panel (surface mounting)
Drive	Frequency converter for controlling AC motors
EFB	Embedded fieldbus
FBA	Fieldbus adapter
FCAN-01	Optional CANopen adapter module
FDNA-01	Optional DeviceNet adapter module
FENA-01/-11/-21	Optional Ethernet adapter module for EtherNet/IP, Modbus TCP and PROFINET IO protocols
FLON-01	LonWorks® adapter module
FPBA-01	Optional PROFIBUS DP 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 <i>Operation principle and hardware description</i> , section <i>Type designation label</i> in the <i>Hardware manual</i> of the drive.

Term/abbreviation	Explanation
FSCA-01	Optional RSA-485 adapter module
ID run	Motor identification run. During the identification run, the drive will identify the characteristics of the motor for optimum motor control.
IGBT	Insulated gate bipolar transistor
Intermediate circuit	See DC link.
Inverter	Converts direct current and voltage to alternating current and voltage.
I/O	Input/Output
IPC	Intelligent pump control
LonWorks®	LONWORKS® (local operating network) is a networking platform specifically created to address the needs of control applications.
LSW	Least significant word
NETA-21	Remote monitoring tool
Network control	With fieldbus protocols based on the Common Industrial Protocol (CIP TM), such as DeviceNet and 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 manuals: • FDNA-01 DeviceNet adapter module user's manual (3AFE68573360 [English]), and • FENA-01/-11/-21 Ethernet adapter module user's manual
Parameter	(3AUA0000093568 [English]). User-adjustable operation instruction to the drive, or signal measured or
Parameter	calculated by the drive
PFC	Single pump control
PID/Loop controller	Proportional–integral–derivative controller. Drive speed control is based on PID algorithm.
PLC	Programmable logic controller
PROFIBUS, PROFIBUS DP, PROFINET IO	Registered trademarks of PI - PROFIBUS & PROFINET International
PTC	Positive temperature coefficient, thermistor whose resistance is dependent on temperature,
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.
SPFC	Soft pump control
STO	Safe torque off. See chapter <i>The Safe torque off function</i> in the <i>Hardware manual</i> 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.

Start-up, control with I/O and **ID** run

Contents of this chapter

The chapter describes how to:

- perform the start-up
- · 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

Power up the drive.

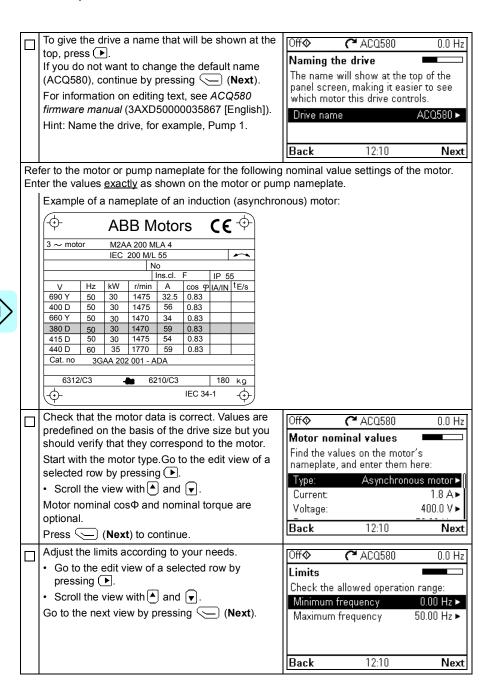
How to start up the drive using First start assistant on the Hand-Off-Auto control panel

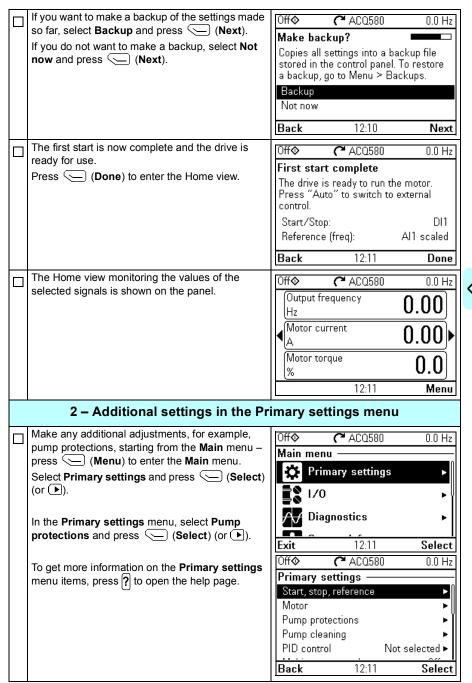
	Safety			
	Λ Do not start-up the drive unless you are a qualified electrician.			
Ľ	$oxed{\Delta}$ Read and obey the instructions in chapter Safety instructions at the beginning of the			
	rdware manual of the drive. Ignoring the instructions can cause physical injury or death, or			
daı	mage to the equipment			
	Check the installation. See chapter Installation checklist in the Hardware manual of the			
	drive.			
	Make sure there is no active start on (DI1 in factory settings, that is, Water default			
	configuration). The drive will start up automatically at power-up if the external run command is on and the drive is in the external control mode.			
	Check that the starting of the motor does not cause any danger.			
	De-couple 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 start-up, when the load torque is higher			
	than 20% or the machinery is not able to withstand the nominal torque transient during the ID run.			
	Hints on using the assistant control panel			
	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.			
	Lies keys (4) (5) (A) and (1) to make the surger			
	and/or change values depending on the active			
	view.			
	Key ? shows a context-sensitive help page.			
	For more information, see ACS-AP-x assistant			
	control panels user's manual (3AUA0000085685			
	[English]).			
	1 – First start assistant guided settings:			
	Language, date and time, and motor nominal values			
	Have the motor or pump name plate data at hand.			





The First start assistant guides you through the first start-up. 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.	English Deutsch Suomi Français Italiano Svenska Español OK ►
Select Start set-up and press (Next).	Off
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).	Off
To change a value 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.	Off
 Change the units shown on the 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). 	Off C* ACQ580 0.0 Hz Units Image: Composition of the properties







3 - Hand/Off/Auto operation

The drive can be in remote control or local control. and in local control there are additionally two different modes

Remote control: Drive is controlled from the I/O or the fieldbus.

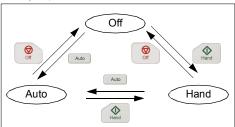
· Top row of the view shows Auto.

Local control: Drive is controlled from the control panel.

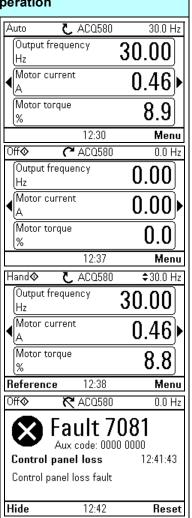
- · Top row of the view shows Off, that is, the drive is in the Off mode. Drive is stopped.
- · Top row of the view shows Hand, that is, the drive is in the Hand mode. Drive is running. The initial reference in the Hand mode is copied from the drive reference

Symbol ♦ on the top row indicates that you can change the reference with ♠ and ▶.

The following diagram shows the state transitions when you press the Hand, Off or Auto button:



Note: When you restart the drive while fault 7081 Control panel loss is active, the mode changes from Hand or Off to Auto





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 start-up is performed, and
- the default parameter settings of the Water default configurations are in use.

Preliminary settings

If you need to change the direction of rotation, check that limits allow reverse direction: Check parameter group 30 Limits and make sure that the minimum limit has a negative value and the maximum limit has a positive value.

Note that efficient pump cleaning can require reverse speed.

Make sure that the control connections are wired according to the connection diagram given for the Water default.

Make sure that the drive is in external control. To switch to external control, press key

See section Water default on page 36.

In external control, the panel display shows text Auto 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.

Auto (j. ACQ580	22.5 Hz
Output frequency Hz	7.03
Motor current A	0.41
Motor torque %	-0.1
12:13	Menu

Stopping the motor

Switch digital input DI1 off. The arrow stops rotating.

Auto 🐣	ACQ580	22.5 Hz
Output freque Hz	ncy	0.00
√ Motor current A	t	0.00
Motor torque %		0.0
	12:14	Menu



How to perform the ID run

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
- synchronous reluctance motor (SynRM) is used (parameter 99.03 Motor type is set to SynRM), 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 25).

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

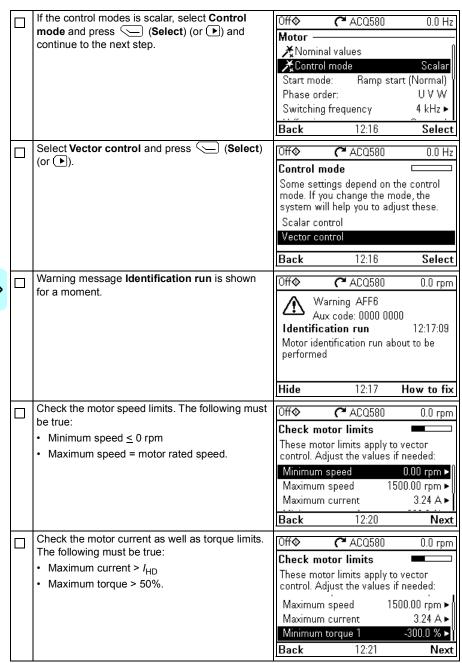
- set parameter 99.04 Motor control mode to Vector, and
 - for I/O controlled drive, check parameters in groups 22 Speed reference selection, 23 Speed reference ramp, 12 Standard AI, 30 Limits and 46 Monitoring/scaling settings.



■ ID run procedure with the ID Run assistant

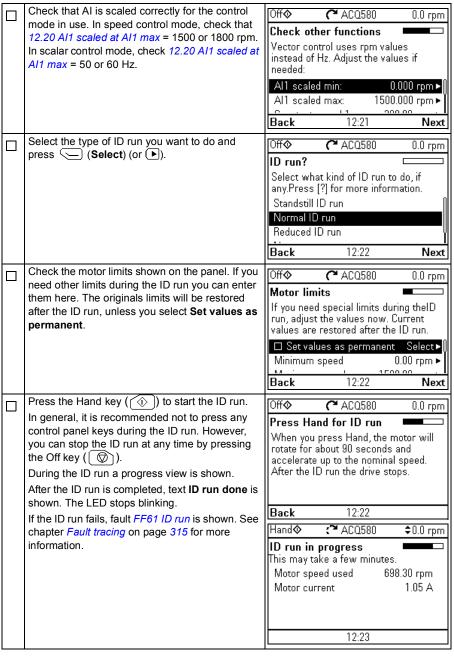
WARNING! The motor will run at up to approximately 5080% of the nominal speed during the ID run. The motor will rotate in the forward direction. Make sure that it is safe to run the motor before performing the ID run! □ De-couple the motor from the pump. □ Check that the values of the motor data parameters are equivalent to those on the motor nameplate. □ Check that the STO circuit is closed. The assistant will ask if you want to use temporary motor limits. They must meet the following conditions: □ Minimum speed ≤ 0 rpm □ Maximum speed = motor rated speed (Normal ID run procedure needs the motor to be run at 100% speed.) □ Maximum current > I _{HD} □ Maximum torque > 50% □ Make sure that the panel is in the Off mode control (text Off shown at the top left). Press the Off key ② to switch to the Off mode. ■ Co to the Main menu by pressing ○ (Menu) in the Home view. Select Primary settings and press ○ (Select) (or ○). ■ Primary settings □ I/0 ■ Primary settings □ I/0 ■ Primary settings □ Start, stop, reference ■ Motor ■ Pump protections		Pre-check	
Check that the values of the motor data parameters are equivalent to those on the motor nameplate. Check that the STO circuit is closed. The assistant will ask if you want to use temporary motor limits. They must meet the following conditions: Minimum speed ≤ 0 rpm Maximum speed = motor rated speed (Normal ID run procedure needs the motor to be run at 100% speed.) Maximum current > I _{HD} Maximum torque > 50% Make sure that the panel is in the Off mode control (text Off shown at the top left). Press the Off key to switch to the Off mode. ID run Go to the Main menu by pressing (Menu) in the Home view. Select Primary settings and press (Select) (or). Primary settings Salz 1/0 Diagnostics Exit 12:15 Select Primary settings Start, stop, reference Motor Pump protections Pump cleaning PID control Not selected ▶	<u></u>	$\Delta Z! \Delta$ speed during the ID run. The motor will re	otate in the forward direction. Make
nameplate. Check that the STO circuit is closed. The assistant will ask if you want to use temporary motor limits. They must meet the following conditions: Minimum speed ≤ 0 rpm Maximum speed = motor rated speed (Normal ID run procedure needs the motor to be run at 100% speed.) Maximum current > I _{HD} Maximum torque > 50% Make sure that the panel is in the Off mode control (text Off shown at the top left). Press the Off key to switch to the Off mode. ID run Go to the Main menu by pressing (Menu) in the Home view. Select Primary settings and press (Select) (or). Select Motor and press (Select) (or). Select Motor and press Start, stop, reference Motor Pump protections Pump protections Pump cleaning PID control Not selected PID Primary Selected PID PID PID PID PID PID PID PI		De-couple the motor from the pump.	
The assistant will ask if you want to use temporary motor limits. They must meet the following conditions: Minimum speed ≤ 0 rpm Maximum speed = motor rated speed (Normal ID run procedure needs the motor to be run at 100% speed.) Maximum current > I _{HD} Maximum torque > 50% Make sure that the panel is in the Off mode control (text Off shown at the top left). Press the Off key to switch to the Off mode. ID run Go to the Main menu by pressing (Menu) in the Home view. Select Primary settings and press (Select) (or). Primary settings Select Select Motor and press (Select) (or). Off AC0580 0.0 Hz Primary settings Start, stop, reference Motor Pump protections Pump cleaning PlD control Not selected > 100000000000000000000000000000000000		•	ers are equivalent to those on the motor
following conditions: Minimum speed ≤ 0 rpm Maximum speed = motor rated speed (Normal ID run procedure needs the motor to be run at 100% speed.) Maximum current > IHD Maximum torque > 50% Make sure that the panel is in the Off mode control (text Off shown at the top left). Press the Off key to switch to the Off mode. ID run Go to the Main menu by pressing (Menu) in the Home view. Select Primary settings and press Main menu Primary settings Select Select Motor and press (Select) (or). Select Motor and press Start, stop, reference Motor Pump protections Pump cleaning PID control Not selected > 100 Main menu		Check that the STO circuit is closed.	
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Maximum torque > 50% Make sure that the panel is in the Off mode control (text Off shown at the top left). Press the Off key to switch to the Off mode. Drun			run procedure needs the motor to be
Make sure that the panel is in the Off mode control (text Off shown at the top left). Press the Off key to switch to the Off mode. Drun		Maximum current > I _{HD}	
the Off key to switch to the Off mode. Drun		Maximum torque > 50%	
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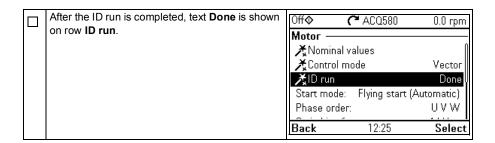
















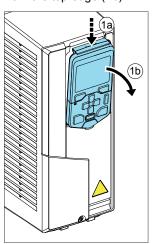
Control panel

Contents of this chapter

This chapter contains instructions for removing and reinstalling the assistant control panel and briefly describes its display, keys and key shortcuts. For more information, see ACS-AP-x assistant control panels user's manual (3AUA0000085685 [English]).

Removing and reinstalling the control panel

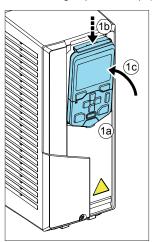
To remove the control panel, press the retaining clip at the top (1a) and pull it forward from the top edge (1b)



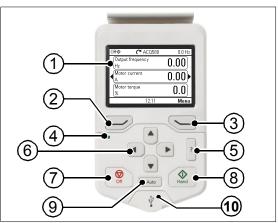




To reinstall the control panel, put the bottom of the container in position (1a), press the retaining clip at the top (1b) and push the control panel in at the top edge (1c).



Layout of the control panel

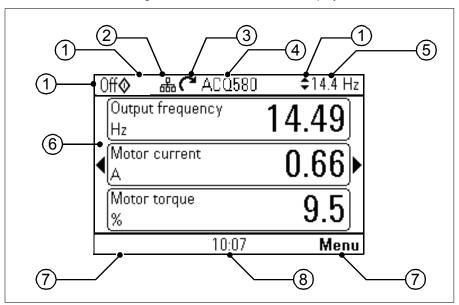


1	Layout of the control panel display			
2	Left softkey			
3	Right softkey			
4	Status LED, see chapter Maintenance and hardware diagnostics, section LEDs in the Hardware manual of the drive.			
5	Help			

6	The arrow keys		
7	Off (see Hand, Off and Auto)		
8	Hand (see Hand, Off and Auto)		
9	Auto (see Hand, Off and Auto)		
10	USB connector		

Layout of the control panel display

In most views, the following elements are shown on the display:



- 1. Control location and related icons: Indicates how the drive is controlled:
 - No text: The drive is in local control, but controlled from another device. The icons in the top pane indicate which actions are allowed:

Text/Icons	Starting from this control panel		Giving reference from this panel
	Not allowed		Not allowed

Local: The drive is in local control, and controlled from this control panel. The icons in the top panel indicate which actions are allowed:

Text/Icons			Starting from this control panel	Stopping from this control panel	Giving reference from this panel
Off		‡	Allowed	Drive is stopped	Not allowed
Hand		‡	Allowed	Allowed	Allowed

External: The drive is in external control, ie, controlled through I/O or fieldbus.
 The icons in the top pane indicate which actions are allowed with the control panel:

Text/Icons			Starting from this control panel	Stopping from this control panel	Giving reference from this panel
Auto			Not allowed	Not allowed	Not allowed
Auto	\lambda		Allowed	Allowed	Not allowed
Auto		\$	Not allowed	Allowed	Allowed
Auto	\lambda	‡	Allowed	Allowed	Allowed

- Panel bus: Indicates that there are more than one drive connected to this panel.
 To switch to another drive, go to Options Select drive.
- 3. **Status icon**: Indicates the status of the drive and the motor. The direction of the arrow indicates forward (clockwise) or reverse (counter-clockwise) rotation

Status icon	Animation	Drive status
C'	-	Stopped
R	-	Stopped, start inhibited
C+K	Blinking	Stopped, start command given but start inhibited. See Menu - Diagnostics on the control panel
K ↔ ®	Blinking	Faulted
(24↔	Blinking	Running, at reference, but the reference value is 0
(A⇔J)	Rotating	Running, not at reference
G+J	Rotating	Running, at reference

- Drive name: If a name has been given, it is displayed in the top pane. By default, it is "ACQ580". You can change the name on the control panel by selecting Menu Primary settings Clock, region, display (see page 93).
- 5. **Reference value**: Speed, frequency, etc. is shown with its unit. For information on changing the reference value in the **Primary settings** menu (see page *84*).
- Content area: The actual content of the view is displayed in this area. The
 content varies from view to view. The example view on page 31 is the main view
 of the control panel which is called the Home view.
- 7. **Softkey selections**: Displays the functions of the softkeys (and) in a given context.
- Clock: The clock displays the current time. You can change the time and time format on the control panel by selecting Menu - Primary settings - Clock, region, display (see page 93).

You can adjust the display contrast and back light functionality on the control panel by selecting **Menu - Primary settings - Clock, region, display** (see page 93).

Keys

The keys of the control panel are described below.



Left softkey

The left softkey () is usually used for exiting and canceling. Its function in a given situation is shown by the softkey selection in the bottom left corner of the display.

Holding — down exits each view in turn until you are back in the Home view. This function does not work in special screens.

Right softkey

The right softkey () is usually used for selecting, accepting and confirming. The function of the right softkey in a given situation is shown by the softkey selection in the bottom right corner of the display.

The arrow keys

The up and down arrow keys (♠ and ▶) are used to highlight selections in menus and selection lists, to scroll up and down on text pages, and to adjust values when, for example, setting the time, entering a passcode or changing a parameter value.

The left and right arrow keys (and) are used to move the cursor left and right in parameter editing and to move forward and backward in assistants. In menus, (4) and • function the same way as — and —, respectively.

Help

The help key ([?]) opens a help page. The help page is context-sensitive, in other words, the content of the page is relevant to the menu or view in question.

Hand, Off and Auto

The ACQ580 can be in local or external control. The local control has two modes: Hand and Off. See also the diagram in section Local control vs. external control on page 39.

Hand key ((\lambda \cdot):

- In local control / Off mode: Starts the drive. The drive will switch to the Hand mode.
- In external control: Switches the drive to local control / Hand mode, keeping it running.

Off key ():

· Stops the drive and switches to the Off mode.

Auto key (Auto):

· In local control: The drive will switch to external control.

Key shortcuts

The table below lists key shortcuts and combinations. Simultaneous key presses are indicated by the plus sign (+).

Shortcut	Available in	Effect
+ •	any view	Save a screenshot. Up to fifteen images may be stored in the control panel memory. To transfer images to PC, connect the assistant control panel to PC with a USB cable and the panel will mount itself as an MTP (media transfer protocol) device. Pictures are stored in the screen shots folder.
		For more instructions, see ACS-AP-x assistant control panels user's manual (3AUA0000085685 [English]).
+ ♠, + ▼	any view	Adjust backlight brightness.
+ A ,	any view	Adjust display contrast.
▲ or ▼	Home view	Adjust reference.
↑ + √	parameter edit views	Revert an editable parameter to its default value.
4 + >	view showing a list of selections for a parameter	Show/hide selection index numbers.
(keep down)	any view	Return to the Home view by pressing down the key until the Home view is shown.

Default configuration

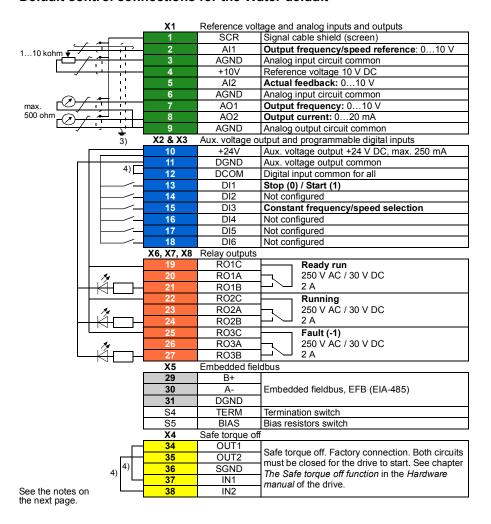
Contents of this chapter

This chapter describes the intended use, operation and default control connections of the application.

Water default

This is the default configuration of control connections for water and waste water applications.

Default control connections for the Water default



Terminal sizes:

R0...R5: 0.2...2.5 mm² (24...14 AWG): Terminals +24V, DGND, DCOM, B+, A-, DGND, Ext. 24V 0.14...1.5 mm² (26...16 AWG): Terminals DI, AI, AO, AGND, RO, STO

R6...R9: 0.14...2.5 mm² (all terminals)

Tightening torques: 0.5...0.6 N·m (0.4 lbf·ft)

Notes:

- ³⁾ Ground the outer shield of the cable 360 degrees under the grounding clamp on the grounding shelf for the control cables.
- ⁴⁾ Connected with jumpers at the factory.

Input signals

- Analog frequency reference (Al1)
- Start/stop selection (DI1)
- Constant speed/frequency selection (DI3)

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)



Program features

What this chapter contains

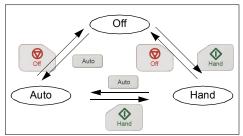
This chapter describes some of the more important functions within the control program, how to use them and how to program them to operate. It also explains the control locations and operating modes.

Local control vs. external control

The ACQ580 has two main control locations: external and local. In local control there are additionally two different modes: Off mode and Hand mode.

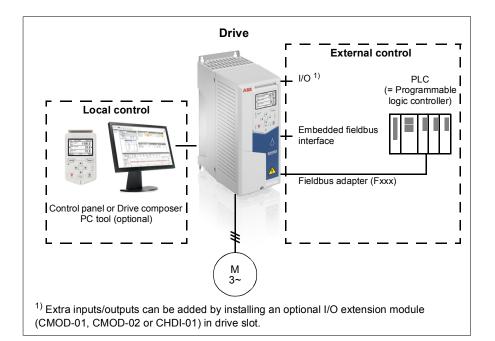
In the Off mode, the drive is stopped. In the Hand mode, the drive is running. The initial reference in the Hand mode is copied from the drive reference.

The following diagram shows the state transitions when you press the Hand, Off or Auto button:



The control location can also be selected in the PC tool.

Note: When you restart the drive while fault 7081 Control panel loss is active, the mode changes from Hand or Off to Auto.



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; 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

The user can select by a parameter (49.05 Communication loss action) how the drive reacts to a control panel or PC tool communication break. (The parameter has no effect in external control.)

External control

When the drive is in external control, control commands are given through

- the I/O terminals (digital and analog inputs), or optional I/O extension modules
- · the fieldbus interface (via the embedded fieldbus interface or an optional fieldbus adapter module).

Two external control locations, EXT1 and EXT2, are available. The user can select the sources of the start and stop commands separately for each location by setting parameters 20.01...20.10. The operating mode can be selected separately for each location, which enables quick switching between different operating modes, for example speed and process PID control. Selection between EXT1 and EXT2 is done via any binary source such as a digital input or fieldbus control word (parameter 19.11 Ext1/Ext2 selection). The source of reference is selectable for each operating mode separately.

Communication fail functionality

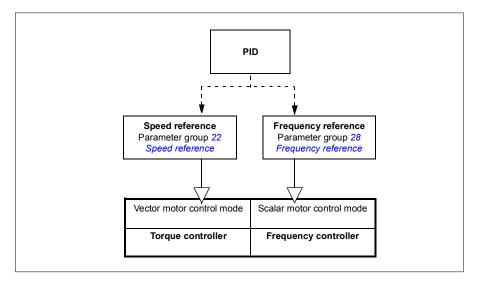
The communication fail functionality ensures continuous process without interruptions. If there is a communication loss, the drive automatically changes the control location from EXT1 to EXT2. This enables process to be controlled, for example, with the drive PID controller. When the original control location recovers, the drive automatically switches control back to the communication network (EXT1).

Settings

Parameters 19.11 Ext1/Ext2 selection (page 133); 20.01...20.10 (page 134).

Operating modes of the drive

The drive can operate in several operating modes with different types of reference. The mode is selectable for each control location (Local, EXT1 and EXT2) in parameter group 19 Operation mode. An overview of the different reference types and control chains is shown below.



Speed control mode

The motor follows a speed reference given to the drive. This mode can be used with estimated speed used as feedback.

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

Speed control uses speed reference chain. Select speed reference with parameters in group 22 Speed reference selection on page 146.

Frequency control mode

The motor follows a frequency reference given to the drive. Frequency control is available in both local and external control. It is supported in scalar motor control only.

Frequency control uses frequency reference chain. Select frequency reference with parameters in group 28 Frequency reference chain on page 162.

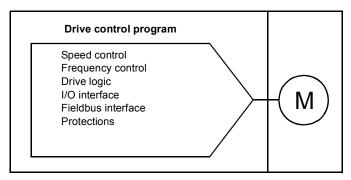
Special control modes

In addition to the above-mentioned control modes, the following special control modes are available:

- Process PID control. For more information, see section Process PID control (PID/Loop controller) (page 56).
- Emergency stop modes OFF1 and OFF3: Drive stops along the defined deceleration ramp and drive modulation stops.
- Pre-magnetization: DC magnetization of the motor before start. For more information, see section *Pre-magnetization* (page 70).
- DC hold: Locking the rotor at (near) zero speed in the middle of normal operation. For more information, see section *DC hold* (page 71).
- Pre-heating (motor heating): Keeping the motor warm when the drive is stopped. For more information, see section Pre-heating (Motor heating) (page 72).

Drive configuration and programming

The drive control program performs the main control functions, including speed, frequency control, drive logic (start/stop), I/O, feedback, communication and protection functions. Control program functions are configured and programmed with parameters.



Configuring via parameters

Parameters configure all of the standard drive operations and can be set via

- the control panel, as described in chapter Control panel
- the Drive composer PC tool, as described in *Drive composer user's manual* (3AUA000094606 [English]), 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 VDC 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.

Control interfaces

Programmable analog inputs

The control unit has two programmable analog inputs. Each of the inputs can be independently set as a voltage (0/2...10 V) or current (0/4...20 mA) input with parameters. Each input can be filtered, inverted and scaled.

Settings

Parameter group 12 Standard AI (page 116).

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 a parameter. Analog output 2 always uses current. Each output can be filtered, inverted and scaled.

Settings

Parameter group 13 Standard AO (page 120).

Programmable digital inputs and outputs

The control unit has six digital inputs.

Digital input DI5 can be used as a frequency input.

Six digital inputs can be added by using a CHDI-01 115/230 V digital input extension module and one digital output by using a CMOD-01 multifunction extension module.

Settings

Parameter groups 10 Standard DI, RO (page 109) and 11 Standard DIO, FI, FO (page 114).

Programmable frequency input and output

Digital input DI5 can be configured as a frequency input.

A frequency output can be implemented with a CMOD-01 multifunction extension module.

Settings

Parameter groups 10 Standard DI, RO (page 109), 11 Standard DIO, FI, FO (page 114) and 15 I/O extension module (page 125).

Programmable relay outputs

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

Two relay outputs can be added by using a CMOD-01 multifunction extension module or a CHDI-01 115/230 V digital input extension module.

Settings

Parameter group 10 Standard DI, RO (page 109) and 15 I/O extension module (page 125).

Programmable I/O extensions

Inputs and outputs can be added by using a CMOD-01 multifunction extension module or a CHDI-01 115/230 V digital input extension module. The module is mounted on option slot 2 of the control unit.

The table below shows the number of I/O on the control unit as well as optional CMOD-01 and a CHDI-01 modules.

Location	Digital inputs (DI)	Digital outputs (DO)	Digital I/Os (DIO)	Analog inputs (AI)	Analog outputs (AO)	Relay outputs (RO)
Control unit	6	-	-	2	2	3
CMOD-01	-	1	-	-	-	2
CHDI-01	6 (115/230 V)	-	-	-	-	2

The I/O extension module can be activated and configured using parameter group 15.

Note: The configuration parameter group contains parameters that display the values of the inputs on the extension module. These parameters are the only way of utilizing the inputs on an I/O extension module as signal sources. To connect to an input, choose the setting *Other* in the source selector parameter, then specify the appropriate value parameter (and bit, for digital signals) in group 15.

Settings

Parameter group 15 I/O extension module (page 125).

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 335) and Fieldbus control through a fieldbus adapter (page 363).

Settings

Parameter groups 50 Fieldbus adapter (FBA) (page 232), 51 FBA A settings (page 236), 52 FBA A data in (page 238), and 53 FBA A data out (page 238) and 58 Embedded fieldbus (page 239).

Pump control features

Note: ABB recommends reading the pump manufacturer's instructions for optimal performance.

Reference ramping

Acceleration and deceleration ramping times can be set individually for speed and frequency reference.

With a speed or frequency reference, the ramps are defined as the time it takes for the drive to accelerate or decelerate between zero speed or frequency and the value defined by parameter 46.01 Speed scaling or 46.02 Frequency scaling. For speed reference, also the shape of the ramp can be controlled.

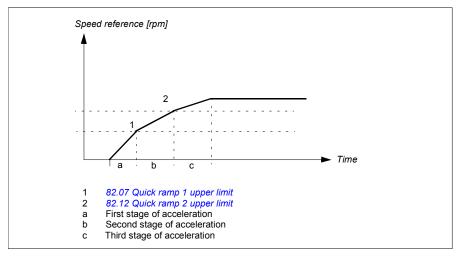
Special acceleration/deceleration ramps

The change rate of the motor potentiometer function (page 73) is adjustable. The same rate applies in both directions.

A deceleration ramp can be defined for emergency stop ("Off3" mode).

Pump protections - Quick ramps

The quick ramp function allows you to use two additional ramp sets to accelerate or decelerate the pump. The following figure illustrates the acceleration in a guick ramp mode when both additional ramp sets are used.



In submersible (a.k.a borehole) pumps, the mechanical wearing of bearings can be reduced by ramping the pump guickly to a certain speed.

The following examples describes the first, second and third stage of acceleration in quick ramp mode.

- First stage of acceleration (a) is to lift the impeller so that the fluid protects the bearings and sealings. Otherwise, the pump can get damaged. For example, 0 Hz to 25/30 Hz with ramp time of 1 second.
- Second stage of acceleration (b) is an optional. The pump produces a valid flow in this region, so the reasonable acceleration rate is requested to limit the turbidity. The effective inside region is 25/30 to 43/45 Hz and the ramp times typically are between 10 to 45 seconds.
- Third stage of acceleration (c) is a normal ramp. The pump provides a reasonable flow rate. The drive uses normal ramp times, for example, 60 seconds.

Settings

- Menu Primary settings Ramps
- Speed reference ramping: Parameters 23.12...23.13 and 46.01 (pages 154 and 228).
- Frequency reference ramping: Parameters 28.72...28.73 and 46.02 (pages 168 and 228).
- Motor potentiometer: Parameter 22.75 (page 153).
- Emergency stop ("Off3" mode): Parameter 23.23 Emergency stop time (page 155).
- Pump protections Quick ramps: Parameter group 82 Pump protections (page 259).

Constant speeds/frequencies

Constant speeds and frequencies are predefined references that can be quickly activated, for example, through digital inputs. It is possible to define up to 7 speeds for speed control and 7 constant frequencies for frequency control.



WARNING: Speeds and frequencies override the normal reference irrespective of where the reference is coming from.

Settings

Parameter groups 22 Speed reference selection (page 146) and 28 Frequency reference chain (page 162).

Critical speeds/frequencies

Critical speeds (sometimes called "skip speeds") can be predefined for applications where it is necessary to avoid certain motor speeds or speed ranges because of, for example, mechanical resonance problems.

The critical speeds function prevents the reference from dwelling within a critical band for extended times. When a changing reference (22.87 Speed reference act 7) enters a critical range, the output of the function (22.01 Speed ref unlimited) freezes until the reference exits the range. Any instant change in the output is smoothed out by the ramping function further in the reference chain.

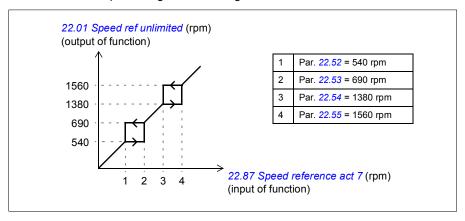
When the drive is limiting the allowed output speeds/frequencies, it limits to the absolutely lowest critical speed (critical speed low or critical frequency low) when accelerating from standstill, unless the speed reference is over the upper critical speed/ frequency limit.

The function is also available for scalar motor control with a frequency reference. The input of the function is shown by 28.96 Frequency ref act 7.

Example

A pump has vibrations in the range of 540...690 rpm and 1380...1560 rpm. To make the drive avoid these speed ranges,

- the critical speeds function by turning on bit 0 of parameter 22.51 Critical speed function, and
- set the critical speed ranges as in the figure below.



Settinas

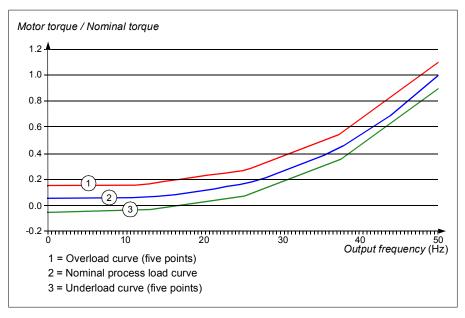
- Critical speeds: parameters 22.51...22.57 (page 151)
- Critical frequencies: parameters 28.51...28.57 (page 167).

User load curve (Condition monitoring)

The User load curve provides a supervisory function that monitors an input signal as a function of frequency or speed, and load. It shows the status of the monitored signal and can give a warning or fault based on the violation of a user defined profile.

The user load curve consists of an overload and an underload curve, or just one of them. Each curve is formed by five points that represent the monitored signal as a function of frequency or speed.

In the example below, the user load curve is constructed from the motor nominal torque to which a 10% margin is added and subtracted. The margin curves define a working envelope for the motor so that excursions outside the envelope can be supervised, timed and detected.



An overload warning and/or fault can be set to occur if the monitored signal stays continuously over the overload curve for a defined time. An underload warning and/or fault can be set to occur if the monitored signal stays continuously under the underload for a defined time.

Overload can be for example used to monitor for a stuck pump or dirty impeller.

Underload can be for example used to monitor for load dropping and for a blockage in pump inlet (suction side).

The load curve can be used as a trigger for the pump cleaning function. (Underload = blocked inlet on the pump, Overload = blockage in the pump impeller or output of the pump).

52 Program features

The user load curve can also, over a longer time period, be used to demonstrate when the efficiency of a pump system may be dropping so it can be used along with a maintenance trigger.

Settings

Parameter group 37 User load curve (page 209).

Pump cleaning

The pump cleaning function is mainly used in wastewater applications to prevent solid particles from being stuck on the pump impellers or in the piping. This function consists of a programmable sequence of forward and reverse rotations of the pump to shake off and remove any residue or rags on the impeller or piping.

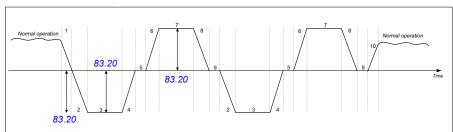
The Pump cleaning function prevents:

- 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 and negative 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	

The time from zero speed to 83.20 Cleaning speed step is considered as Time to zero 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.

- The pump system meets the triggering conditions defined by parameter 83.10
 Pump cleaning action. At this conditions, normal operation stops and the drive uses the target time defined in parameter 83.26 Time to zero-speed to reach zero speed.
- 2. Acceleration for cleaning is defined by parameter 83.25 Time to cleaning speed.
- 3. The pump runs at cleaning speed for the time defined by parameter 83.27 Cleaning on time.
- 4. The pump decelerates to zero-speed. Target time 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*.
- 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 drive automatically determines the fastest ramp during the pump cleaning and used to protect the pump. It is possible that the quick ramps are faster than the pump cleaning ramps.

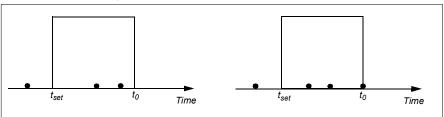
The cleaning sequence starts based on the selected triggering conditions. The cleaning sequence follows the diagram on page 53. You can start the sequence in these conditions:

- on every start and stop
- based on the monitoring pump condition (for example, supervision 1...3; underload and overload curve, see group 37 User load curve on 209)
- based on time interval (for example, at every 10 hours)
- manually (for example, DI4 to DI6, defined by parameter 83.12 Manually force cleaning)
- through fieldbus, using parameter 83.12 Manually force cleaning. Set the
 parameter to a value of 1 (a 2 s pulse) from the fieldbus to start a cleaning cycle
 from an overriding controller.

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.

Settings

Menu - Primary settings - Pump cleaning

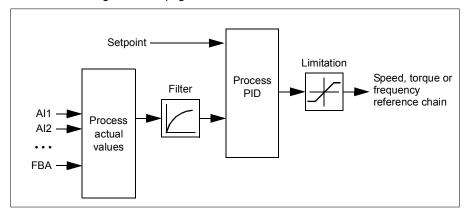
Parameter group 83 Pump cleaning (page 260).

Process PID control (PID/Loop controller)

There are two built-in process PID controllers (PID set 1 and PID set 2) in the drive. The controller can be used to control process variables such as pressure or flow in the pipe or fluid level in the container.

In process PID control, a process reference (setpoint) is connected to the drive instead of a speed reference. An actual value (process feedback) is also brought back to the drive. The process PID control adjusts the drive speed in order to keep the measured process quantity (actual value) at the desired level (setpoint). This means that user does not need to set a frequency/speed/torque reference to the drive but the drive adjust its operation according to the process PID.

The simplified block diagram below illustrates the process PID control. For more detailed block diagrams, see pages 383 and 384.



The drive contains two complete sets of process PID controller settings that can be alternated whenever necessary; see parameter 40.57 PID set1/set2 selection.

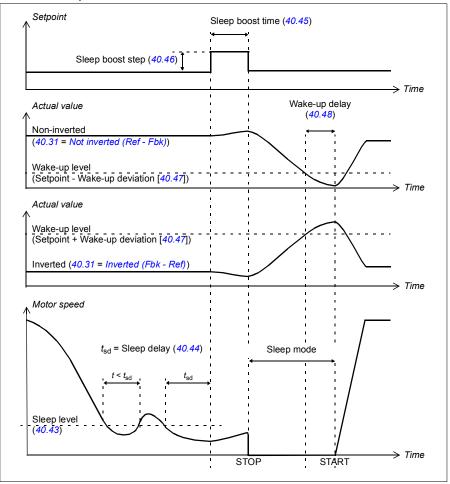
Note: Process PID control is only available in external control location EXT2; see section Local control vs. external control (page 39).

Sleep and boost functions for process PID control

The sleep function is suitable for PID control applications where the consumption varies, such as clean water pumping systems. When used, it stops the pump completely during low demand, instead of running the pump slowly below its efficient operating range. The following example visualizes the operation of the function.

Example: The drive controls a pressure boost pump. The water consumption falls at night. As a consequence, the process PID controller decreases the motor speed. However, due to natural losses in the pipes and the low efficiency of the centrifugal pump at low speeds, the motor would never stop rotating. The sleep function detects the slow rotation and stops the unnecessary pumping after the sleep delay has passed. The drive shifts into sleep mode, still monitoring the pressure. The pumping resumes when the pressure falls under the predefined minimum level and the wakeup delay has passed.

The user can extend the PID sleep time by the boost functionality. The boost functionality increases the process setpoint for a predetermined time before the drive enters the sleep mode.



Tracking

In tracking mode, the PID block output is set directly to the value of parameter 40.50 (or 41.50) 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

 Parameter groups 40 Process PID set 1 (page 212) and 41 Process PID set 2 (page 223).

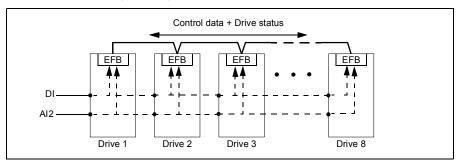
Intelligent pump control (IPC)

The Intelligent pump control (IPC) system can be used to control the speed/frequency of multiple pumps in a pump system. Each pump is connected to a separate drive.

The IPC system supports redundancy, so that in case of a pump failure or a drive is disconnected for maintenance, the system still continues the operation with the remaining drives. The IPC system can be enabled with parameter 76.21 Multipump configuration.

The IPC system at first increases the pump speed and if this speed is not sufficient, the system will start a new pump based on process demand. While starting a new pump, the speed of the already running pumps is reduced to allow smooth flow of liquid.

In an IPC system, the drives communicates through inverter-to-inverter link on embedded fieldbus. Each drive receives a start command through digital input DI and a process value through analog input Al2.



Starting the IPC system

The IPC system starts operation when the drive receives a start command from external control location EXT2 (parameter 20.08 Ext2 in1 source). The start command indicates that the pump is available to the IPC system. However, the system sends the actual start command to the follower drives based on the required output of the system.

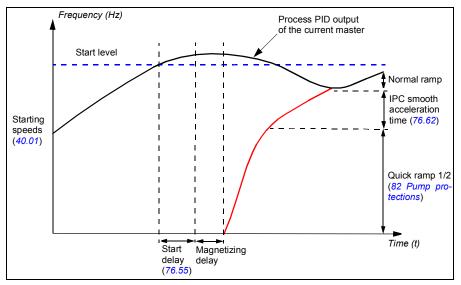
If all drives in the system receive a start command simultaneously, then the drive with the lowest node number will start as the master drive. See parameter 76.22 Multipump node number (page 249).

For optimal energy operation, you can combine the PID sleep function with IPC system. For information on PID sleep function, see Sleep and boost functions for process PID control (page 56).

Note: The IPC system is not active on external control location EXT1.

Smooth pump transitions





The timing diagram of Smooth pump transitions shows the pump starting steps. In this case, the process PID output of the current master has exceeded the start level (76.30...76.36).

- The IPC system starts a new pump after the start delay time (76.55 Start delay) is elapsed.
- 2. After the motor is magnetized and starts rotating, the new pump accelerates using quick ramp 1/2 to obtain productive zone.
 - **Note:** This operation is effective only when quick ramp mode is enabled with parameter 82.01 Quick ramp mode (page 259).
- 3. The new pump then accelerates along IPC smooth ramp time defined with parameter 76.62 IPC smooth acceleration time.
- 4. When a new pump is accelerating, the other pumps decelerate to maintain the stable output of the system, shown as Normal ramp in the diagram.
- 5. After the new pump reaches the speed of the current master pump, the new pump becomes the new master.
- 6. The new master and all the remaining pumps will start to follow the master drive speed defined by the process PID of the master drive.

Pump priorities

The pumps are prioritized based on energy efficiency and process demand.

High – more energy efficient pumps

Normal – less energy efficient pumps

Low – pumps which do not run unless process demands

You can select the pump priority with parameter 76.77 Pump priority. The IPC system prefers high priority pumps over normal and low priority pumps. You can limit the time with parameter 76.76 Max stationary time, so that even the low priority pumps are often run to keep them in operational condition.

Automatic parameter synchronization

Automatic parameter synchronization feature reduces the number of configuration steps in the IPC system.

The synchronized parameter groups are selected with parameter 76.102 IPC synchronization settings. In addition, there are some drive dependent parameters that are not synchronized, like 76.22 Multipump node number. To enable synchronization of a parameter group between two or more drives, the group synchronization must be enabled in all the drives.

The synchronization process uses two mechanisms to make sure that the parameter groups are synchronized. When a parameter value is changed in a drive, it broadcasts the changed parameter value to inverter-to-inverter (I2I) link. From the inverter-to-inverter (I2I) link, all the drives that have the synchronization enabled, reads the value and set their own parameter value.

In addition, the drive periodically broadcast the group CRC to the inverter-to-inverter (I2I) link along with the time stamp of the last edit time of the group. From this information, the drives can conclude if the group is synchronized and which drive has the latest parameter values. If there is a CRC mismatch, the drives request the parameter values from the parameter group and from the drive with the latest values.

Note: Multipump is supported only with option +N845 and software version 2.01.100.12.

Settings

Menu - Primary settings - Multipump Control (IPC)

Parameter groups 01 Actual values (page 97), 40 Process PID set 1 (page 212), 76 Multipump configuration (page 248), 77 Multipump maintenance and monitoring (page 256) and 82 Pump protections (page 259).

Single pump control (PFC)

The Single pump control (PFC) is used in pump systems consisting of one drive and multiple pumps. The drive controls the speed of one of the pumps and in addition connects (and disconnects) the other pumps directly to the supply network through contactors.

The PFC control logic switches auxiliary motors on and off as required by the capacity changes of the process. In a pump application for example, the drive controls the motor of the first pump, varying the motor speed to control the output of the pump. This pump is the speed regulated pump. When the demand (represented by the process PID reference) exceeds the capacity of the first pump (a user defined speed/frequency limit), the PFC logic automatically starts an auxiliary pump. The logic also reduces the speed of the first pump, controlled by the drive, to account for the addition to the total system output by the auxiliary pump. Then, as before, the PID controller adjusts the speed/frequency of the first pump in such a way that the system output meets the process needs. If the demand continues to increase, the PFC logic adds further auxiliary pumps, in a similar manner as just described.

As the demand drops, making the speed of the first pump fall below a minimum limit (user defined as a speed/frequency limit), the PFC logic automatically stops an auxiliary pump. The PFC logic also increases the speed of the drive controlled pump to account for the missing output of the stopped auxiliary pump.

The Single pump control (PFC) is supported in external control location EXT2 only.

Autochange

Automatic rotation of the start order, or Autochange functionality, serves two main purposes in many PFC type setups. One is to keep the run times of the pumps equal over time to even their wear. The other is to prevent any pump from standing still for too long, which would clog up the unit. In some cases it is desirable to rotate the start order only when all units are stopped, for example to minimize the impact on the process.

The Autochange can also be triggered by the Timed function (see page 65).

Interlock

There is an option to define interlock signals for each motor in the PFC system. When the interlock signal of a motor is Available, the motor participates in the PFC starting sequence. If the signal is Interlocked, the motor is excluded. This feature can be used for informing the PFC logic that a motor is not available (for example due to maintenance or manual direct-on-line starting).

Soft pump control (SPFC)

The Soft pump control (SPFC) logic is a variant of the PFC logic for pump and alternation applications where lower pressure peaks are desirable when a new auxiliary motor is to be started. The SPFC logic is an easy way to implement soft starting of direct on line (auxiliary) motors.

The main difference between traditional PFC and SPFC logic is how the SPFC logic connects auxiliary motors on-line. When the criteria for starting a new motor is fulfilled (see above) the SPFC logic connects the drive controlled motor to the supply network in a flying start, that is, while the motor is still coasting. The drive then connects to the next pump unit to be started and starts controlling the speed of that one, while the previously controlled unit now is connected directly on line through a contactor. Further (auxiliary) motors are started in a similar manner. The motor stopping routine is the same as for the normal PFC routine.

In some cases SPFC makes it possible to soften the start-up current while connecting auxiliary motors on-line. Lower pressure peaks on the pipelines and pumps may be achieved as a result.

Settings

- Parameter group 10 Standard DI, RO (page 109)
- Parameter group 40 Process PID set 1 (page 212)
- Parameter groups 76 Multipump configuration (page 248) and 77 Multipump maintenance and monitoring (page 256).

Timed functions

See parameter group 34 Timed functions.

Settings

Parameter group 34 Timed functions (page 189).

Motor potentiometer

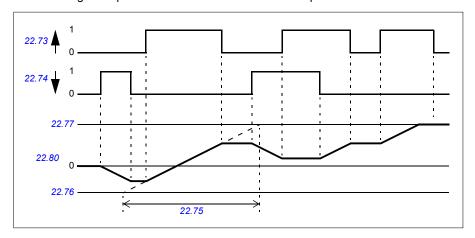
The motor potentiometer is, in effect, a counter whose value can be adjusted up and down using two digital signals selected by parameters 22.73 Motor potentiometer up source and 22.74 Motor potentiometer down source.

When enabled by 22.71 Motor potentiometer function, the motor potentiometer assumes the value set by 22.72 Motor potentiometer initial value. Depending on the mode selected in 22.71, the motor potentiometer value is either retained or reset over a power cycle.

The change rate is defined in 22.75 Motor potentiometer ramp time as the time it would take for the value to change from the minimum (22.76 Motor potentiometer min value) to the maximum (22.77 Motor potentiometer max value) or vice versa. If the up and down signals are simultaneously on, the motor potentiometer value does not change.

The output of the function is shown by 22.80 Motor potentiometer ref act, which can directly be set as the reference source in the main selector parameters, or used as an input by other source selector parameters, both in scalar and vector control.

The following example shows the behavior of the motor potentiometer value.



Settings

Parameters 22.71...22.80 (page 152).

Motor control

Motor types

The drive supports asynchronous AC induction, permanent magnet (PM) and synchronous reluctance motors (SynRM).

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 the first time the start command is given. During this first start-up, 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 demanding applications a separate Identification run (ID run) can be performed.

Settings

99.13 ID run requested (page 278).

Scalar motor control

Scalar motor control is the default motor control method. In scalar control mode, the drive is controlled with a frequency reference. However, the excellent performance of vector control is not achieved in scalar control.

It is recommended to activate scalar motor control mode in the following situations:

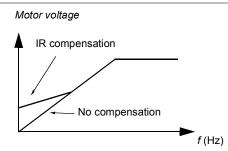
- If the exact nominal motor values are not available or the drive needs to run different motor after the commissioning phase
- If a short commissioning time is needed or no ID run is wanted
- In multimotor systems: 1) if the load is not equally shared between the motors, 2) if the motors are of different sizes, or 3) if the motors are going to be changed after 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 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.

In scalar control, some standard features are not available.

See also section Operating modes of the drive (page 42).

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 to the motor at low speeds. IR compensation is useful in applications, such as positive displacement pumps, that require a high break-away torque.



In vector control, no IR compensation is possible or needed as it is applied automatically.

Settings

- Menu Primary settings Motor IR compensation
- Parameters 97.13 IR compensation (page 273) and 99.04 Motor control mode (page 276)
- Parameter group 28 Frequency reference chain (page 162).

Vector control

Vector control is the motor control mode that is intended for applications where high control accuracy is needed. It requires an identification run at startup. Vector control cannot be used in all applications, eq sine filters.

The switching of the output semiconductors is controlled to achieve the required stator flux and motor torque. The output frequency is changed only if the actual torque and stator flux values differ from their reference values by more than the allowed hysteresis. The reference value for the torque controller comes from the speed controller or directly from an external torque reference source.

Motor control requires measurement of the DC voltage and two motor phase currents. Stator flux is calculated by integrating the motor voltage in vector space. Motor torque is calculated as a cross product of the stator flux and the rotor current. By utilizing the identified motor model, the stator flux estimate is improved. Actual motor shaft speed is not needed for the motor control.

The main difference between traditional control and vector control is that torque control operates at the same time level as the power switch control. There is no separate voltage and frequency controlled PWM modulator; the output stage switching is wholly based on the electromagnetic state of the motor.

The best motor control accuracy is achieved by activating a separate motor identification run (normal ID run).

See also section *DC voltage control* (page 73).

Settings

- · Menu Primary settings Motor Control mode
- Parameters 99.04 Motor control mode (page 276) and 99.13 ID run requested (page 278).

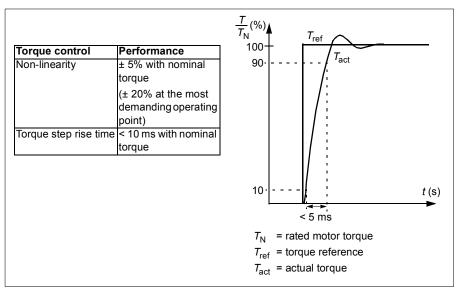
Speed control performance figures

The table below shows typical performance figures for speed control.

Speed control	Performance	$\frac{T}{T_N}$ (%)	T _{load}
Static accuracy	20% of motor nominal slip		
Dynamic accuracy	< 10% s with 100% torque step (with default speed controller tuning)	n n .	t(s)
Tuned speed	< 2% s with 100%	$\frac{n_{\text{act}}-n_{\text{ref}}}{n_{\text{N}}}$	
controller	torque step	$T_{\rm N}$ = rat $n_{\rm N}$ = rat $n_{\rm act}$ = act	ed motor torque ed motor speed tual speed eed reference

Torque control performance figures

The drive can perform precise torque control in vector control mode without any speed feedback from the motor shaft. The table below shows typical performance figures for vector control.



Power loss ride-through

See section Undervoltage control (power loss ride-through) on page 73.

U/f ratio

The *Ulf* function is only available in scalar motor control mode, which uses frequency control.

The function has two modes: linear and squared.

In linear mode, the ratio of voltage to frequency is constant below the field weakening point. This is used in constant torque applications where it may be necessary to produce torque at or near the rated torque of the motor throughout the frequency range

In squared mode (default), the ratio of the voltage to frequency increases as the square of the frequency below the field weakening point. This is typically used in centrifugal pump applications. For these applications, the torque required follows the square relationship with frequency. Therefore, if the voltage is varied using the square relationship, the motor operates at improved efficiency and lower noise levels in these applications.

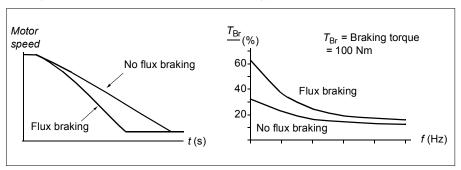
The *U*/f function cannot be used with energy optimization; if parameter 45.11 Energy optimizer is set to Enable, parameter 97.20 U/F ratio is ignored.

Settings

- Menu Primary settings Motor U/f ratio
- Parameter 97.20 U/F ratio (page 273).

Flux braking

The drive can provide greater deceleration by raising the level of magnetization in the motor. By increasing the motor flux, the energy generated by the motor during braking can be converted to motor thermal energy.



The drive monitors the motor status continuously, also during flux braking. Therefore, flux braking can be used both for stopping the motor and for changing the speed. The other benefits of flux braking are:

- The braking starts immediately after a stop command is given. The function does not need to wait for the flux reduction before it can start the braking.
- The cooling of the induction motor is efficient. The stator current of the motor increases during flux braking, not the rotor current. The stator cools much more efficiently than the rotor.
- · Flux braking can be used with induction motors and permanent magnet synchronous motors.

Two braking power levels are available:

- Moderate braking provides faster deceleration compared to a situation where flux braking is disabled. The flux level of the motor is limited to prevent excessive heating of the motor.
- Full braking exploits almost all available current to convert the mechanical braking energy to motor thermal energy. Braking time is shorter compared to moderate braking. In cyclic use, motor heating may be significant.



WARNING: The motor needs to be rated to absorb the thermal energy generated by flux braking.

Settings

- Menu Primary settings Motor Flux braking
- Parameter 97.05 Flux braking (page 271).

DC magnetization

The drive has different magnetization functions for different phases of motor start/rotation/stop: pre-magnetization, DC hold, post-magnetization and pre-heating (motor heating).

Pre-magnetization

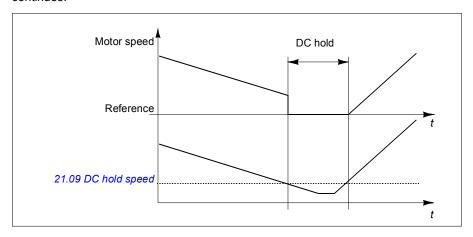
Pre-magnetization refers to DC magnetization of the motor before start. Depending on the selected start mode (21.01 Vector start mode or 21.19 Scalar start mode), premagnetization can be applied to guarantee the highest possible breakaway torque, up to 200% of the nominal torque of the motor. By adjusting the pre-magnetization time (21.02 Magnetization time), it is possible to synchronize the motor start and, for example, the release of a mechanical brake.

Settings

Parameters 21.01 Vector start mode, 21.19 Scalar start mode, 21.02 Magnetization time

DC hold

The function makes it possible to lock the rotor at (near) zero speed in the middle of normal operation. DC hold is activated by parameter 21.08 DC current control. When both the reference and motor speed drop below a certain level (parameter 21.09 DC hold speed), the drive will stop generating sinusoidal current and start to inject DC into the motor. The current is set by parameter 21.10 DC current reference. When the reference exceeds parameter 21.09 DC hold speed, normal drive operation continues.



Settings

Parameters 21.08 DC current control and 21.09 DC hold speed

Post-magnetization

The function keeps the motor magnetized for a certain period (parameter 21.11 Post magnetization time) after stopping. This is to prevent the machinery from moving under load, for example before a mechanical brake can be applied. Postmagnetization is activated by parameter 21.08 DC current control. The magnetization current is set by parameter 21.10 DC current reference.

Note: Post-magnetization is only available when ramp stop is selected (see parameter 21.03 Stop mode). Post-magnetization is only supported in vector control.

Settings

Parameters 21.03 Stop mode (page 140), 21.08 DC current control and 21.11 Preheating input source.

Pre-heating (Motor heating)

The pre-heating function keeps the motor warm and prevents condensation inside the motor by feeding it with DC current when the drive has been stopped. The heating can only be on when the drive is in the stopped state, and starting the drive stops the heating.

When pre-heating is activated and the stop command is given, pre-heating starts immediately if the drive is running below zero speed (see bit 0 in parameter *06.19 Speed control status word*). If the drive is running above zero speed, pre-heating is delayed by 60 seconds to prevent excessive current.

The function can be defined to be always active when the drive is stopped or it can be activated by a digital input, fieldbus, timed function or supervision function. For example, with the help of signal supervision function, the heating can be activated by a thermal measurement signal from the motor.

The pre-heating current fed to the motor can be defined as 0...30% of the nominal motor current.

Notes:

- In applications where the motor keeps rotating for a long time after the modulation is stopped, it is recommended to use ramp stop with pre-heating to prevent a sudden pull at the rotor when the pre-heating is activated.
- The heating function requires that the STO circuit is closed or not triggered open.
- The heating function requires that the drive is not faulted.
- · Pre-heating uses DC hold to produce current.

Settings

- · Menu Primary settings Motor Pre-heating
- Parameters 21.14 Pre-heating input source and 21.16 Pre-heating current (page 143)

Energy optimization

The function optimizes the motor flux so that total energy consumption and motor noise level are reduced when the drive operates below the nominal load. The total efficiency (motor and drive) can be improved by 1...20% depending on load torque and speed.

Note: With permanent magnet and synchronous reluctance motors, energy optimization is always enabled.

Settings

- Menu Energy efficiency
- Parameter 45.11 Energy optimizer (page 227)

Switching frequency

The drive has two switching frequencies: 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 as 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 as with some external filters, 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 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 262).

DC voltage control

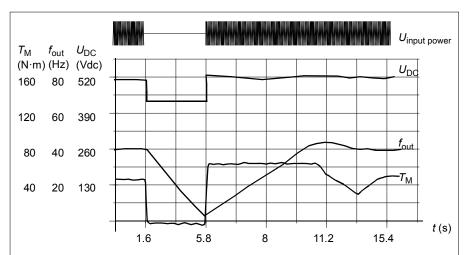
Overvoltage control

Overvoltage control of the intermediate DC link is typically needed when the motor is in generating mode. The motor can generate when it decelerates or when the load overhauls the motor shaft, causing the shaft to turn faster than the applied speed or frequency. To prevent the DC voltage from exceeding the overvoltage control limit, the overvoltage controller automatically decreases the generating torque when the limit is reached.

Undervoltage control (power loss ride-through)

If the incoming supply voltage is cut off, the drive will continue to operate by utilizing the kinetic energy of the rotating motor. The drive will be fully operational as long as the motor rotates and generates energy to the drive. The drive can continue operation after the break if the main contactor (if present) remained closed.

Note: Units equipped with a main contactor must be equipped with a hold circuit (e.g. UPS) to keep the contactor control circuit closed during a short supply break.



 $U_{\rm DC}$ = Intermediate circuit voltage of the drive, $f_{\rm out}$ = Output frequency of the drive, $T_{\rm M}$ = Motor torque

Loss of supply voltage at nominal load ($f_{\rm out}$ = 40 Hz). The intermediate circuit DC voltage drops to the minimum limit. The controller keeps the voltage steady as long as the input power is switched off. The drive runs the motor in generator mode. The motor speed falls but the drive is operational as long as the motor has enough kinetic energy.

Implementing the undervoltage control (power loss ride-through)

Implement the undervoltage control function as follows:

- Check that the undervoltage control function of the drive is enabled with parameter 30.31 Undervoltage control.
- Parameter 21.01 Vector start mode must be set to Automatic (in vector mode) or parameter 21.19 Scalar start mode to Automatic (in scalar mode) to make flying start (starting into a rotating motor) possible.

If the installation is equipped with a main contactor, prevent its tripping at the input power break. For example, use a time delay relay (hold) in the contactor control circuit.



WARNING! Make sure that the flying restart of the motor will not cause any danger. If you are in doubt, do not implement the undervoltage control function.

Automatic restart

It is possible to restart the drive automatically after a short (max. 5 seconds) power supply failure by using the Automatic restart function, provided that the drive is allowed to run for 5 seconds without the cooling fans operating.

When enabled, the function takes the following actions upon a supply failure to a successful restart:

- The undervoltage fault is suppressed (but a warning is generated).
- Modulation and cooling is stopped to conserve any remaining energy.
- DC circuit pre-charging is enabled.

If the DC voltage is restored before the expiration of the period defined by parameter 21.18 Auto restart time and the start signal is still on, normal operation will continue. However, if the DC voltage remains too low at that point, the drive trips on a fault, 3220 DC link undervoltage.

WARNING! Before you activate the function, make sure that no dangerous situations can occur. The function restarts the drive automatically and continues operation after a supply break.

Voltage control and trip limits

The control and trip limits of the intermediate DC voltage regulator are relative to the supply voltage as well as drive/inverter type. The DC voltage (U_{DC}) is approximately 1.35 times the line-to-line supply voltage, and is displayed by parameter 01.11 DC voltage.

The following table shows the values of selected DC voltage levels. Note that the absolute voltages vary according to the drive/inverter type and AC supply voltage range.

	DC voltage level [V]		
See 95.01 Supply voltage.	AC supply voltage range [V] 380415	AC supply voltage range [V] 440480	
Overvoltage fault limit	840	840	
Overvoltage control limit	780	780	
Internal brake chopper start limit	780	780	
Internal brake chopper stop limit	760	760	
Overvoltage warning limit	745	745	
Undervoltage warning limit	0.85×1.41×par 95.03 value 1)	0.85×1.41×par 95.03 value 1)	
	0.85×1.41×380 = 455 ²⁾	0.85×1.41×440 = 527 ²⁾	
Undervoltage control limit	0.75×1.41×par 95.03 value 1)	0.75×1.41×par 95.03 value 1)	
	0.75×1.41×380 = 402 ²⁾	0.75×1.41×440 = 465 ²⁾	
Charging relay closing limit	0.75×1.41×par 95.03 value 1)	0.75×1.41×par 95.03 value 1)	
	0.75×1.41×380 = 402 ²⁾	0.75×1.41×440 = 465 ²⁾	
Charging relay opening limit	0.65×1.41×par 95.03 value 1)	0.65×1.41 ×par 95.03 value 1)	
	0.65×1.41×380 = 348 ²⁾	0.65×1.41×440 = 403 ²⁾	
DC voltage at upper bound of supply voltage range ($U_{\rm DCmax}$)	560	648	
DC voltage at lower bound of supply voltage range ($U_{\rm DCmin}$)	513	594	
Charging activation/standby limit 3)	0.65×1.41×par 95.03 value 1)	0.65×1.41×par 95.03 value 1)	
	0.65×1.41×380 = 348 ²⁾	0.65×1.41×440 = 403 ²⁾	
Undervoltage fault limit	0.45×1.41×par 95.03 value 1)	0.45×1.41×par 95.03 value 1)	
	0.45×1.41×380 = 241 ²⁾	0.45×1.41×440 = 279 ²⁾	

¹⁾ If parameter 95.01 Supply voltage is set to Automatic / not selected and 95.02 Adaptive voltage limits is set to Enable, the value of parameter 95.03 Estimated AC supply voltage is used,

Settings

Parameters 01.11 DC voltage (page 97), 30.30 Overvoltage control (page 175), 30.31 Undervoltage control (page 175), 95.01 Supply voltage (page 262) and 95.02 Adaptive voltage limits (page 263).

²⁾ otherwise the lower limit of the range selected with parameter 95.01 Supply voltage is used.

³⁾ When standby is activated, drive modulation is stopped, the fan is stopped and the pre-charge circuit is activated. If the voltage exceeds this level again, the drive has to complete charging before it will automatically continue operation.

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.

DC overvoltage

See section Overvoltage control on page 73.

DC undervoltage

See section *Undervoltage control* (power loss ride-through) on page 73.

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.

Emergency stop

The emergency stop signal is connected to the input selected by 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 mode of the emergency stop 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 stop ramp defined by parameter 23.23 Emergency stop time.
- Stop torque.

With Off1 or Off3 emergency stop modes, the ramp-down of the motor speed can be supervised by parameters 31.32 Emergency ramp supervision and 31.33 Emergency ramp supervision delay.

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 is detected, the emergency stop function cannot be canceled even though the signal is 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 141), 21.05 Emergency stop source (page 141), 23.23 Emergency stop time (page 155), 31.32 Emergency ramp supervision (page 181) and 31.33 Emergency ramp supervision delay (page 182).

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 the following assumptions:

- 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.
- 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.

Note: The motor thermal model can be used when only one motor is connected to the inverter.

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.

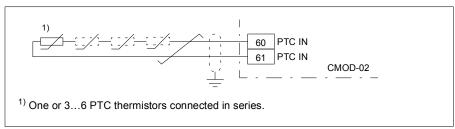
To fulfil this requirement, connect a thermistor to the drive's control terminals using any of these alternatives:

- 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.

When CMOD-02 multifunction module is used, it provides sufficient insulation.

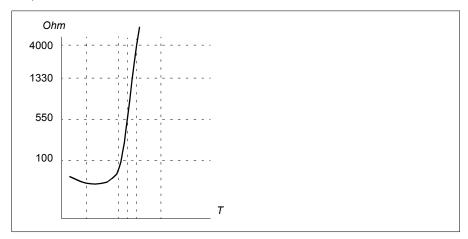
Temperature monitoring using PTC sensors

PTC sensors are connected through a CMOD-02 multifunction module (see chapter Optional I/O extension modules, section CMOD-02 multifunction extension module (external 24 V AC/DC and isolated PTC interface) in the Hardware manual of the drive).



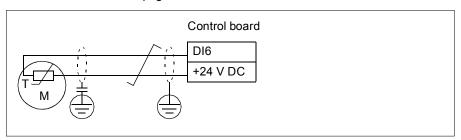
The resistance of the PTC sensor increases when its temperature rises. The increasing resistance of the sensor decreases the voltage at the input, and eventually its state switches from 1 to 0, indicating overtemperature.

The figure below shows typical PTC sensor resistance values as a function of temperature.



One isolated PTC sensor can also be connected directly to digital input DI6. At the motor end, the cable shield should be earthed through a capacitor. If this is not possible, leave the shield unconnected.

See section Insulation on page 79.



Temperature monitoring using Pt100 sensors

1...3 Pt100 sensors can be connected in series to an analog input and an analog output.

The analog output feeds a constant excitation current of 9.1 mA through the sensor. The sensor resistance increases as the motor temperature rises, as does the voltage over the sensor. The temperature measurement function reads the voltage through the analog input and converts it into degrees Celsius.

It is possible to adjust the motor temperature supervision limits and select how the drive reacts when overtemperature is detected.

See section *Insulation* on page 79.

For the wiring of the sensor, see chapter Electrical installation, section Al1 and Al2 as Pt100, Pt1000, Ni1000, KTY83 and KTY84 sensor inputs (X1) in the Hardware manual of the drive.

Temperature monitoring using Pt1000 sensors

1...3 Pt1000 sensors can be connected in series to an analog input and an analog output.

The analog output feeds a constant excitation current of 0.1 mA through the sensor. The sensor resistance increases as the motor temperature rises, as does the voltage over the sensor. The temperature measurement function reads the voltage through the analog input and converts it into degrees Celsius.

See section *Insulation* on page 79.

For the wiring of the sensor, see chapter Electrical installation, Al1 and Al2 as Pt100, Pt1000, Ni1000, KTY83 and KTY84 sensor inputs (X1) in the Hardware manual of the rive.

Temperature monitoring using Ni1000 sensors

One Ni1000 sensor can be connected to an analog input and an analog output on the control unit.

The analog output feeds a constant excitation current of 9.1 mA through the sensor. The sensor resistance increases as the motor temperature rises, as does the voltage over the sensor. The temperature measurement function reads the voltage through the analog input and converts it into degrees Celsius.

See section *Insulation* on page 79.

For the wiring of the sensor, see chapter Electrical installation, Al1 and Al2 as Pt100. Pt1000, Ni1000, KTY83 and KTY84 sensor inputs (X1) in the Hardware manual of the drive.

Temperature monitoring using KTY84 sensors

One KTY84 sensor can be connected to an analog input and an analog output on the control unit.

The analog output feeds a constant excitation current of 2.0 mA through the sensor. The sensor resistance increases as the motor temperature rises, as does the voltage over the sensor. The temperature measurement function reads the voltage through the analog input and converts it into degrees Celsius.

The figure and table on page 82 show typical KTY84 sensor resistance values as a function of the motor operating temperature.

See section *Insulation* on page 79.

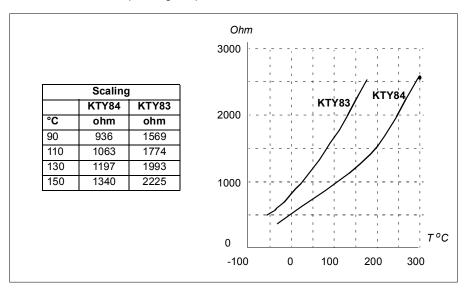
For the wiring of the sensor, see chapter *Electrical installation*, *Al1 and Al2 as Pt100*, *Pt1000*, *Ni1000*, *KTY83 and KTY84 sensor inputs* (*X1*) in the *Hardware manual* of the drive.

Temperature monitoring using KTY83 sensors

One KTY83 sensor can be connected to an analog input and an analog output on the control unit.

The analog output feeds a constant excitation current of 1.0 mA through the sensor. The sensor resistance increases as the motor temperature rises, as does the voltage over the sensor. The temperature measurement function reads the voltage through the analog input and converts it into degrees Celsius.

The figure and table below show typical KTY83 sensor resistance values as a function of the motor operating temperature.



It is possible to adjust the motor temperature supervision limits and select how the drive reacts when overtemperature is detected.

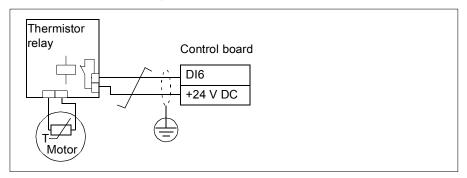
See section *Insulation* on page 79.

For the wiring of the sensor, see chapter *Electrical installation*, *Al1 and Al2 as Pt100*, *Pt1000*, *Ni1000*, *KTY83 and KTY84 sensor inputs* (X1) in the *Hardware manual* of the drive.

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 79.



Settings

- Parameter group 35 Motor thermal protection (page 196).
- 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. The contents of the messages can be edited on the control panel by selecting Menu - Primary settings -Advanced functions - External events.

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.

Supply phase loss detection (parameter 31.21)

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

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 does not affect the operation of the Safe torque off function itself). For more information on the Safe torque off function, see chapter *Planning the electrical installation*, section *Implementing the Safe torque off function* in the *Hardware manual* of the drive.

Swapped supply and motor cabling (parameter 31.23)

The drive can detect if the supply and motor cables have accidentally been swapped (for example, if the supply is connected to the motor connection of the drive). The parameter selects if a fault is generated or not.

Stall protection (parameters 31.24...31.28)

The drive protects the motor in a stall situation. It is possible to adjust the supervision limits (current, frequency and time) and choose how the drive reacts to a motor stall condition.

Overspeed protection (parameter 31.30)

The user can set overspeed limits by specifying a margin that is added to the currently-used 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.

Al supervision (parameters 12.03...12.04)

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.

Automatic fault resets

The drive can automatically reset itself after overcurrent, overvoltage, undervoltage and external faults. The user can also specify a fault that is automatically reset.

By default, automatic resets are off and must be specifically activated by the user.

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.

- Menu Primary settings Fault functions Autoreset faults
- Parameters 31.12...31.16 (page 178).

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.

The supervised signal is low-pass filtered.

Settings

Parameter group 32 Supervision (page 182).

Energy saving calculators

This feature consists of the following functionalities:

- An energy optimizer that adjusts the motor flux in such a way that the total system efficiency is maximized
- A counter that monitors used and saved energy by the motor and displays them in kWh, currency or volume of CO₂ emissions, and
- A load analyzer showing the load profile of the drive (see separate section on page 87).

In addition, there are counters that show energy consumption in kWh of the current and previous hour as well as the current and previous day.

Note: The accuracy of the energy savings calculation is directly dependent on the accuracy of the reference motor power given in parameter 45.19 Comparison power.

- Menu Energy efficiency
- Parameter group 45 Energy efficiency (page 225).
- Parameters 01.50 Current hour kWh, 01.51 Previous hour kWh, 01.52 Current day kWh and 01.53 Previous day kWh on page 98.

Load analyzer

Peak value logger

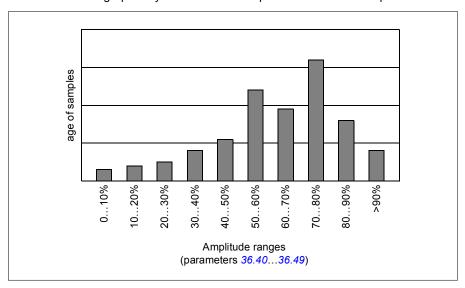
The user can select a signal to be monitored by a peak value logger. The logger records the peak value of the signal along with the time the peak occurred, as well as motor current, DC voltage and motor speed at the time of the peak. The peak value is sampled at 2 ms intervals.

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. Each parameter represents an amplitude range 10 age points wide, and displays the age of the collected samples that have fallen within that range.

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}) , which is listed in the *Hardware manual*. The measured current is logged continuously. The distribution of samples is shown by parameters 36.20...36.29.

- Menu Diagnostics Load profile
- Parameter group 36 Load analyzer (page 206).

Diagnostics menu

The **Diagnostics** menu provides quick information about active faults, warnings and inhibits in the drive and how to fix and reset them. It also helps you to find out why the drive is not starting, stopping or running at the desired speed.



- Drive actual values: Use this view to see the drive actual state.
- Active faults: Use this view to see currently active faults and how to fix and reset them
- Active warnings: Use this view to see currently active warnings and how to fix them.
- Active inhibits: Use this view to see the active inhibits and how to fix them. In
 addition, in the Clock, region, display menu you can disable (enabled by default)
 and pop-up views showing information on inhibits when you try to start the drive
 but it is prevented.
- Fault & event log: Use this view to see the list of faults, warnings and other
 events that have occurred in the drive.
- Start/stop/reference summary: Use this view to find out where the control
 comes from if the drive is not starting or stopping as expected, or runs at an
 undesired speed.
- Limit status: Use this view to find out whether any limitations are active if the
 drive is running at undesired speed.
- **Fieldbus:** Use this view to see the status information and sent and received data from fieldbus for troubleshooting.
- Load profile: Use this view to see the status information of load distribution (that
 is, drive running time spent on each load level) and peak load levels.
- Motor summary: Use this view to see the motor data of the current drive.

- Menu Diagnostics
- Menu Primary settings Clock, region, display Show inhibit pop-up

Miscellaneous

Backup and restore

You can make backups of the settings manually to the assistant panel. The assistant 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 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 assistant 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 if there are additional parameter changes. If there are, it creates a new backup overwriting the previous one when two hours have passed after the latest change.

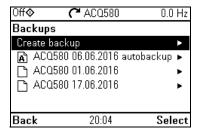
You cannot adjust the delay time or disable the automatic backup function.

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 backups are marked with icon A and manual backups with \(\frac{1}{2} \). To restore a backup, select it and press \(\backslash \). 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 has to be in Local control.





Settings

- Menu Backups
- Parameter 96.07 Parameter save manually (page 265).

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, the drive has to be stopped.

A user parameter set contains all editable values in parameter groups 10...99 except

- 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)
- data storage parameters (group 47)
- 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, the motor ID run needs to be performed with each motor and the results saved to different user sets. The appropriate set can then be recalled when the motor is switched.

Settings

- Menu Primary settings Advanced functions User sets
- Parameters 96.10...96.13 (page 266).

Data storage parameters

Twelve (eight 32-bit, four 16-bit) parameters are reserved for data storage. These parameters are unconnected by default and can be used for linking, testing and commissioning purposes. They can be written to and read from using other parameters' source or target selections.

Settings

Parameter group 47 Data storage (page 230).

User lock

For better cybersecurity, it is highly recommended that you set a master pass code to prevent eg. the 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 Cybersecurity disclaimer (page 16).

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. Then enter a new pass code into 96.100 Change user pass code, and confirm the code in 96.101 Confirm user pass code. In 96.102 User lock functionality, define the actions that you want to prevent (we recommend you select all the actions unless otherwise required by the application).

To close the user lock, enter an invalid pass code into 96.02 Pass code, activate 96.08 Control board boot, or cycle the power. With the lock closed, parameters 96.100...96.102 are hidden.

To reopen the lock, enter your pass code into 96.02 Pass code. This will again make parameters 96.100...96.102 visible.

Settings

Parameters 96.02 (page 265) and 96.100...96.102 (page 269).

Sine filter support

The control program has a setting that enables the use of ABB sine filters (available separately). With a sine filter connected to the output of the drive, bit 1 of 95.01 Special HW settings must be switched on. The setting forces the drive to use the scalar motor control mode, and limits the switching and output frequencies to

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

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

Settings

Parameter 95.01 Special HW settings (page 262).

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 281, 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
Actual signal	Type of <i>parameter</i> that is the result of a measurement or calculation by the drive, or contains status information. Most actual signals are readonly, but some (especially counter-type actual signals) can be reset.
Def	(In the following table, shown on the same row as the parameter name) The default value of a <i>parameter</i> when used in the Factory macro. For information on other macro-specific parameter values, see chapter <i>Default configuration</i> (page 35).
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 283).
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 <i>actual</i> signal.
p.u.	Per unit
[parameter number]	Value of the parameter

Summary of parameter groups

Group	Contents		
01 Actual values	Basic signals for monitoring the drive.	97	
03 Input references	Values of references received from various sources.	99	
04 Warnings and faults	Information on warnings and faults that occurred last.	100	
05 Diagnostics	Various run-time-type counters and measurements related to drive maintenance.	101	
06 Control and status words	Drive control and status words.	103	
07 System info	Drive hardware and firmware information.	109	
10 Standard DI, RO	Configuration of digital inputs and relay outputs.	109	
11 Standard DIO, FI, FO	Configuration of the frequency input.	114	
12 Standard AI	Configuration of standard analog inputs.	116	
13 Standard AO	Configuration of standard analog outputs.	120	
15 I/O extension module	Configuration of the I/O extension module installed in slot 2.	125	
19 Operation mode	Selection of local and external control location sources and operating modes.	133	
20 Start/stop/direction	Start/stop/direction and run/start/jog enable signal source selection; positive/negative reference enable signal source selection.	134	
21 Start/stop mode	Start and stop modes; emergency stop mode and signal source selection; DC magnetization settings.	139	
22 Speed reference selection	Speed reference selection; motor potentiometer settings.		
23 Speed reference ramp	Speed reference ramp settings (programming of the acceleration and deceleration rates for the drive).	154	
24 Speed reference conditioning	Speed error calculation; speed error window control configuration; speed error step.	156	
25 Speed control	Speed controller settings.	157	
28 Frequency reference chain	Settings for the frequency reference chain.	162	
30 Limits	Drive operation limits.	170	
31 Fault functions	Configuration of external events; selection of behavior of the drive upon fault situations.	176	
32 Supervision	Configuration of signal supervision functions 16.	182	
34 Timed functions	Configuration of the timed functions.	189	
35 Motor thermal protection	Motor thermal protection settings such as temperature measurement configuration, load curve definition and motor fan control configuration.	196	
36 Load analyzer	Peak value and amplitude logger settings.	206	
37 User load curve	Settings for user load curve.	209	
40 Process PID set 1	Parameter values for process PID control.	212	
41 Process PID set 2	A second set of parameter values for process PID control.	223	
45 Energy efficiency	Settings for the energy saving calculators.	225	
46 Monitoring/scaling settings			
47 Data storage Data storage parameters that can be written to and read from using other parameters' source and target settings.		230	
49 Panel port communication	Communication settings for the control panel port on the drive.	231	

96 Parameters

Group	Contents	Page		
50 Fieldbus adapter (FBA)	Fieldbus communication configuration.	232		
51 FBA A settings	Fieldbus adapter A configuration.	236		
52 FBA A data in	Selection of data to be transferred from drive to fieldbus controller through fieldbus adapter A.	238		
53 FBA A data out	Selection of data to be transferred from fieldbus controller to drive through fieldbus adapter A.			
58 Embedded fieldbus	Configuration of the embedded fieldbus (EFB) interface.	239		
71 External PID1	Configuration of external PID.	245		
76 Multipump configuration	Multipump configuration parameters.	248		
77 Multipump maintenance and monitoring	Multipump maintenance and monitoring parameters.	256		
80 Flow calculation	Actual flow calculation.	258		
82 Pump protections	Settings for quick ramp functions.	259		
83 Pump cleaning	Settings for the pump cleaning sequence.	260		
95 HW configuration	Various hardware-related settings.	262		
96 System	Language selection; access levels; macro selection; parameter save and restore; control unit reboot; user parameter sets; unit selection.	264		
97 Motor control	Switching frequency; slip gain; voltage reserve; flux braking; anticogging (signal injection); IR compensation.	271		
98 User motor parameters	Motor values supplied by the user that are used in the motor model.	274		
99 Motor data	Motor configuration settings.	275		

Parameter listing

No.	Name/Value	Description	Def/FbEq16
01 Act	tual 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	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.	See par. 46.01
01.02	Motor speed estimated	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.	See par. 46.01
01.03	Motor speed %	Motor speed in percent of the synchronous motor speed.	-
	-1000.00 1000.00%	Motor speed.	10 = 1%
01.06	Output frequency	Estimated drive output frequency in Hz. A filter time constant for this signal can be defined by parameter 46.12 Filter time output frequency.	-
	-500.00500.00 Hz	Estimated output frequency.	See par. 46.02
01.07	Motor current	Measured (absolute) motor current in A.	-
	0.0030000.00 A	Motor current.	1 = 1 A
01.08	Motor current % of motor nom	Motor current (drive output current) in percent of the nominal motor current.	-
	0.01000.0%	Motor current.	1 = 1%
01.09	Motor current % of drive nom	Motor current (drive output current) in percent of the nominal drive current.	-
	0.01000.0%	Motor current.	1 = 1%
01.10	Motor torque	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.	-
	-1600.01600.0%	Motor torque.	See par. 46.03
01.11	DC voltage	Measured DC link voltage.	-
	0.002000.00 V	DC link voltage.	10 = 1 V
01.13	Output voltage	Calculated motor voltage in V AC.	-
	02000 V	Motor voltage.	1 = 1 V

No. Name/Value		Description	Def/FbEq16
01.14	Output power	Drive output power. The unit is selected by parameter 96.16 Unit selection. A filter time constant for this signal can be defined by parameter 46.14 Filter time power.	-
	-32768.00 32767.00 kW or hp	Output power.	1 = 1 unit
01.15	Output power % of motor nom	Output power in percent of the nominal motor power.	-
	-300.00 300.00%	Output power.	1 = 1%
01.16	Output power % of drive nom	Output power in percent of the nominal drive power.	-
	-300.00 300.00%	Output power.	1 = 1%
01.17	Motor shaft power	Estimated mechanical power at motor shaft.	-
	-32768.00 32767.00 kW or hp	Motor shaft power.	1 = 1 unit
01.18	Inverter GWh counter	Amount of energy that has passed through the drive (in either direction) in full gigawatt-hours. The minimum value is zero.	-
	065535 GWh	Energy in GWh.	1 = 1 GWh
01.19	Inverter MWh counter	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.	-
	01000 MWh	Energy in MWh.	1 = 1 MWh
01.20 Inverter kWh counter		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.	-
	01000 kWh	Energy in kWh.	10 = 1 kWh
01.24	Flux actual %	Used flux reference in percent of nominal flux of motor.	-
	0200%	Flux reference.	1 = 1%
01.30	Nominal torque scale	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.	-
	0.0004000000 N·m or lb·ft	Nominal torque.	1 = 100 unit
01.50	Current hour kWh	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	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

1 = 10

No.	Name/Value Description		Def/FbEq16
01.52	Current day kWh	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	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
01.61	Abs motor speed used	Absolute value of parameter 01.01 Motor speed used.	-
	0.00 30000.00 rpm	Estimated motor speed.	See par. 46.01
01.62	Abs motor speed %	Absolute value of parameter 01.03 Motor speed %.	-
	0.00 1000.00%	Estimated motor speed.	10 = 1%
01.63	Abs output frequency	Absolute value of parameter 01.06 Output frequency.	-
	0.00500.00 Hz	Estimated output frequency.	See par. 46.02
01.64	Abs motor torque	Absolute value of parameter 01.10 Motor torque.	-
	0.01600.0%	Motor torque.	See par. 46.03
01.65	Abs output power	Absolute value of parameter 01.14 Output power.	-
	0.00 32767.00 kW or hp	Output power.	1 = 1 kW
01.66	Abs output power % motor nom	Absolute value of parameter 01.15 Output power % of motor nom.	-
	0.00 300.00%	Output power.	1 = 1%
01.67	Abs output power % drive nom	Absolute value of parameter 01.16 Output power % of drive nom.	-
	0.00 300.00%	Output power.	1 = 1%
01.68	Abs motor shaft power	Absolute value of parameter 01.17 Motor shaft power.	-
	0.00 32767.00 kW or hp	Motor shaft power.	1 = 1 kW
03 Inp	ut references	Values of references received from various sources. All parameters in this group are read-only unless otherwise noted.	
03.01	Panel reference	Reference 1 given from the control panel or PC tool.	-
		1	

Control panel or PC tool reference.

-100000.00...

100000.00

03.02	Panel reference	Defense of the feet the control of the BO test	
	remote	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	Reference 1 received through fieldbus adapter A. See also chapter <i>Fieldbus control through a fieldbus adapter</i> (page 363).	-
	-100000.00 100000.00	Reference 1 from fieldbus adapter A.	1 = 10
03.06	FB A reference 2	Reference 2 received through fieldbus adapter A.	-
	-100000.00 100000.00	Reference 2 from fieldbus adapter A.	1 = 10
03.09	EFB reference 1	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	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
04 Wa	rnings and faults	Information on warnings and faults that occurred last. For explanations of individual warning and fault codes, see chapter <i>Fault tracing</i> . All parameters in this group are read-only unless otherwise noted.	
04.01	Tripping fault	Code of the 1st active fault (the fault that caused the current trip).	-
	0000hFFFFh	1st active fault.	1 = 1
04.02	Active fault 2	Code of the 2nd active fault.	-
	0000hFFFFh	2nd active fault.	1 = 1
04.03	Active fault 3	Code of the 3rd active fault.	-
	0000hFFFFh	3rd active fault.	1 = 1
04.06	Active warning 1	Code of the 1st active warning.	-
	0000hFFFFh	1st active warning.	1 = 1
04.07	Active warning 2	Code of the 2nd active warning.	-
	0000hFFFFh	2nd active warning.	1 = 1
04.08	Active warning 3	Code of the 3rd active warning.	-
	0000hFFFFh	3rd active warning.	1 = 1
04.11	Latest fault	Code of the 1st stored (non-active) fault.	-
	0000hFFFFh	1st stored fault.	1 = 1
04.12	2nd latest fault	Code of the 2nd stored (non-active) fault.	-
	0000hFFFFh	2nd stored fault.	1 = 1
04.13	3rd latest fault	Code of the 3rd stored (non-active) fault.	-
	0000hFFFFh	3rd stored fault.	1 = 1

No.	Name/Value	Description	Def/FbEq16
04.16	Latest warning	Code of the 1st stored (non-active) warning.	-
	0000hFFFFh	1st stored warning.	1 = 1
04.17	2nd latest warning	Code of the 2nd stored (non-active) warning.	-
	0000hFFFFh	2nd stored warning.	1 = 1
04.18	3rd latest warning	Code of the 3rd stored (non-active) warning.	-
	0000hFFFFh	3rd stored warning.	1 = 1

05 Diagnostics		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.	-
	065535 d	On-time counter.	1 = 1 d
05.02	Run-time counter	Motor run-time counter. The counter runs when the inverter modulates.	-
	065535 d	Motor run-time counter.	1 = 1 d
05.04	Fan on-time counter	Running time of the drive cooling fan. Can be reset from the control panel by keeping Reset down for over 3 seconds.	-
	065535 d	Cooling fan run-time counter.	1 = 1 d
05.10 Control board temperature Measured temperature of the control l		Measured temperature of the control board	-
	-100 300 °C or °F	Control board temperature in degrees Celsius or Fahrenheit.	1 = unit
05.11	Inverter temperature	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	-
	-40.0160.0%	Drive temperature in percent.	1 = 1%

No.			Descri	ption	Def/FbEq16
05.22				ostic word 3. For possible causes and remedies, see	
	Bit	Name		Value	
	0	Main circuit ON	pwr	yes = Main circuit power is on.	
	1	Ext. pwr su	pply	yes = Control board is powered on from external power example, user provided 24 V.	r supply, for
	2	Programming wand Panel port comm loss Reserved Field bus force trip Start inhibited		yes = Control board is powered on by the Programming wand tool for offline programming or parameterization. Main circuit / power uni is without power.	
	3			yes = Panel port communication lost.	
	4			yes = Fault trip forced (requested) from a field bus. yes = Start inhibited (prevented) due to some reason for example interlock.	
	5				
	6				
	7	Safe Torq C	Off	yes = Safe Torque Off fault active. yes = Safe Torque Off circuitry is broken.	
	8	STO broke	า		
	9	kWh pulse		yes = kWh pulse is active.	
	10	Reserved			
	11	Fan comma	and	On = Drive fan is rotating above idle speed.	
	1215	Reserved			
	0000hFFFFh Diagno		Diagno	estic word 3.	1 = 1

No.	Name/Value	Descrip	tion	Def/FbEq16
06 Cor words	ntrol and status	Drive co	ntrol and status words.	
06.01 Main control word		control s as digita program For the t word and respectiv	bit descriptions see page 369. The related status d state diagram are presented on pages 370 and 371	-
		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	Reserved	
		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	
		1		1
	0000hFFFFh	Main cor	ntrol word.	1 = 1

No.	Name/Value	Descr	Def/FbEq16			
06.11	Main status word	Main s	-			
		word a				
		respectively. This parameter is read-only.				
		The parameter to roug only.				
		Bit	Name			
		0	Ready to switch ON			
		1	Ready run			
		2	Ready ref			
		3	Tripped			
		4	Off 2 inactive			
		5	Off 3 inactive			
		6	Switch-on inhibited			
		7	Warning			
		8	At setpoint			
		9	Remote			
		10	Above limit			
		11	User bit 0			
		12	User bit 1			
		13	User bit 2			
		14	User bit 3			
		15	Reserved			
	0000hFFFFh	Main s	status word.	1 = 1		

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

Bit	Name	Description			
0	Enabled	1 = If Run permissive (par. 20.40) and start interlock signals (par. 20.4120.44) signals are all present.			
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 <i>network control</i> (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 = If Start requested. 0 = When Run permissive signal (see par. 20.40) is 0.			
1415	Reserved				

	0000hTFFFFh	Drive status word 1.	1 = 1
<i>06</i> .	.17 Drive status word 2	Drive status word 2.	-
		This parameter is read-only.	

Bit	Name	Description		
0	Identification run done	1 = Motor identification (ID) run has been performed		
1	Magnetized	1 = The motor has been magnetized		
2	Torque control	1 = Torque control mode active		
3	Speed control	1 = Speed control mode active		
4	Reserved			
5	Safe reference active	1 = A "safe" reference is applied by functions such as parameters 49.05 and 50.02		
6	Last speed active	1 = A "last speed" reference is applied by functions such as parameters 49.05 and 50.02		
7	Loss of reference	1 = Reference signal lost		
8	Emergency stop failed	1 = Emergency stop failed (see parameters 31.32 and 31.33)		
912	Reserved			
1012	Reserved			
13	Start delay active	1 = Start delay (par. 21.22) active.		
1415	Reserved	•		

0000h...FFFFh Drive status word 2. 1 = 1

5.18						
	Start inhibit status word		inhibiting s The condit the start co inhibiting c See also p	It status word. This word specifies the source of the signal that is preventing the drive from starting. It status word with an asterisk (*) only require that command is cycled. In all other instances, the condition must be removed first. It sharemeter 06.16 Drive status word 1, bit 1. In other is read-only.	-	
	Bit	Name		Description		
	0	Not ready run		1 = DC voltage is missing or drive has not been pa correctly. Check the parameters in groups 95 and 9		
	1	Ctrl location	changed	* 1 = Control location has changed		
	2	SSW inhibit Fault reset		1 = Control program is keeping itself in inhibited state * 1 = A fault has been reset		
	3					
	4	Lost start enable		1 = Start enable signal missing		
	5	Lost run enable		1 = Run enable signal missing		
	6	Reserved		,		
	7	STO		1 = Safe torque off function active		
	8	Current cal ended	bration	* 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	nhibit	1 = The autoreset function is inhibiting operation		
	15	Reserved				
	0000h.	FFFFh	Start inhib	it status word.	1 = 1	
19	Speed control		Speed control status word.		-	
	status word		This parar	neter is read-only.		
	Bit	Name		Description		
	0	Zero speed		1 = Drive has been running below zero speed limit (par. 21.06) for a time defined by parameter 21.07 Zero speed delay		
	1	Forward		1 = Drive is running in forward direction above ze (par. 21.06)		
	2	Reverse		1 = Drive is running in reverse direction above ze (par. 21.06)	ro speed limi	
	36	Reserved				
	7	Any consta request	nt speed	1 = A constant speed or frequency has been selected 06.20.	cted; see par	
	815	Reserved		•		
		FFFFh		ntrol status word.	1 = 1	

No.	Name/\	/alue Descrip		ion	Def/FbEq16	
06.20	Constant speed status word		constant s paramete Constant	speed/frequency status word. Indicates which speed or frequency is active (if any). See also or 06.19 Speed control status word, bit 7, and section speeds/frequencies (page 49). meter is read-only.	-	
	Bit Name		Description			
	0	Constant speed 1		1 = Constant speed or frequency 1 selected		
	1	Constant s	peed 2	1 = Constant speed or frequency 2 selected		
	2	Constant s	peed 3	1 = Constant speed or frequency 3 selected		
	3	Constant sp	peed 4	1 = Constant speed or frequency 4 selected		
	4	Constant sp	peed 5	1 = Constant speed or frequency 5 selected		
	5	Constant sp	peed 6	1 = Constant speed or frequency 6 selected		
	6	Constant sp	peed 7	1 = Constant speed or frequency 7 selected		
	715	Reserved				
	<u>, </u>					
	0000h.	FFFFh	Constant	speed/frequency status word.	1 = 1	
06.21		FFFFh tatus word 3	Drive stat	speed/frequency status word. tus word 3. meter is read-only.	1 = 1	
06.21			Drive stat This para	tus word 3.	1 = 1	
06.21	Drive si	tatus word 3	Drive stat	tus word 3. meter is read-only.	1 = 1	
06.21	Drive s	tatus word 3	Drive stat This para Detive 1 =	tus word 3. meter is read-only. escription	1 = 1	
06.21	Drive st	Name DC hold ac Post-magne	Drive stat This para Detive 1 = etizing 1 =	tus word 3. meter is read-only. escription = DC hold is active	1 = 1	
06.21	Bit 0	Name DC hold ac Post-magnactive Motor pre-h	Drive stat This para De tive 1 = etizing 1 =	rus word 3. meter is read-only. Pactive Both Post-magnetizing is active	1 = 1	
06.21	Bit 0 1	Name DC hold ac Post-magniactive Motor pre-hactive PM smooth	Drive stat This para De tive 1 = etizing 1 =	rus word 3. meter is read-only. Pescription = DC hold is active = Post-magnetizing is active = Motor pre-heating is active	1 = 1	
06.21	Bit 0 1 2 3	Name DC hold ac Post-magniactive Motor pre-ractive PM smooth active	Drive stat This para De tive 1 = etizing 1 =	rus word 3. meter is read-only. Pescription = DC hold is active = Post-magnetizing is active = Motor pre-heating is active	1 = 1	

selection False

Other [bit]

True

0.

No.	Name/Value Water status word		Descrip	Description		
06.22			Water specific status word. This parameter is read-only.		-	
	Bit Name		Description			
	0	Hand mode	Э	0 = Drive is not operated from the panel in hand mo	ode; 1 = Drive	
	1	Off mode		0 = Drive is not in off mode; 1 = Drive is in off mode	e.	
	2	Auto mode		0 = Drive is not in auto mode; 1 = Drive is in auto r	node.	
	3	Reserved				
	4	Pre-heating	9	0 = Motor pre-heating is not active; 1 = Motor pre-hactive.	neating is	
	56	Reserved		•		
	7	Run permis	ssive	0 = Run permissive is not present, drive is not allow Run permissive is present, drive is allowed to run.	ed to run; 1 =	
	8	Start interlo	ock 1	0 = Start interlock 1 is not present, drive is not allowed to start; 1 = Start interlock 1 is present, drive is allowed to start.		
	9	Start interlo	ock 2	0 = Start interlock 2 is not present, drive is not allowed to start; 1 = Start interlock 2 is present, drive is allowed to start.		
	10	Start interlock 3		0 = Start interlock 3 is not present, drive is not allowed to start; 1 = Start interlock 3 is present, drive is allowed to start.		
	11	Start interlock 4		0 = Start interlock 4 is not present, drive is not allowed to start; 1 = Start interlock 4 is present, drive is allowed to start.		
	1215 Reserved					
	0000h.	FFFFh	Start inhi	ibit status word.	1 = 1	
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 104).	2	
	Other [bit]	Source s	selection (see Terms and abbreviations on page 94).	-	
06.31	MSW bit 12 selection			a binary source whose status is transmitted as bit 12 1) of 06.11 Main status word.		
	False		0.		0	
	True		1.		1	
	Other	bit]	Source s	selection (see <i>Terms and abbreviations</i> on page 94).	-	
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 s	selection (see <i>Terms and abbreviations</i> on page 94).	-	
06.33 MSW bit 14 selection		oit 14	Selects a	a binary source whose status is transmitted as bit 14 3) of 06.11 Main status word.	False	
		-	1220. 510	(Soci Sit S) of So. 11 Main Status Wold.		

Source selection (see Terms and abbreviations on page 94).

0

1

No.	Name/V	/alue	Description		Def/FbEq16
07 Sys	07 System info			are and firmware information. rs in this group are read-only.	
07.03	Drive ra	ting id	Type of the o	drive. (Rating ID in brackets.)	-
07.04	Firmwai	re name	Firmware ide	entification.	-
07.05	Firmwai	re version	Version num	ber of the firmware.	-
07.06	Loading name	package	Name of the	firmware loading package.	-
07.07	Loading version	package	Version num	ber of the firmware loading package.	-
07.11	Cpu usa	age	Microproces	sor load in percent.	-
	01009	%	Microproces	sor load.	1 = 1%
07.25	Customization package name		package. Th	CII letters of the name given to the customization e full name is visible under System info on the I or the Drive composer PC tool.	-
07.26	Custom package	ization e version		on package version number. Also visible under on the control panel or the Drive composer PC	-
10 Sta	ndard D	I, RO	Configuration	n of digital inputs and relay outputs.	
10.02 DI delayed status		ved status	the delayed Example: 00 DI3, DI4 and This word is delay. When remain the s for the new v	status of digital inputs DI1DI6. Bits 05 reflect status of DI1DI6. 000000000010011b = DI5, DI2 and DI1 are on, IDI6 are off. updated only after a 2 ms activation/deactivation the value of a digital input changes, it must ame in two consecutive samples, that is for 2 ms, value to be accepted. ter is read-only.	-
	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.	
	615	Reserved			
	00006	TTT-b	Deleved -+-+	ura for digital inputs	1 - 4
	0000hFFFFh		Delayed stat	us for digital inputs.	1 = 1

No.	Name/Value		Description	Def/FbEq16
10.03	DI force	e selection	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).	0000h
	Bit	Value		
	0	1 = Force [DI1 to value of bit 0 of parameter 10.04 DI forced data. (0 = Norr	nal mode)
	1	1 = Force [DI2 to value of bit 1 of parameter 10.04 DI forced data. (0 = Norr	nal mode)
	2	1 = Force [DI3 to value of bit 2 of parameter 10.04 DI forced data. (0 = Norr	nal mode)
	3	1 = Force [DI4 to value of bit 3 of parameter 10.04 DI forced data. (0 = Norr	nal mode)
	4	1 = Force [DI5 to value of bit 4 of parameter 10.04 DI forced data. (0 = Norr	nal mode)
	5	1 = Force [DI6 to value of bit 5 of parameter 10.04 DI forced data. (0 = Norr	nal mode)
	615	Reserved		
	0000h.	FFFFh	Override selection for digital inputs.	1 = 1
10.04	DI force		Allows the data value of a forced digital input to be changed	0000h
70.04			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.	
	Bit	Value		
	0	Force the	value of this bit to D1, if so defined in parameter 10.03 DI force	selection.
	1	Force the	value of this bit to D3, if so defined in parameter 10.03 DI force	selection.
	2	Force the	value of this bit to D3, if so defined in parameter 10.03 DI force	selection.
	3	Force the	value of this bit to D4, if so defined in parameter 10.03 DI force	selection.
	4	Force the	value of this bit to D5, if so defined in parameter 10.03 DI force	selection.
	5	Force the	value of this bit to D6, if so defined in parameter 10.03 DI force	selection.
	615	Reserved		
	0000h	FFFFh	Forced values of digital inputs.	1 = 1
10.21	RO stat	tus	Status of relay outputs RO3RO1.	-
10.21				
10.21	Bit	Value		
10.21	Bit 0		energized.	
10.21		1 = RO1 is	energized. energized.	
10.21	0	1 = RO1 is 1 = RO2 is	_	
10.21	0	1 = RO1 is 1 = RO2 is	energized.	

No.	Name/\	/alue	Description	Def/FbEq16		
10.22	RO force	e 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).	0000h		
	Bit	Value				
	0	1 = Force F	RO1 to value of bit 0 of parameter 10.23 RO forced data. (0 = No	ormal mode)		
	1		RO2 to value of bit 1 of parameter 10.23 RO forced data. (0 = No			
	2		RO3 to value of bit 2 of parameter 10.23 RO forced data. (0 = No	ormal mode)		
	315	Reserved				
	0000h	.FFFFh	Override selection for relay outputs.	1 = 1		
10.23	RO ford	ed 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.			
	Bit	Value				
	0		value of this bit to RO1, if so defined in parameter 10.22 RO force			
	1		Force the value of this bit to RO2, if so defined in parameter 10.22 RO force			
		2 Force the value of this bit to RO3, if so defined in parameter 10.22 RO fo		e selection.		
	315 Reserved					
	0000h	.FFFFh	Forced RO values.	1 = 1		
10.24	RO1 so	urce	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 104).	2		
	Enable	t	Bit 0 of 06.16 Drive status word 1 (see page 105).	4		
	Started		Bit 5 of 06.16 Drive status word 1 (see page 105).	5		
	Magnetized		Bit 1 of 06.17 Drive status word 2 (see page 105).	6		
	Running	g	Bit 6 of 06.16 Drive status word 1 (see page 105).	7		
	Ready	ref	Bit 2 of 06.11 Main status word (see page 104).	8		
	At setpo	oint	Bit 8 of 06.11 Main status word (see page 104).	9		
	Reverse	е	Bit 2 of 06.19 Speed control status word (see page 106).	10		
	Zero sp	eed	Bit 0 of 06.19 Speed control status word (see page 106).	11		
	Above I	imit	Bit 10 of 06.17 Drive status word 2 (see page 105).	12		
	Warning	3	Bit 7 of 06.11 Main status word (see page 104).	13		
	Fault	-	Bit 3 of 06.11 Main status word (see page 104).	14		
	Fault (-	1)	Inverted bit 3 of 06.11 Main status word (see page 104).	15		
	Fault/W		Bit 3 of 06.11 Main status word OR bit 7 of 06.11 Main status word (see page 104).	16		
	Overcu	rrent	Fault 2310 Overcurrent has occurred.	17		
	Overvo	ltage	Fault 3210 DC link overvoltage has occurred.	18		
			I .	1		

No.	Name/Value	Description	Def/FbEq16
	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
	Reserved		22
	Ext2 active	Bit 11 of 06.16 Drive status word 1 (see page 105).	23
	Remote control	Bit 9 of 06.11 Main status word (see page 104).	24
	Reserved		2526
	Timed function 1	Bit 0 of 34.01 Timed functions status (see page 189).	27
	Timed function 2	Bit 1 of 34.01 Timed functions status (see page 189).	28
	Timed function 3	Bit 2 of 34.01 Timed functions status (see page 189).	29
	Reserved		3032
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 182).	33
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 182).	34
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 182).	35
	Reserved		3638
	Start delay	Bit 13 of 06.17 Drive status word 2 (see page 105).	39
	RO/DIO control word bit0	Bit 0 of 10.99 RO/DIO control word (see page 114).	40
	RO/DIO control word bit1	Bit 1 of 10.99 RO/DIO control word (see page 114).	41
	RO/DIO control word bit2	Bit 2 of 10.99 RO/DIO control word (see page 114).	42
	Reserved		4344
	PFC1	Bit 0 of 76.01 PFC status (see page 248).	45
	PFC2	Bit 1 of 76.01 PFC status (see page 248).	46
	PFC3	Bit 2 of 76.01 PFC status (see page 248).	47
	PFC4	Bit 3 of 76.01 PFC status (see page 248).	48
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 94).	-
10.25	RO1 ON delay	Defines the activation delay for relay output RO1.	0.0 s
	Status of selected source		1 0 1
	RO status — —	$\langle \cdot \cdot \rangle$ $\langle \cdot \rangle$ $\langle \cdot \cdot \rangle$	── 0 ──> Time
	t _{On} = 10.25 RO1 ON del t _{Off} = 10.26 RO1 OFF de	lay elay	
	0.0 3000.0 s	Activation delay for RO1.	10 = 1 s

No.	Name/Value	Description	Def/FbEq16
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
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
	Status of selected source		1 0 1
	t _{On} = 10.28 RO2 ON de t _{Off} = 10.29 RO2 OFF d	t _{On} t _{Off} t _{On} t _{Off} lay elay	
	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
	Status of selected source		1 — 0 1
	RO status — —		0 Time
	$t_{\rm On}$ = 10.31 RO3 ON de $t_{\rm Off}$ = 10.32 RO3 OFF d		
	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

No.	Name/V	/alue	Description	Def/FbEq16
10.99	RO/DIO word	ocontrol	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 (58.10158.114) to RO/DIO control word. In the source selection parameter of the desired output, select the appropriate bit of this word.	0000h
	Bit	Name	Description	
	0	RO1	Source bits for relay outputs RO1RO3. See parameter	rs 10.24,
	1	RO2	10.27 and 10.30.	
	2	RO3		
	3	RO4	Source bits for relay outputs RO4RO5 with a CHDI-01 extension module. See parameters 15.07 and 15.10.	or CMOD-01
	4 5	RO5 Reserved	extension module. See parameters 75.07 and 75.70.	
	6	DIO1	Source bit for digital outputs DO1 with a CMOD-01 exter See parameter 15.23.	sion module.
	715 Reserved			
				1
	0000h		RO/DIO control word.	1 = 1
10.101	10.101 RO1 toggle counter		Displays the number of times relay output RO1 has changed states.	-
	04294	1967000	State change count.	1 = 1
10.102	RO2 tog	ggle counter	Displays the number of times relay output RO2 has changed states.	-
	04294	1967000	State change count.	1 = 1
10.103	RO3 tog	ggle counter	Displays the number of times relay output RO3 has changed states.	-
	04294	1967000	State change count.	1 = 1
11 Stai	ndard D	IO, FI, FO	Configuration of the frequency input.	
11.21	DI5 con	figuration	Selects how digital input 5 is used.	Digital input
	Digital in	nput	DI5 is used as a digital input.	0
	Frequer	ncy input	DI5 is used as a frequency input.	1
11.38	Freq in 1 actual value		Displays the value of frequency input 1 (via DI5 when it is used as a frequency input) before scaling. See parameter 11.42 Freq in 1 min. This parameter is read-only.	-
	0 160	000 Hz	Unscaled value of frequency input 1.	1 = 1 Hz
11.39	Freq in value	1 scaled	Displays the value of frequency input 1 (via DI5 when it is used as a frequency input) after scaling. See parameter 11.42 Freq in 1 min. This parameter is read-only.	-
	-32768. 32767.0		Scaled value of frequency input 1 (DI5).	1 = 1

No.	Name/Value	Description	Def/FbEq16
11.42	Freq in 1 min	Defines the minimum for the frequency actually arriving at frequency input 1 (DI5 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 11.4211.45 as follows: 11.45 11.44 11.44 11.44 11.45 11.43 11.43	0 Hz
	0 16000 Hz	Minimum frequency of frequency input 1 (DI5).	1 = 1 Hz
11.43	Freq in 1 max	Defines the maximum for the frequency actually arriving at frequency input 1 (DI5 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).	1 = 1 Hz
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.	1500.000
	-32768.000 32767.000	Value corresponding to maximum of frequency input 1.	1 = 1

No.	Name/Va	alue	Description	Def/FbEq16
12 Sta	ndard Al	1	Configuration of standard analog inputs.	
12.02	2 Al 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: Al filter times (parameters 12.16 Al1 filter time and 12.26 Al2 filter time) have no effect on forced Al values (parameters 12.13 Al1 forced value and 12.23 Al2 forced value). Note: Boot and power cycle reset the force selections (parameters 12.02 and 12.03).	0000h
	Bit	Value		
	0	1 = Force A	II1 to value of parameter 12.13 AI1 forced value.	
	1	1 = Force A	I2 to value of parameter 12.23 AI2 forced value.	
	215	Reserved		
				T
	0000h		Forced values selector for analog inputs Al1 and Al2.	1 = 1
12.03	AI super function	vision	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	No action
	No setio		parameter 12.04 Al supervision selection.	0
	No action	n	No action taken.	0
	Fault		Drive trips on 80A0 AI supervision.	1
	Warning		Drive generates an A8A0 AI supervision warning.	2
	Last spe	ed	Drive generates a warning (A8A0 Al supervision) and freezes the speed (or frequency) to the level the drive was operating at. The speed/frequency is determined on the basis of actual speed using 850 ms low-pass filtering. WARNING! Make sure that it is safe to continue operation in case of a communication break.	3
	Speed ref safe		Drive generates a warning (A8A0 Al supervision) and sets the speed to the speed defined by parameter 22.41 Speed ref safe (or 28.41 Frequency ref safe when frequency reference is being used). WARNING! Make sure that it is safe to continue operation in case of a communication break.	4
12.04	Al super selection		Specifies the analog input limits to be supervised. See parameter 12.03 Al supervision function.	0000h
	Bit	Name	Description	
	0	Al1 < MIN	1 = Minimum limit supervision of Al1 active.	
	1	Al1 > MAX	1 = Maximum limit supervision of Al1 active.	
	2	AI2 < MIN	1 = Minimum limit supervision of Al2 active.	
	3	Al2 > MAX	1 = Maximum limit supervision of Al2 active.	
	415	Reserved	i - Ivianimum iimit supervision or Aiz active.	
	410	reserved		
	0000h	EEEEh	Activation of analog input supervision.	1 = 1
	000011		7.00.740.011 Of diffullog input supervision.	

No.	Name/Value	Description	Def/FbEq16
12.11	Al1 actual value	Displays the value of analog input Al1 in mA or V (depending on whether the input is set to current or voltage by a hardware setting). This parameter is read-only.	-
	0.00020.000 mA or 0.00010.000 V	Value of analog input Al1.	1000 = 1 unit
12.12	Al1 scaled value	Displays the value of analog input Al1 after scaling. See parameters 12.19 Al1 scaled at Al1 min and 12.20 Al1 scaled at Al1 max. This parameter is read-only.	-
	-32768.000 32767.000	Scaled value of analog input Al1.	1 = 1
12.13	Al1 forced value	Forced value that can be used instead of the true reading of the input. See parameter 12.02 Al force selection.	-
	0.00020.000 mA or 0.00010.000 V	Forced value of analog input Al1.	1000 = 1 unit
12.15	Al1 unit selection	Selects the unit for readings and settings related to analog input Al1.	V
	V	Volts.	2
	mA	Milliamperes.	10
12.16	Al1 filter time	Defines the filter time constant for analog input Al1. "Unfiltered signal 100 63 Filtered signal O = I × (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
	0.00030.000 s	Filter time constant.	1000 = 1 s
12.17	Al1 min	Defines the minimum site value for analog input Al1. 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 Al1 scaled at Al1 min.	4.000 mA or 0.000 V
	0.00020.000 mA or 0.00010.000 V	Minimum value of Al1.	1000 = 1 unit

No.	Name/Value	Description	Def/FbEq16
12.18	Al1 max	Defines the maximum site value for analog input Al1. 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 Al1 scaled at Al1 min.	20.000 mA or 10.000 V
	0.00020.000 mA or 0.00010.000 V	Maximum value of Al1.	1000 = 1 unit
12.19	Al1 scaled at Al1 min	Defines the real internal value that corresponds to the minimum analog input Al1 value defined by parameter 12.17 Al1 min. (Changing the polarity settings of 12.19 and 12.20 can effectively invert the analog input.) Al _{scaled} (12.12) 12.20 12.17 Al _{in} (12.11)	0.000
	-32768.000 32767.000	Real value corresponding to minimum Al1 value.	1 = 1
12.20	Al1 scaled at Al1 max	Defines the real internal value that corresponds to the maximum analog input Al1 value defined by parameter 12.18 Al1 max. See the drawing at parameter 12.19 Al1 scaled at Al1 min.	50.000
	-32768.000 32767.000	Real value corresponding to maximum Al1 value.	1 = 1
12.21	Al2 actual value	Displays the value of analog input Al2 in mA or V (depending on whether the input is set to current or voltage by a hardware setting). This parameter is read-only.	-
	0.00020.000 mA or 0.00010.000 V	Value of analog input Al2.	1000 = 1 unit
12.22	Al2 scaled value	Displays the value of analog input Al2 after scaling. See parameters 12.29 Al2 scaled at Al2 min and 12.101 Al1 percent value. This parameter is read-only.	-
	-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 Al force selection.	-
	0.00020.000 mA or 0.00010.000 V	Forced value of analog input AI2.	1000 = 1 unit

No.	Name/Value	Description	Def/FbEq16
12.25	Al2 unit selection	Selects the unit for readings and settings related to analog input Al2.	mA
	V	Volts.	2
	mA	Milliamperes.	10
12.26	AI2 filter time	Defines the filter time constant for analog input Al2. See parameter 12.16 Al1 filter time.	0.100 s
	0.00030.000 s	Filter time constant.	1000 = 1 s
12.27	AI2 min	Defines the minimum site value for analog input Al2. Set the value actually sent to the drive when the analog signal from plant is wound to its minimum setting.	4.000 mA or 0.000 V
	0.00020.000 mA or 0.00010.000 V	Minimum value of Al2.	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 or 10.000 V
	0.00020.000 mA or 0.00010.000 V	Maximum value of AI2.	1000 = 1 unit
12.29	Al2 scaled at Al2 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.) AI _{scaled} (12.22) 12.101 12.27 AI _{in} (12.21)	0.000
	-32768.000 32767.000	Real value corresponding to minimum Al2 value.	1 = 1
12.30	Al2 scaled at Al2 max	Defines the real value that corresponds to the minimum analog input Al2 value defined by parameter 12.28 Al2 max. See the drawing at parameter of 12.29 Al2 scaled at Al2 min.	50.000
	-32768.000 32767.000	Real value corresponding to maximum Al2 value.	1 = 1
12.101	Al1 percent value	Value of analog input Al1 in percent of Al1 scaling (12.18 Al1 max - 12.17 Al1 min).	-
	0.00100.00%	Al1 value	100 = 1%
12.102	Al2 percent value	Value of analog input Al2 in percent of Al2 scaling (12.28 Al2 max - 12.27 Al2 min).	-
	0.00100.00%	Al2 value	100 = 1%

No.	Name/Value		Description	Def/FbEq16
13 Sta	13 Standard AO		Configuration of standard analog outputs.	
13.02	AO forc	e 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).	0000h
	Bit	Value		
	0	1 = Force A	O1 to value of parameter 13.13 AO1 forced value. (0 = Normal	mode)
	1	1 = Force A	O2 to value of parameter 13.23 AO2 forced value. (0 = Normal	mode)
	215	Reserved		
	0000h	.FFFFh	Forced values selector for analog outputs AO1 and AO2.	1 = 1
13.11	AO1 ac	tual value	Displays the value of AO1 in mA or V. This parameter is read-only.	-
		22.000 mA / .11.000 V	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 s	peed used	01.01 Motor speed used (page 97).	1
	Reserve	ed		2
	Output	frequency	01.06 Output frequency (page 97).	3
	Motor c	urrent	01.07 Motor current (page 97).	4
	Motor c motor n	urrent % of ominal	01.08 Motor current % of motor nom (page 97).	5
	Motor to	orque	01.10 Motor torque (page 97).	6
	DC volta	age	01.11 DC voltage (page 97).	7
	Output	power	01.14 Output power (page 98).	8
	Reserve	ed		9
	Speed r	ef ramp in	23.01 Speed ref ramp input (page 154).	10
	Speed r	ef ramp out	23.02 Speed ref ramp output (page 154).	11
	Speed r	ef used	24.01 Used speed reference (page 156).	12
	Reserve	ed		13
	Freq ref	fused	28.02 Frequency ref ramp output (page 162).	14
	Reserve	ed		15
	Process	s PID out	40.01 Process PID output actual (page 212).	16
	Reserve	ed		1719
	Temp se 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 78).	20
	Temp se 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 78).	21

No.	Name/Value	Description	Def/FbEq16
	Reserved		2125
	Abs motor speed used	01.61 Abs motor speed used (page 99).	26
	Abs motor speed %	01.62 Abs motor speed % (page 99).	27
	Abs output frequency	01.63 Abs output frequency (page 99).	28
	Reserved		29
	Abs motor torque	01.64 Abs motor torque (page 99).	30
	Abs output power	01.65 Abs output power (page 99).	31
	Abs motor shaft power	01.68 Abs motor shaft power (page 99).	32
	External PID1 out	71.01 External PID act value ((page 245).	33
	Reserved		3436
	AO1 data storage	13.91 AO1 data storage (page 125).	37
	AO2 data storage	13.92 AO2 data storage (page 125).	38
	Other	Source selection (see <i>Terms and abbreviations</i> on page 94).	-
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
	0.00022.000 mA / 0.00011.000 V	Forced value for AO1.	1 = 1 unit
13.15	AO1 unit selection	Selects the unit for readings and settings related to analog input AO1.	mA
	V	Volts.	2
	mA	Milliamperes.	10
13.16	AO1 filter time	Defines the filtering time constant for analog output AO1. "Unfiltered signal 100 63 Filtered signal	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). I_{AO1} (mA)	0.0
		13.19 13.17 Signal (real) selected by 13.12	

No.	Nam	e/Value	Description			Def/FbEq16	
	AO has automatic scaling. Every time the source for the AO is changed, the scaling rar changed accordingly. User given minimum and maximum values override the automatic						
		13.12 AO1 so		13.17 AO1 source min,	13.18 AO1 source		
	13.22 AO2 so		urce	13.27 AO2 source min	13.28 AO2 source	e max	
	0	Zero		N/A (Output is constant zero.)	T		
	1	Motor speed u		0	46.01 Speed sca	_	
	3	Output freque	ncy	0	46.02 Frequency		
	4	Motor current	0/ - 5 1	0%	30.17 Maximum 100%	current	
	5	Motor current nominal	% of motor	0%	100%		
	6	Motor torque		0	46.03 Torque sca	aling	
	7	DC voltage		Min. value of 01.11 DC voltage	Max. value of 01 voltage	.11 DC	
	8	Output power		0	46.04 Power sca	ling	
	10	Speed ref ram	np in	0	46.01 Speed sca	ling	
	11	Speed ref ram	p out	0	46.01 Speed sca	ling	
	12	Speed ref use	d	0	46.01 Speed sca	ling	
	14	Freq ref used		0	46.02 Frequency	scaling	
	16	Process PID o	out	Min. value of 40.01 Process PID output actual	Max. value of 40 PID output actual	1	
	20	Temp sensor 1 excitation		N/A (Analog output is not scaled; it is determined by sensor's triggering voltage.)		d by the	
	21	Temp sensor 2 excitation					
	26	Abs motor speed used Abs motor speed % Abs output frequency Abs motor torque Abs output power Abs motor shaft power		0	46.01 Speed sca	_	
	27			0	46.01 Speed sca		
	28			0	46.02 Frequency		
	30			0	46.03 Torque sca		
	31			0	46.04 Power sca	•	
	32			0	46.04 Power sca		
	33	External PID1	out	Min. value of 71.01 External PID act value	Max. value of 71.01 Externa		
	Other			Min. value of the selected parameter	Max. value of the selected parameter		
	-3276	68.032767.0	Real signal v value.	alue corresponding to minimum	AO1 output	1 = 1	
13.18	AO1 source max		parameter 13 maximum re	ne real maximum value of the signal (selected by r 13.12 AO1 source) that corresponds to the required AO1 output value (defined by parameter 1 out at AO1 src max). See parameter 13.17 AO1 in.		50.0	
	-3276	68.032767.0	Real signal value corresponding to maximum AO1 output value. Defines the minimum output value for analog output AO1. See also drawing at parameter 13.17 AO1 source min.		n AO1 output	1 = 1	
13.19	AO1 min	out at AO1 src				0.000 mA	
		022.000 mA / 011.000 V	Minimum AO	1 output value.		1000 = 1 mA	
13.20	AO1 max	out at AO1 src		maximum output value for analo wing at parameter 13.17 AO1 s	• .	20.000 mA	
		022.000 mA / 011.000 V	Maximum AC	O1 output value.		1000 = 1 mA	

No.	Name/Value	Description	Def/FbEq16
13.21	AO2 actual value	Displays the value of AO2 in mA. This parameter is read-only.	-
	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
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. IAO2 (mA) 13.29 Programming 13.27 as the maximum value and 13.28 as the minimum value inverts the output. IAO2 (mA) 13.30 IAO2 (mA) 13.29 Signal (real) selected by 13.22 Signal (real) selected by 13.22	0.0
	-32768.032767.0	Real signal value corresponding to minimum AO2 output value.	1 = 1

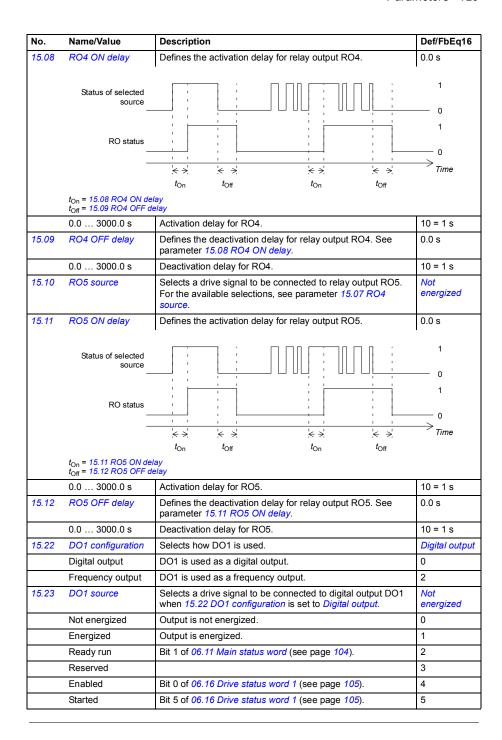
No.	Name/Value	Description	Def/FbEq16
13.28	AO2 source max	Defines the real maximum value of the signal (selected by parameter 13.22 AO2 source) that corresponds to the maximum required AO2 output value (defined by parameter 13.30 AO2 out at AO2 src max). See parameter 13.27 AO2 source min. See parameter 13.17 AO1 source min about the AO automatic scaling.	
	-32768.032767.0	Real signal value corresponding to maximum AO2 output value.	1 = 1
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 the embedded fieldbus interface. In parameter 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 (58.10158.114) to AO1 data storage.	0.00
	-327.68327.67	Storage parameter for AO1.	100 = 1
13.92	AO2 data storage	Storage parameter for controlling analog output AO2 eg. through the embedded fieldbus interface. In parameter 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 (58.10158.114) to AO2 data storage.	0.00
	-327.68327.67	Storage parameter for AO2.	100 = 1
15 I/O modu	extension le	Configuration of the I/O extension module installed in slot 2. See also section <i>Programmable I/O extensions</i> (page 46). Note: The contents of the parameter group vary according to the selected I/O extension module type.	
15.01	Extension module type	Activates (and specifies the type of) I/O extension module. If the value is <i>None</i> , when an extension module has been installed and the dive is powered, the drive automatically sets the value to the type it has detected (= value of parameter 15.02 Detected extension module); otherwise warning A7AB Extension I/O configuration failure is generated and you have	None

15 I/O modul	extension e	Configuration of the I/O extension module installed in slot 2. See also section <i>Programmable I/O extensions</i> (page 46). Note: The contents of the parameter group vary according to the selected I/O extension module type.	
15.01	Extension module type	Activates (and specifies the type of) I/O extension module. If the value is <i>None</i> , when an extension module has been installed and the dive is powered, the drive automatically sets the value to the type it has detected (= value of parameter 15.02 <i>Detected extension module</i>); otherwise warning <i>A7AB Extension I/O configuration failure</i> is generated and you have to set the value of this parameter manually.	None
	None	Inactive.	0
	CMOD-01	CMOD-01 multifunction extension module (external 24 V AC/DC and digital I/O).	1
	CMOD-02	CMOD-02 multifunction extension module (external 24 V AC/DC and isolated PTC interface).	2
	CHDI-01	CHDI-01 115/230 V digital input extension module.	3
15.02	Detected extension module	I/O extension module detected on the drive.	None
	None	Inactive.	0

CMOD-01	1 2 3 -
24 V AC/DC and isolated PTC interface). CHDI-01 CHDI-01 115/230 V digital input extension module. Displays the status of the digital inputs DI7DI12 on the extension module Bit 0 indicates the status of DI7. Example: 001001b = DI7 and DI10 are on, remainder are of This parameter is read-only. Bit Name Description Diff 1 = Digital input 7 is ON. 1 DI8 1 = Digital input 8 is ON. 2 DI9 1 = Digital input 9 is ON. 2 DI10 1 = Digital input 10 is ON. 4 DI11 1 = Digital input 11 is ON. 5 DI12 1 = Digital input 12 is ON. 615 Reserved	3 -
Displays the status of the digital inputs DI7DI12 on the extension module Bit 0 indicates the status of DI7.	-
Extension module Bit 0 indicates the status of DI7. Example: 001001b = DI7 and DI10 are on, remainder are of This parameter is read-only. Bit Name Description	
0 DI7	
0 DI7	
2 DI9 1 = Digital input 9 is ON. 2 DI10 1 = Digital input 10 is ON. 4 DI11 1 = Digital input 11 is ON. 5 DI12 1 = Digital input 12 is ON. 615 Reserved	
2 DI10 1 = Digital input 10 is ON. 4 DI11 1 = Digital input 11 is ON. 5 DI12 1 = Digital input 12 is ON. 615 Reserved	
4 DI11 1 = Digital input 11 is ON. 5 DI12 1 = Digital input 12 is ON. 615 Reserved	
5 DI12 1 = Digital input 12 is ON. 615 Reserved	
615 Reserved	
0000hFFFFh Status of digital input/outputs.	1 = 1
Displays the status of the relay outputs RO4 and RO5 and digital output DO1 on the extension module. Bits 01 indicates the status of RO4RO5; bit 5 indicates the status of DO1. Example: 100101b = RO4 is on, RO5 is off. and DO1 is on This parameter is read-only.	
Bit Name Description	
0 RO4 1 = Relay output 4 is ON.	
1 RO5 1 = Relay output 5 is ON	
24 Reserved	
5 DO1 1 = Digital output 1 is ON.	
615 Reserved	
0000hFFFFh Status of relay/digital outputs.	1 = 1

No.	Name/	Value	Description	Def/FbEq16
15.05	RO/DO selection		The electrical statuses of the relay/digital outputs can be overridden for eg. testing purposes. A bit in parameter 15.06 RO/DO forced data is provided for each relay or digital 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 15.05 and 15.06).	0000h
	Bit	Value		
			RO4 to value of bit 0 of parameter 15.06 RO/DO forced data.	
	1	1 = Force F	RO5 to value of bit 1 of parameter 15.06 RO/DO forced data.	
	24	Reserved		
	5	1 = Force [DO1 to value of bit 5 of parameter 15.06 RO/DO forced data.	
	615	Reserved		
	0000h.	FFFFh	Override selection for relay/digital outputs.	1 = 1
15.06	RO/DC) forced data	Allows the data value of a forced relay or digital output to be changed from 0 to 1. It is only possible to force an output that has been selected in parameter 15.05 RO/DO force selection. Bits 01 are the forced values for RO4RO5; bit 5 is the forced value for DO1.	0000h
	Bit	Name	Description	
	0	RO4	Force the value of this bit to RO4, if so defined in parameter force selection.	15.05 RO/DO
	1	RO5	Force the value of this bit to RO5, if so defined in parameter force selection.	15.05 RO/DO
	24	Reserved		
	5	DO1	1Force the value of this bit to DO1 if so defined in parameter force selection.	15.05 RO/DO
	615	Reserved		
	0000h.	FFFFh	Forced values of relay/digital outputs.	1 = 1
15.07	RO4 so	ource	Selects a drive signal to be connected to relay output RO4.	Not energized
	Not en	ergized	Output is not energized.	0
	Energiz	zed	Output is energized.	1
	Ready		Bit 1 of 06.11 Main status word (see page 104).	2
	Reserv		,	3
	Enable	d	Bit 0 of 06.16 Drive status word 1 (see page 105).	4
	Started		Bit 5 of 06.16 Drive status word 1 (see page 105).	5
	Magne	tized	Bit 1 of 06.17 Drive status word 2 (see page 105).	6
			Bit 6 of 06.16 Drive status word 1 (see page 105).	7
	Runnin	a		
	Runnin		` ,	8
	Ready	ref	Bit 2 of 06.11 Main status word (see page 104).	8
		ref oint	` ,	8 9 10

No.	Name/Value	Description	Def/FbEq16
	Above limit	Bit 10 of 06.17 Drive status word 2 (see page 105).	12
	Warning	Bit 7 of 06.11 Main status word (see page 104).	13
	Fault	Bit 3 of 06.11 Main status word (see page 104).	14
	Fault (-1)	Inverted bit 3 of 06.11 Main status word (see page 104).	15
	Fault/Warning	Bit 3 of 06.11 Main status word OR bit 7 of 06.11 Main status word (see page 104).	16
	Overcurrent	Fault 2310 Overcurrent has occurred.	17
	Overvoltage	Fault 3210 DC link overvoltage has occurred.	18
	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
	Reserved		22
	Ext2 active	Bit 11 of 06.16 Drive status word 1 (see page 105).	23
	Remote control	Bit 9 of 06.11 Main status word (see page 104).	24
	Reserved		2526
	Timed function 1	Bit 0 of 34.01 Timed functions status (see page 189).	27
	Timed function 2	Bit 1 of 34.01 Timed functions status (see page 189).	28
	Timed function 3	Bit 2 of 34.01 Timed functions status (see page 189).	29
	Reserved		3032
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 182).	33
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 182).	34
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 182).	35
	Reserved		3638
	Start delay	Bit 13 of 06.17 Drive status word 2 (see page 105).	39
	RO/DIO control word bit0	Bit 0 of 10.99 RO/DIO control word (see page 114).	40
	RO/DIO control word bit1	Bit 1 of 10.99 RO/DIO control word (see page 114).	41
	RO/DIO control word bit2	Bit 2 of 10.99 RO/DIO control word (see page 114).	42
	Reserved		4344
	PFC1	Bit 0 of 76.01 PFC status (see page 248).	45
	PFC2	Bit 1 of 76.01 PFC status (see page 248).	46
	PFC3	Bit 2 of 76.01 PFC status (see page 248).	47
	PFC4	Bit 3 of 76.01 PFC status (see page 248).	48
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 94).	-



No.	Name/Value	Description	Def/FbEq16
	Magnetized	Bit 1 of 06.17 Drive status word 2 (see page 105).	6
	Running	Bit 6 of 06.16 Drive status word 1 (see page 105).	7
	Ready ref	Bit 2 of 06.11 Main status word (see page 104).	8
	At setpoint	Bit 8 of 06.11 Main status word (see page 104).	9
	Reverse	Bit 2 of 06.19 Speed control status word (see page 106).	10
	Zero speed	Bit 0 of 06.19 Speed control status word (see page 106).	11
	Above limit	Bit 10 of 06.17 Drive status word 2 (see page 105).	12
	Warning	Bit 7 of 06.11 Main status word (see page 104).	13
	Fault	Bit 3 of 06.11 Main status word (see page 104).	14
	Fault (-1)	Inverted bit 3 of 06.11 Main status word (see page 104).	15
	Fault/Warning	Bit 3 of 06.11 Main status word OR bit 7 of 06.11 Main status word (see page 104).	16
	Overcurrent	Fault 2310 Overcurrent has occurred.	17
	Overvoltage	Fault 3210 DC link overvoltage has occurred.	18
	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
	Reserved		22
	Ext2 active	Bit 11 of 06.16 Drive status word 1 (see page 105).	23
	Remote control	Bit 9 of 06.11 Main status word (see page 104).	24
	Reserved		2526
	Timed function 1	Bit 0 of 34.01 Timed functions status (see page 189).	27
	Timed function 2	Bit 1 of 34.01 Timed functions status (see page 189).	28
	Timed function 3	Bit 2 of 34.01 Timed functions status (see page 189).	29
	Reserved		3032
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 182).	33
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 182).	34
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 182).	35
	Reserved		3638
	Start delay	Bit 13 of 06.17 Drive status word 2 (see page 105).	39
	RO/DIO control word bit0	Bit 0 of 10.99 RO/DIO control word (see page 114).	40
	RO/DIO control word bit1	Bit 1 of 10.99 RO/DIO control word (see page 114).	41
	RO/DIO control word bit2	Bit 2 of 10.99 RO/DIO control word (see page 114).	42
	PFC1	Bit 0 of 76.01 PFC status (see page 248).	45
	PFC2	Bit 1 of 76.01 PFC status (see page 248).	46
	PFC3	Bit 2 of 76.01 PFC status (see page 248).	47
	PFC4	Bit 3 of 76.01 PFC status (see page 248).	48

No.	Name/Value	Description	Def/FbEq16
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 94).	-
15.24	DO1 ON delay	Defines the activation delay for digital output DO1 when 15.22 DO1 configuration is set to Digital output.	0.0 s
	Status of selected source		1 — 0
	DO status		1 0
	_	'	Time
	t _{On} = 15.24 DO1 ON det t _{Off} = 15.25 DO1 OFF de	lay elay	
	0.0 3000.0 s	Activation delay for DO1.	10 = 1 s
15.25	DO1 OFF delay	Defines the deactivation delay for relay output DO1 when 15.22 DO1 configuration is set to Digital output. See parameter 15.24 DO1 ON delay.	0.0 s
	0.0 3000.0 s	Deactivation delay for DO1.	10 = 1 s
15.32	Freq out 1 actual value	Displays the value of frequency output 1 at digital output DO1 when 15.22 DO1 configuration is set to Frequency output. This parameter is read-only.	-
	0 16000 Hz	Value of frequency output 1.	1 = 1 Hz
15.33	Freq out 1 source	Selects a signal to be connected to digital output DO1 when 15.22 DO1 configuration is set to Frequency output. Alternatively, sets the output to excitation mode to feed a constant current to a temperature sensor.	Not selected
	Not selected	None.	0
	Motor speed used	01.01 Motor speed used (page 97).	1
	Output frequency	01.06 Output frequency (page 97).	3
	Motor current	01.07 Motor current (page 97).	4
	Motor torque	01.10 Motor torque (page 97).	6
	DC voltage	01.11 DC voltage (page 97).	7
	Output power	01.14 Output power (page 98).	8
	Speed ref ramp in	23.01 Speed ref ramp input (page 154).	10
	Speed ref ramp out	23.02 Speed ref ramp output (page 154).	11
	Speed ref used	24.01 Used speed reference (page 156).	12
	Reserved		13
	Freq ref used	28.02 Frequency ref ramp output (page 162).	14
	Reserved		15
	Process PID out	40.01 Process PID output actual (page 212).	16
	Other	Source selection (see <i>Terms and abbreviations</i> on page 94).	-

No.	Name/Value	Description	Def/FbEq16
15.34	Freq out 1 src min	Defines the real value of the signal (selected by parameter 15.33 Freq out 1 source) that corresponds to the minimum value of frequency output 1 (defined by parameter 15.36 Freq out 1 at src min). This applies when 15.22 DO1 configuration is set to Frequency output. 15.36 15.37 15.36 15.37 Signal (real) selected by par. 15.33 15.36 15.37 Signal (real) selected by par. 15.33	0.000
	-32768.000 32767.000	Real signal value corresponding to minimum value of frequency output 1.	1 = 1
15.35	Freq out 1 src max	Defines the real value of the signal (selected by parameter 15.33 Freq out 1 source) that corresponds to the maximum value of frequency output 1 (defined by parameter 15.37 Freq out 1 at src max). This applies when 15.22 DO1 configuration is set to Frequency output. See parameter 15.34 Freq out 1 src min.	1500.000
	-32768.000 32767.000	Real signal value corresponding to maximum value of frequency output 1.	1 = 1
15.36	Freq out 1 at src min	Defines the minimum output value of frequency output 1 when 15.22 DO1 configuration is set to Frequency output. See also drawing at parameter 15.34 Freq out 1 src min.	0 Hz
	0 16000 Hz	Minimum frequency output 1 value.	1 = 1 Hz
15.37	Freq out 1 at src max	Defines the maximum value of frequency output 1 when 15.22 DO1 configuration is set to Frequency output. See also drawing at parameter 15.34 Freq out 1 src min.	16000 Hz
	0 16000 Hz	Maximum value of frequency output 1.	1 = 1 Hz

No.	Name/Value	Description	Def/FbEq16
19 Op	eration mode	Selection of local and external control location sources and operating modes. See also section <i>Operating modes of the drive</i> (page 42).	
19.01	Actual operation mode	Displays the operating mode currently used. See parameter 19.11. This parameter is read-only.	-
	Zero	None.	1
	Speed	Speed control (in vector motor control mode).	2
	Reserved		39
	Scalar (Hz)	Frequency control in scalar motor control mode (in scalar motor control mode).	10
	Forced magn.	Motor is in magnetizing mode.	20
19.11	Ext1/Ext2 selection	Selects the source for external control location EXT1/EXT2 selection. 0 = EXT1 1 = EXT2	EXT1
	EXT1	EXT1 (permanently selected).	0
	EXT2	EXT2 (permanently selected).	1
	FBA A MCW bit 11	Control word bit 11 received through fieldbus interface A.	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
	Reserved		918
	Timed function 1	Bit 0 of 34.01 Timed functions status (see page 189).	19
	Timed function 2	Bit 1 of 34.01 Timed functions status (see page 189).	20
	Timed function 3	Bit 2 of 34.01 Timed functions status (see page 189).	21
	Reserved		2224
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 182).	25
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 182).	26
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 182).	27
	Reserved		2831
	EFB MCW bit 11	Control word bit 11 received through the embedded fieldbus interface.	32
	FBA A connection loss	Detected communication loss of fieldbus interface A changes control mode to EXT2.	33
	EFB connection loss	Detected communication loss of embedded fieldbus interface changes control mode to EXT2.	34
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 94).	-

No.	Name/Value	Description					Def/FbEq16
20 Sta	rt/stop/direction	Start/stop/direction and run/start/jog enable signal source selection; positive/negative reference enable signal source selection. For information on control locations, see section <i>Local control vs. external control</i> (page 39).					
20.01	Ext1 commands	external control location	Selects the source of start, stop and direction commands for external control location 1 (EXT1). See also parameters 20.0220.05.				In1 Start
	Not selected	No start or stop comma	and s	ources selected	l.		0
	In1 Start	The source of the start parameter 20.03 Ext1 is source bits are interpret	n1 sc	ource. The state			1
		State of source 1 (20 0 -> 1 (20.02 = Edg 1 (20.02 = Level)	e)	Start Stop			
	In1P Start; In2 Stop	The sources of the start and stop commands are selected by parameters 20.03 Ext1 in1 source and 20.04 Ext1 in2 source. The state transitions of the source bits are interpreted as follows:				4	
		State of source 1 (20.03)	Sta	ate of source 2 (20.04)	Co	ommand	
		0 -> 1		1		Start	
		Any		0		Stop	
		Notes: Parameter 20.02 Ex this setting. When source 2 is 0, panel are disabled.					
	Reserved						710
	Control panel	The start and stop companel (or PC connected				control	11
	Fieldbus A	The start and stop com A. Note: Set also 20.02 E				•	12
	Reserved						13
	Embedded fieldbus	The start and stop comfieldbus interface. Note: Set also 20.02 E					14
20.02	Ext1 start trigger type	Defines whether the state EXT1 is edge-triggered Note: This parameter is signal is selected. See parameter 20.01 Ext1 (or less not the d	evel-triggered. effective if a pulescriptions of the	lse-type	e start	Level
	Edge	The start signal is edge-triggered.				0	
	Level	The start signal is level	-trigg	ered.			1
20.03	Ext1 in1 source	Selects source 1 for pa	rame	ter 20.01 Ext1	comma	nds.	DI1
	Not selected	0 (always off).					0

No.	Name/Value	Description			Def/FbEq16		
	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	gital input DI6 (10.02 DI delayed status, bit 5).				
	Reserved		1				
	Timed function 1	Bit 0 of 34.01 Timed fun	octions status (see page	: 189).	18		
	Timed function 2	Bit 1 of 34.01 Timed fun	octions status (see page	: 189).	19		
	Timed function 3	Bit 2 of 34.01 Timed fun	octions status (see page	: 189).	20		
	Reserved				2123		
	Supervision 1	Bit 0 of 32.01 Supervision	on status (see page 182	2).	24		
	Supervision 2	Bit 1 of 32.01 Supervision	on status (see page 182	2).	25		
	Supervision 3	Bit 2 of 32.01 Supervision	on status (see page 182	2).	26		
	Other [bit]	Source selection (see 7	erms and abbreviations	on page 94).	-		
20.04	Ext1 in2 source	· ·	Selects source 2 for parameter 20.01 Ext1 commands. For the available selections, see parameter 20.03 Ext1 in1				
20.05	Ext1 in3 source		Selects source 3 for parameter 20.01 Ext1 commands. For the available selections, see parameter 20.03 Ext1 in1 source.				
20.06	Ext2 commands	Selects the source of strexternal control location See also parameters 20	2 (EXT2).	ommands for	Not selected		
	Not selected	No start or stop comma			0		
	In1 Start	The source of the start a parameter 20.08 Ext2 ir source bits are interpret	and stop commands is and source. The state tra		1		
		State of source 1 (20.	08) Command				
		0 -> 1 (20.07 = Edge 1 (20.07 = Level)	Start				
		0	Stop				
	In1 Start fwd; In2 Start rev	The source selected by start signal; the source the reverse start signal. bits are interpreted as for	3				
		State of source 1 (20.08)	State of source 2 (20.09)	Command			
		0	0	Stop			
		0 -> 1 (20.07 = Edge) 1 (20.07 = Level)	0	Start forward			
		0	0 -> 1 (20.07 = Edge) 1 (20.07 = Level)	Start reverse			
		1	1	Stop			

No.	Name/Value	Description					Def/FbEq16
	In1P Start; In2 Stop The sources of the start and stop commands are selected parameters 20.08 Ext2 in1 source and 20.09 Ext2 in2 sour The state transitions of the source bits are interpreted as follows:					Ext2 in2 source.	4
		State of sou (20.08)			of source 2 (20.09)	Command	
		0 -> 1			1	Start	
		Any			0	Stop	
		this setting.	e 2 is 0, th		<i>trigger type</i> has	s no effect with	
	In1P Start; In2 Stop; In3 Dir	parameters 20.	08 Ext2 in ected by 2 state trans	11 sou 20.10 E	rce and 20.09 E Ext2 in3 source	are selected by Ext2 in2 source. determines the its are	5
		State of source 1 (20.08)	State source (20.0	e 2	State of source 3 (20.10)	Command	
		0 -> 1	1		0	Start forward	
		0 -> 1	1		1	Start reverse	
		Any	0		Any	Stop	
		this setting.	e 2 is 0, th		trigger type has	s no effect with	
	In1P Start fwd; In2P Start rev; In3 Stop	parameters 20.	08 Ext2 in source. The nes the di	ne sou rection	rce, 20.09 Ext2 rce selected by n. The state tra	are selected by in2 source and 20.10 Ext2 in3 nsitions of the	6
		State of source 1 (20.08)	State source (20.0	e 2	State of source 3 (20.10)	Command	
		0 -> 1	Any		1	Start forward	
		Any	0 ->		1	Start reverse	
		Any	Any	'	0	Stop	
		Note: Paramete with this setting		Ext2 si	art trigger type	has no effect	
	Reserved						710
	Control panel	The start and stop commands are taken from the control panel (or PC connected to the panel connector).					11
	Fieldbus A	A.	The start and stop commands are taken from fieldbus adapter A. Note: Set also 20.07 Ext2 start trigger type to Level.				12
		Note. Set also	20.01 EXI	2 Star	ungger type to	LEVEI.	10
	Reserved						13

No.	Name/Value	Description	Def/FbEq16
	Embedded fieldbus	The start and stop commands are taken from the embedded fieldbus interface. Note: Set also 20.07 Ext2 start trigger type to Level.	14
20.07	Ext2 start trigger type	Defines whether the start signal for external control location EXT2 is edge-triggered or level-triggered. Note: This parameter is not effective if a pulse-type start signal is selected. See the descriptions of the selections of parameter 20.06 Ext2 commands.	Level
	Edge	The start signal is edge-triggered.	0
	Level	The start signal is level-triggered.	1
20.08	Ext2 in1 source	Selects source 1 for parameter 20.06 Ext2 commands. For the available selections, see parameter 20.03 Ext1 in1 source.	Not selected
20.09	Ext2 in2 source	Selects source 2 for parameter 20.06 Ext2 commands. For the available selections, see parameter 20.03 Ext1 in1 source.	Not selected
20.10	Ext2 in3 source	Selects source 3 for parameter 20.06 Ext2 commands. For the available selections, see parameter 20.03 Ext1 in1 source.	Not selected
20.40	Run permissive	Selects the source of the Run permissive signal. Value 0 of the source deactivates the Run permissive and prevents starting. Value 1 of the source activates the Run permissive and permits starting.	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
	-DI1	Digital input DI1 (10.02 DI delayed status, bit 0).	8
	-DI2	Digital input DI2 (10.02 DI delayed status, bit 1).	9
	-DI3	Digital input DI3 (10.02 DI delayed status, bit 2).	10
	-DI4	Digital input DI4 (10.02 DI delayed status, bit 3).	11
	-DI5	Digital input DI5 (10.02 DI delayed status, bit 4).	12
	-DI6	Digital input DI6 (10.02 DI delayed status, bit 5).	13
	Fieldbus adapter	Fieldbus adapter.	14
	Embedded fieldbus	Embedded fieldbus.	15
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 94).	-
20.41	Start interlock 1	Selects the source of the Start interlock 1 signal. Value 0 of the source deactivates the start interlock 1 signal. Value 1 of the source activates the start interlock 1 signal.	Selected
	Not selected	0.	0
	Selected	1.	1

No.	Name/Value	Description	Def/FbEq16
	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
	-DI1	Digital input DI1 (10.02 DI delayed status, bit 0).	8
	-DI2	Digital input DI2 (10.02 DI delayed status, bit 1).	9
	-DI3	Digital input DI3 (10.02 DI delayed status, bit 2).	10
	-DI4	Digital input DI4 (10.02 DI delayed status, bit 3).	11
	-DI5	Digital input DI5 (10.02 DI delayed status, bit 4).	12
	-DI6	Digital input DI6 (10.02 DI delayed status, bit 5).	13
	Fieldbus adapter	Fieldbus adapter.	14
	Embedded fieldbus	Embedded fieldbus.	15
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 94).	-
20.42	Start interlock 2	Selects the source of the Start interlock 2 signal. For the selections, see parameter 20.41 Start interlock 1.	Selected
20.43	Start interlock 3	Selects the source of the Start interlock 3 signal. For the selections, see parameter 20.41 Start interlock 1.	Selected
20.44	Start interlock 4	Selects the source of the Start interlock 4 signal. For the selections, see parameter 20.41 Start interlock 1.	Selected
20.45	Start interlock stop mode	Selects the method of stopping if a Start interlock signal is lost. Applies to 20.41 Start interlock 1, 20.42 Start interlock 2, 20.43 Start interlock 3 and 20.44 Start interlock 4.	Not used
	Not used	Not in use.	0
	Coast	The motor coasts to a stop.	1
	Ramp	Stop along the active deceleration ramp.	2
20.46	Run permissive text	Alternative alarm texts for the run permissive.	Run permissive
	Run permissive		0
	Damper end switch		1
	Valve opening		2
	Pre-lube cycle		3
	Full text editor	Enter your own text in the text editor. Not supported yet.	4
20.47	Start interlock 1 text	Alternative alarm texts for the start interlock 1.	Start interlock 1
	Start interlock 1		0
	Vibration switch		1
	Firestat		2
	Freeze stat		3
	Overpressure		4
	Vibration trip		5
	Smoke alarm		6

No.	Name/Value	Description	Def/FbEq16
	Auxiliary open		7
	Low suction		8
	Low pressure		9
	Access door		10
	Pressure relief		11
	Motor disconnect open		12
	Full text editor	Enter your own text in the text editor. Not supported yet.	13
20.48	Start interlock 1 text	Alternative alarm texts for the start interlock 2. See parameter 20.47 Start interlock 1 text.	Start interlock 2
	Start interlock 2	For other selections, see parameter 20.47 Start interlock 1 text.	0
20.49	Start interlock 1 text	Alternative alarm texts for the start interlock 3. See parameter 20.47 Start interlock 1 text.	Start interlock 3
	Start interlock 3	For other selections, see parameter 20.47 Start interlock 1 text.	0
20.50	Start interlock 4 text	Alternative alarm texts for the start interlock 4. See parameter 20.47 Start interlock 1 text.	Start interlock 4
	Start interlock 4	For other selections, see parameter 20.47 Start interlock 1 text.	0

21 Sta	rt/stop mode	Start and stop modes; emergency stop mode and signal source selection; DC magnetization settings.	
21.01	Vector 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. See also section DC magnetization (page 70).	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

No.	Name/Value	Description		Def/FbEq16
	Const time	The drive pre-magnetizes the magnetizing time is defined by Magnetization time. This mode pre-magnetizing time is require be synchronized with the relea This setting also guarantees th torque when the pre-magnetizing time has pragnetizing time has pragnetizing time has pragnetizing time is long enough magnetizing time is long enough magnetization and torque.	1	
	Automatic	Automatic start guarantees opt It includes the flying start funct motor) and the automatic resta control program identifies the f state of the motor and starts th conditions. Note: If parameter 99.04 Motono flying start or automatic resiparameter 21.19 Scalar start in	ion (starting into a rotating art function. The drive motor lux as well as the mechanical e motor instantly under all ar control mode is set to Scalar, tart is possible unless	2
21.02	Magnetization time	Defines the pre-magnetization • parameter 21.01 Vector star vector motor control mode), • parameter 21.19 Scalar star scalar motor control mode). After the start command, the d premagnetizes the motor for th magnetizing, set this paramete higher than, the rotor time consule-of-thumb value given in th	500 ms	
		Motor rated power	Constant magnetizing time	
		< 1 kW	≥ 50 to 100 ms	
		1 to 10 kW	≥ 100 to 200 ms	
		10 to 200 kW	≥ 200 to 1000 ms	
		200 to 1000 kW	≥ 1000 to 2000 ms	
		Note: This parameter cannot brunning.		
	010000 ms	Constant DC magnetizing time).	1 = 1 ms
21.03	Stop mode	Selects the way the motor is st is received. Additional braking is possible to parameter 97.05 Flux braking)	Coast	
	Coast	Stop by switching off the output The motor coasts to a stop. WARNING! If a mechan safe to stop the drive by	nical brake is used, ensure it is	0
	Ramp	Stop along the active decelerar group 23 Speed reference ram Frequency reference chain on	<i>p</i> on page <i>154</i> or <i>28</i>	1

No.	Name/Value	Description	Def/FbEq16
	Torque limit	Stop according to torque limits (parameters 30.19 and 30.20). This mode is only possible in vector motor control mode.	2
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.	Ramp stop (Off1)
	Ramp stop (Off1)	With the drive running: 1 = Normal operation. 0 = Normal stop along the standard deceleration ramp defined for the particular reference type (see section DC voltage control [page 73]). 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.	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
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 <i>Terms and abbreviations</i> on page 94).	-

speed ramp (when ramped stop is selected or emergency stop time is used) until the defined zero speed limit is reached. After the zero speed delay, the motor coasts to a stop. O.0030000.00 Zero speed limit. See par. 46.01	No.	Name/Value	Description	Def/FbEq16
21.07 Zero speed delay Defines the delay for the zero speed delay function. The function is useful in applications where a smooth and quick restarting is essential. During the delay, the drive knows the rotor position accurately. Without zero speed delay: The drive receives a stop command and decelerates along a ramp. When actual motor speed falls below the value of parameter 21.06 Zero speed limit, inverter modulation is stopped and the motor coasts to a standstill. Speed Speed Speed controller switched off: Motor coasts to a stop. With zero speed delay: The drive receives a stop command and decelerates along a ramp. When actual motor speed falls below the value of parameter 21.06 Zero speed limit, the zero speed delay function activates. During the delay the function keeps the speed controller live: the inverter modulates, motor is magnetized and the drive is ready for a quick restart. Speed Speed Speed controller remains active. Motor is decelerated to true zero speed. 21.06 Zero speed limit Time	21.06	Zero speed limit	speed ramp (when ramped stop is selected or emergency stop time is used) until the defined zero speed limit is reached. After the zero speed delay, the motor coasts to a	30.00 rpm
function is useful in applications where a smooth and quick restarting is essential. During the delay, the drive knows the rotor position accurately. Without zero speed delay: The drive receives a stop command and decelerates along a ramp. When actual motor speed falls below the value of parameter 21.06 Zero speed limit, inverter modulation is stopped and the motor coasts to a standstill. Speed Speed Controller switched off: Motor coasts to a stop. With zero speed delay: The drive receives a stop command and decelerates along a ramp. When actual motor speed falls below the value of parameter 21.06 Zero speed limit, the zero speed delay function activates. During the delay the function keeps the speed controller live: the inverter modulates, motor is magnetized and the drive is ready for a quick restart. Speed Speed controller remains active. Motor is decelerated to true zero speed.			Zero speed limit.	
·	21.07	rpm	Defines the delay for the zero speed delay function. The function is useful in applications where a smooth and quick restarting is essential. During the delay, the drive knows the rotor position accurately. Without zero speed delay: The drive receives a stop command and decelerates along a ramp. When actual motor speed falls below the value of parameter 21.06 Zero speed limit, inverter modulation is stopped and the motor coasts to a standstill. Speed Speed controller switched off: Motor coasts to a stop. With zero speed delay: The drive receives a stop command and decelerates along a ramp. When actual motor speed falls below the value of parameter 21.06 Zero speed limit, the zero speed delay function activates. During the delay the function keeps the speed controller live: the inverter modulates, motor is magnetized and the drive is ready for a quick restart. Speed Speed controller remains active. Motor is decelerated to true zero speed.	46.01
		030000 ms	Zero speed delay.	1 = 1 ms

No.	Name/Value	Description	Def/FbEq16
21.08	DC current control	Activates/deactivates the DC hold and post-magnetization functions. See section <i>DC magnetization</i> (page 70). Note: DC magnetization causes the motor to heat up. In applications where long DC magnetization times are required, externally ventilated motors should be used. If the DC magnetization period is long, DC magnetization cannot prevent the motor shaft from rotating if a constant load is applied to the motor.	0000Ь
	Bit Value		
	0 1 = Enable	DC hold. See section DC hold (page 71).	
		DC hold function has no effect if the start signal is switched off.	
	Note: Post- parameter	post-magnetization. See section Settings (page 71). -magnetization is only available when ramping is the selected sta 21.03 Stop mode). -magnetization with scalar control is not supported at the mome	
	215 Reserved		
	,		
	0000b0011b	DC magnetization selection.	1 = 1
21.09	DC hold speed	Defines the DC hold speed in speed control mode. See parameter 21.08 DC current control, and section DC hold (page 71).	5.00 rpm
	0.001000.00 rpm	DC hold speed.	See par. 46.01
21.10	DC current reference	Defines the DC hold current in percent of the motor nominal current. See parameter 21.08 DC current control, and section DC magnetization (page 70).	30.0%
	0.0100.0%	DC hold current.	1 = 1%
21.11	Post magnetization time	Defines the length of time for which post-magnetization is active after stopping the motor. The magnetization current is defined by parameter 21.10 DC current reference. See parameter 21.08 DC current control.	0 s
	03000 s	Post-magnetization time.	1 = 1 s
21.14	Pre-heating input source	Selects the source for controlling pre-heating for the motor. The status of the pre-heating is shown as bit 2 of 06.21 Drive status word 3. Notes: The heating function requires that STO is not triggered. The heating function requires that the drive is not faulted.	Off
	Off	Pre-heating is always deactivated.	0
	On	1. Pre-heating is always activated when the drive is stopped.	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 182).	8
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 182).	9
		1	1

No.	Name/Value	Description	Def/FbEq16
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 182).	10
	Timed function 1	Bit 0 of 34.01 Timed functions status (see page 189).	11
	Timed function 2	Bit 1 of 34.01 Timed functions status (see page 189).	12
	Timed function 3	Bit 2 of 34.01 Timed functions status (see page 189).	13
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 94).	-
21.16	Pre-heating current	Defines the DC current used to heat the motor. The value is in percent of the nominal motor current.	0.0%
	0.030.0%	Pre-heating current.	1 = 1%
21.18	Auto restart time	The motor can be automatically started after a short supply power failure using the automatic restart function. See section Automatic restart (page 75). When this parameter is set to 0.0 seconds, automatic restarting is disabled. Otherwise, the parameter defines the maximum duration of the power failure after which restarting is attempted. Note that this time also includes the DC precharging delay. WARNING! Before you activate the function, make sure that no dangerous situations can occur. The function restarts the drive automatically and continues operation after a supply break.	10.0 s
	0.0 s	Automatic restarting disabled.	0
	0.110.0 s	Maximum power failure duration.	1 = 1 s
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. Notes: The start function for the vector motor control mode is selected by parameter 21.01 Vector start mode. With permanent magnet motors, Automatic start mode must be used. This parameter cannot be changed while the drive is running. See also section DC magnetization (page 70).	Normal
	Normal	Immediate start from zero speed.	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. 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
	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: Cannot be used in multimotor systems.	2

No.	Name/Value	Description	Def/FbEq16
	Torque boost	The drive pre-magnetizes the motor before the start. The pre-magnetizing time is defined by parameter 21.02 Magnetization time. 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. See parameter 21.26 Torque boost current. This mode should selected if a high break-away torque is required. Note: This mode cannot be used to start into a rotating motor. WARNING! The drive will start after the set premagnetizing 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
21.21	DC hold frequency	Defines the DC hold frequency, which is used instead of parameter 21.09 DC hold speed when the motor is in scalar frequency mode. See parameter 21.08 DC current control, and section DC hold (page 71).	5.00 Hz
	0.001000.00 Hz	DC hold frequency.	1 = 1 Hz
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 <i>AFE9 Start delay</i> is shown. Start delay can be used with all start modes.	0.00 s
	0.0060.00 s	Start delay	1 = 1 s
21.23	Smooth start	Selects the forced current vector rotation mode at low speeds. When the 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. 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 needs to be minimized. Note that accurate torque control is not possible in the current vector rotation mode. Can be used for permanent magnet synchronous motors only.	50.0%
	10.0100.0%	Value in percent of the nominal motor current.	1 = 1%

No.	Name/Value	Description	Def/FbEq16
21.25	Smooth start speed	Output frequency up to which the current vector rotation is used. See parameter 21.19 Scalar start mode. Can be used for permanent magnet synchronous motors only.	10.0%
	2.0100.0%	Value as a percentage of the nominal motor frequency.	1 = 1%
21.26	Torque boost current	Maximum current supplied during torque boost. Can be used for permanent magnet synchronous motors only.	100.0%
	15.0300.0%	Value in percent of the nominal motor current.	1 = 1%
21.30	Speed compensated stop mode	Selects the method used to stop the drive. See also section. *DC voltage control* (page 73). Speed compensated stop is active only if the operation mode is not torque, and parameter 21.03 Stop mode is Ramp	Off
	Off	Stop according parameter 21.03 Stop mode, no speed compensated stop.	0
	Speed comp FWD	If the direction of rotation is forward, speed compensation is used for constant distance braking. Speed difference (between used speed and maximum speed) is compensated by running the drive with current speed before the motor is stopped along a ramp. If the direction of rotation is reverse, the drive is stopped along a ramp.	1
	Speed comp REV	If the direction of rotation is reverse, speed compensation is used for constant distance braking. Speed difference (between used speed and maximum speed) is compensated by running the drive with current speed before the motor is stopped along a ramp. If the direction of rotation is forward, the drive is stopped along a ramp.	2
	Speed comp bipolar	Regardless of the direction of rotation, speed compensation is used for constant distance braking. Speed difference (between used speed and maximum speed) is compensated by running the drive with current speed before the motor is stopped along a ramp.	3
21.31	Speed comp stop delay	This delay adds distance to the total distance traveled during a stop from maximum speed. It is used to adjust the distance to match requirements so that the distance traveled is not solely determined by the deceleration rate.	0.00 s
	0.001000.00 s	Speed delay.	1 = 1 s
21.32	Speed comp stop threshold	This parameter sets a speed threshold below which the Speed compensated stop feature is disabled. In this speed region, the speed compensated stop is not attempted and the drive stops as it would, using the ramp option.	10%
	0100%	Speed threshold as a percent of the motor nominal speed.	1 = 1%
22 Spe select	eed reference ion	Speed reference selection; motor potentiometer settings. See the control chain diagrams on pages 376379.	
22.01	Speed ref unlimited	Displays the output of the speed reference selection block. See the control chain diagram on page 378. This parameter is read-only.	-
	-30000.00 30000.00 rpm	Value of the selected speed reference.	See par. 46.01

No.	Name/Value	Description	Def/FbEq16
22.11	Ext1 speed ref1	Selects Ext1 speed reference source 1. A digital source selected by 19.11 Ext1/Ext2 selection can be used to switch between Ext1 reference and the corresponding Ext2 reference defined by parameter 22.18 Ext2 speed ref1.	Al1 scaled
	Zero	None.	0
	Al1 scaled	12.12 Al1 scaled value (see page 117).	1
	Al2 scaled	12.22 Al2 scaled value (see page 118).	2
	Reserved		3
	FB A ref1	03.05 FB A reference 1 (see page 100).	4
	FB A ref2	03.06 FB A reference 2 (see page 100).	5
	Reserved		67
	EFB ref1	03.09 EFB reference 1 (see page 100).	8
	EFB ref2	03.10 EFB reference 2 (see page 100).	9
	Reserved		1014
	Motor potentiometer	22.80 Motor potentiometer ref act (output of the motor potentiometer).	15
	PID	40.01 Process PID output actual (output of the process PID controller).	16
	Frequency input	11.38 Freq in 1 actual value (when DI5 is used as a frequency input).	17
	Control panel (ref saved)	Panel reference (03.01 Panel reference, see page 99) saved by the control system for the location where the control returns is used as the reference. Reference Ext1 reference Ext2 reference Active reference Inactive reference	18
	Control panel (ref copied)	Panel reference (03.01 Panel reference, see page 99) 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. Reference Ext1 reference Ext2 reference Active reference Inactive reference	19
	Other	Source selection (see <i>Terms and abbreviations</i> on page <i>94</i>).	-
22.18	Ext2 speed ref1	Selects Ext2 speed reference source 1.	Zero
	Zero	None.	0
	Al1 scaled	12.12 Al1 scaled value (see page 117).	1
	Al2 scaled	12.22 AI2 scaled value (see page 118).	2

No.	Name/Value	Description	Def/FbEq16
	Reserved		3
	FB A ref1	03.05 FB A reference 1 (see page 100).	4
	FB A ref2	03.06 FB A reference 2 (see page 100).	5
	Reserved		67
	EFB ref1	03.09 EFB reference 1 (see page 100).	8
	EFB ref2	03.10 EFB reference 2 (see page 100).	9
	Reserved		1014
	Motor potentiometer	22.80 Motor potentiometer ref act (output of the motor potentiometer).	15
	PID	40.01 Process PID output actual (output of the process PID controller).	16
	Frequency input	11.38 Freq in 1 actual value (when DI5 is used as a frequency input).	17
	Control panel (ref saved)	Panel reference (03.01 Panel reference, see page 99) saved by the control system for the location where the control returns is used as the reference. Reference Ext1 reference Ext2 reference Active reference Inactive reference	18
	Control panel (ref copied)	Panel reference (03.01 Panel reference, see page 99) 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. Reference Ext1 reference Ext2 reference Active reference Inactive reference	19
	Other	Source selection (see <i>Terms and abbreviations</i> on page 94).	-

No.	Name/	Value	Des	scription			Def/FbEq16
22.21	Consta function	nt speed า	the		ignal is considered	lected, and whether I or not when	0001b
	Bit	Name		Information			
	0	Constant s	peed	defined by parame	eters 22.22, 22.23		
				the sources define	ed by parameters 2	and 3 are separately a 2.22, 22.23 and 22.24 d with the smaller nur	respectively.
	1	Direction enable		sign of the constant multiplied by the d effectively allows t	nt speed setting (pa lirection signal (for the drive to have 14	rection for a constant arameters 22.2622. ward: +1, reverse: -1). 4 (7 forward, 7 reverse	32) is This
				warning constant spare direction. 0 = Accord Par: Ti	peed is negative, the running direction	gnal is reverse and the ne drive will run in the ne for the constant spents speed setting (para	forward ed is
				22.2622.32).	sign of the consta	nt speed setting (para	meters
	215 Reserved						
	0000b.	0001b	Cor	nstant speed config	guration word.		1 = 1
	sel1	Source def	Who (Pa	en bit 0 of parameticked), this parameted sel2 and 22.24		e/3 select three	
		by par. 22		by par. 22.23	by par. 22.24	Constant speed ac	tive
		0		0	0	None	
		1		0	0	Constant speed	
		0		1	0	Constant speed Constant speed	
		0		0	1	Constant speed	
		1		0	1	Constant speed	
		0		1	1	Constant speed	
		1		1	1	Constant speed	7
	Not sel	ected	0 (a	always off).			0
	Selected DI1		1 (always on).			1	
			+ `	Digital input DI1 (10.02 DI delayed status, bit 0).		s, bit 0).	2
	DI2		<u> </u>		2 DI delayed status	<u> </u>	3
	DI3		Ť	· ` ` ` ` ` ` ` ` ` ` ` ` ` ` ` ` ` ` `	2 DI delayed status	<u> </u>	4
						•	
	DI4		Dig	ital input DI4 (10.0	2 DI delayed status	s, bit 3).	5
	DI4 DI5				2 DI delayed status 2 DI delayed status		5 6

No.	Name/Value	Description	Def/FbEq16
	Reserved		817
	Timed function 1	Bit 0 of 34.01 Timed functions status (see page 189).	18
	Timed function 2	Bit 1 of 34.01 Timed functions status (see page 189).	19
	Timed function 3	Bit 2 of 34.01 Timed functions status (see page 189).	20
	Reserved		2123
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 182).	24
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 182).	25
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 182).	26
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 94).	-
22.23	Constant speed sel2	When bit 0 of parameter 22.21 Constant speed function is 0 (Separate), selects a source that activates constant speed 2. When bit 0 of parameter 22.21 Constant speed function is 1 (Packed), this parameter and parameters 22.22 Constant speed sel1 and 22.24 Constant speed sel3 select three sources that are used to activate constant speeds. See table at parameter 22.22 Constant speed sel1. For the selections, see parameter 22.22 Constant speed sel1.	DI4
22.24	Constant speed sel3	When bit 0 of parameter 22.21 Constant speed function is 0 (Separate), selects a source that activates constant speed 3. When bit 0 of parameter 22.21 Constant speed function is 1 (Packed), this parameter and parameters 22.22 Constant speed sel1 and 22.23 Constant speed sel2 select three sources that are used to activate constant speeds. See table at parameter 22.22 Constant speed sel1. For the selections, see parameter 22.22 Constant speed sel1.	Not selected
22.26	Constant speed 1	Defines constant speed 1 (the speed the motor will turn when constant speed 1 is selected).	300.00 rpm
	-30000.00 30000.00 rpm	Constant speed 1.	See par. 46.01
22.27	Constant speed 2	Defines constant speed 2.	600.00 rpm
	-30000.00 30000.00 rpm	Constant speed 2.	See par. 46.01
22.28	Constant speed 3	Defines constant speed 3.	900.00 rpm
	-30000.00 30000.00 rpm	Constant speed 3.	See par. 46.01
22.29	Constant speed 4	Defines constant speed 4.	1200.00 rpm
	-30000.00 30000.00 rpm	Constant speed 4.	See par. 46.01
22.30	Constant speed 5	Defines constant speed 5.	1500.00 rpm
	-30000.00 30000.00 rpm	Constant speed 5.	See par. 46.01
22.31	Constant speed 6	Defines constant speed 6.	2400.00 rpm
	-30000.00 30000.00 rpm	Constant speed 6.	See par. 46.01
22.32	Constant speed 7	Defines constant speed 7.	3000.00 rpm
	-30000.00 30000.00 rpm	Constant speed 7.	See par. 46.01

No.	Name/V	'alue	Description	Def/FbEq16	
22.41	2.41 Speed ref safe		Defines a safe speed reference value that is used with supervision functions such as 12.03 Al supervision function 49.05 Communication loss action 50.02 FBA A comm loss func.	0.00 rpm	
	-30000.0 30000.0		Safe speed reference.	See par. 46.01	
22.51	Critical s function		Enables/disables the critical speeds function. Also determines whether the specified ranges are effective in both rotating directions or not. See also section <i>Critical speeds/frequencies</i> (page 50).	0000b	
	Bit	Name	Information		
	0	Enable	1 = Enable: Critical speeds enabled.		
			0 = Disable: Critical speeds disabled.		
	1	Sign mode	1 = Signed: The signs of parameters 22.5222.57 are tall account.	en into	
			0 = Absolute: Parameters 22.5222.57 are handled as ab Each range is effective in both directions of rotation.	solute values.	
	215	Reserved	·		
	0000b	.0011b	Critical speeds configuration word.	1 = 1	
22.52	Critical	speed 1 low	Defines the low limit for critical speed range 1. Note: This value must be less than or equal to the value of 22.53 Critical speed 1 high.	0.00 rpm	
	-30000.0 30000.0		Low limit for critical speed 1.	See par. 46.01	
22.53	Critical s high	speed 1	Defines the high limit for critical speed range 1. Note: This value must be greater than or equal to the value of 22.52 Critical speed 1 low.	0.00 rpm	
	-30000.0 30000.0		High limit for critical speed 1.	See par. 46.01	
22.54	Critical	speed 2 low	Defines the low limit for critical speed range 2. Note: This value must be less than or equal to the value of 22.55 Critical speed 2 high.	0.00 rpm	
	-30000.0 30000.0		Low limit for critical speed 2.	See par. 46.01	
22.55	Critical s high	speed 2	Defines the high limit for critical speed range 2. Note: This value must be greater than or equal to the value of 22.54 Critical speed 2 low.	0.00 rpm	
	-30000.0 30000.0		High limit for critical speed 2.	See par. 46.01	
22.56	Critical	speed 3 low	Defines the low limit for critical speed range 3. Note: This value must be less than or equal to the value of 22.57 Critical speed 3 high.	0.00 rpm	
	-30000.0 30000.0		Low limit for critical speed 3.	See par. 46.01	

No.	Name/Value	Description	Def/FbEq16
22.57	Critical speed 3 high	Defines the high limit for critical speed range 3. Note: This value must be greater than or equal to the value of 22.56 Critical speed 3 low.	0.00 rpm
	-30000.00 30000.00 rpm	High limit for critical speed 3.	See par. 46.01
22.71	Motor potentiometer function	Activates and selects the mode of the motor potentiometer. See section <i>DC voltage control</i> (page 73).	Disabled
	Disabled	Motor potentiometer is disabled and its value set to 0.	0
	Enabled (init at stop /power-up)	When enabled, the motor potentiometer first adopts the value defined by parameter 22.72 Motor potentiometer initial value. The value can then be adjusted from the up and down sources defined by parameters 22.73 Motor potentiometer up source and 22.74 Motor potentiometer down source. A stop or a power cycle will reset the motor potentiometer to the initial value (22.72).	1
	Enabled (resume always)	As Enabled (init at stop /power-up), but the motor potentiometer value is retained over a power cycle.	2
	Enabled (init to actual)	Whenever another reference source is selected, the value of the motor potentiometer follows that reference. After the source of reference returns to the motor potentiometer, its value can again be changed by the up and down sources (defined by 22.73 and 22.74).	3
22.72	Motor potentiometer initial value	Defines an initial value (starting point) for the motor potentiometer. See the selections of parameter 22.71 Motor potentiometer function.	0.00
	-32768.00 32767.00	Initial value for motor potentiometer.	1 = 1
22.73	Motor potentiometer up source	Selects the source of motor potentiometer up signal. 0 = No change 1 = Increase motor potentiometer value. (If both the up and down sources are on, the potentiometer value will not change.)	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		817
	Timed function 1	Bit 0 of 34.01 Timed functions status (see page 189).	18
	Timed function 2	Bit 1 of 34.01 Timed functions status (see page 189).	19
	Timed function 3	Bit 2 of 34.01 Timed functions status (see page 189).	20
	Reserved		2123
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 182).	24
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 182).	25

No.	Name/Value	Description	Def/FbEq16 26 - Not selected
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 182).	26
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 94).	-
22.74	Motor potentiometer down source	Selects the source of motor potentiometer down signal. 0 = No change 1 = Decrease motor potentiometer value. (If both the up and down sources are on, the potentiometer value will not change.) For the selections, see parameter 22.73 Motor potentiometer up source.	Not selected
22.75	Motor potentiometer ramp time	Defines the change rate of the motor potentiometer. This parameter specifies the time required for the motor potentiometer to change from minimum (22.76) to maximum (22.77). The same change rate applies in both directions.	40.0 s
	0.03600.0 s	Motor potentiometer change time.	10 = 1 s
22.76	Motor potentiometer min value	Defines the minimum value of the motor potentiometer. Note: If vector control mode is used, value of this parameter must be changed.	-50.00
	-32768.00 32767.00	Motor potentiometer minimum.	1 = 1
22.77	Motor potentiometer max value	Defines the maximum value of the motor potentiometer. Note: If vector control mode is used, value of this parameter must be changed.	50.00
	-32768.00 32767.00	Motor potentiometer maximum.	1 = 1
22.80	Motor potentiometer ref act	The output of the motor potentiometer function. (The motor potentiometer is configured using parameters 22.7122.74.) This parameter is read-only.	-
	-32768.00 32767.00	Value of motor potentiometer.	1 = 1
22.86	Speed reference act 6	Displays the value of the speed reference (Ext1 or Ext2) that has been selected by 19.11 Ext1/Ext2 selection. See diagram at 22.11 Ext1 speed ref1 or the control chain diagram on page 376. This parameter is read-only.	-
	-30000.00 30000.00 rpm	Speed reference after additive 2.	See par. 46.01
22.87	Speed reference act 7	Displays the value of speed reference before application of critical speeds. See the control chain diagram on page 378. The value is received from 22.86 Speed reference act 6 unless overridden by • any constant speed • network control reference • control panel reference • safe speed reference. This parameter is read-only.	-
	-30000.00 30000.00 rpm	Speed reference before application of critical speeds.	See par. 46.01

No.	Name/Value	Description	Def/FbEq16
23 Spe ramp	eed reference	Speed reference ramp settings (programming of the acceleration and deceleration rates for the drive). See the control chain diagram on page 379.	
23.01	Speed ref ramp input	Displays the used speed reference (in rpm) before it enters the ramping and shaping functions. See the control chain diagram on page 379. This parameter is read-only.	-
	-30000.00 30000.00 rpm	Speed reference before ramping and shaping.	See par. 46.01
23.02	Speed ref ramp output	Displays the ramped and shaped speed reference in rpm. See the control chain diagram on page 379. This parameter is read-only.	-
	-30000.00 30000.00 rpm	Speed reference after ramping and shaping.	See par. 46.01
23.12	Acceleration time 1	Defines acceleration time 1 as the time required for the speed to change from zero to the speed defined by parameter 46.01 Speed scaling (not to parameter 30.12 Maximum speed). If the speed reference increases faster than the set acceleration rate, the motor speed will follow the acceleration rate. If the speed reference increases slower than the set acceleration rate, the motor speed will follow the reference. If the acceleration time is set too short, the drive will automatically prolong the acceleration in order not to exceed the drive torque limits.	20.000 s
	0.0001800.000 s	Acceleration time 1.	10 = 1 s
23.13	Deceleration time 1	Defines deceleration time 1 as 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). If there is any doubt about the deceleration time being too short, ensure that DC overvoltage control is on (parameter 30.30 Overvoltage control). Note: 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
	0.0001800.000 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 (ie. the time required for the speed to change from the speed value defined by parameter 46.01 Speed scaling or 46.02 Frequency scaling to zero). 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. Note: • Emergency stop Off1 uses the standard deceleration ramp as defined by parameters 23.1223.13. • The same parameter value is also used in frequency control mode (ramp parameters 28.7228.73).	3.000 s
	0.0001800.000 s	Emergency stop Off3 deceleration time.	10 = 1 s

No.	Name/Value	Description	Def/FbEq16
23.32	Shape time 1	Defines the shape of the acceleration and deceleration ramps used with the set 1. 0.000 s: Linear ramp. Suitable for steady acceleration or deceleration and for slow ramps. 0.0011000.000 s: S-curve ramp. S-curve ramps are ideal for lifting applications. The S-curve consists of symmetrical curves at both ends of the ramp and a linear part in between. Acceleration: Linear ramp: 23.32 = 0 s S-curve ramp: 23.32 > 0 s S-curve ramp: 23.32 > 0 s	0.100 s
		Deceleration: Speed S-curve ramp: 23.32 > 0 s Linear ramp: 23.32 > 0 s Linear ramp: 23.32 > 0 s Time	
	0.0001800.000 s	Ramp shape at start and end of acceleration and deceleration.	10 = 1 s
	eed reference tioning	Speed error calculation; speed error window control configuration; speed error step. See the control chain diagrams on pages 380 and 381	

24 Speed reference conditioning		Speed error calculation; speed error window control configuration; speed error step. See the control chain diagrams on pages 380 and 381.	
24.01	Used speed reference	Displays the ramped and corrected speed reference (before speed error calculation). See the control chain diagram on page 380. This parameter is read-only.	-
	-30000.00 30000.00 rpm	Speed reference used for speed error calculation.	See par. 46.01

No.	Name/Value	Description	Def/FbEq16
24.02	Used speed feedback	Displays the speed feedback used for speed error calculation. See the control chain diagram on page 380. This parameter is read-only.	-
	-30000.00 30000.00 rpm	Speed feedback used for speed error calculation.	See par. 46.01
•		Displays the filtered speed error. See the control chain diagram on page 380. This parameter is read-only.	-
	-30000.0 30000.0 rpm	Filtered speed error.	See par. 46.01
24.04	Speed error inverted	Displays the inverted (unfiltered) speed error. See the control chain diagram on page 380. This parameter is read-only.	-
	-30000.0 30000.0 rpm	Inverted speed error.	See par. 46.01
,		Defines a speed reference correction, ie. a value added to the existing reference between ramping and limitation. This is useful to trim the speed if necessary, for example to adjust draw between sections of a paper machine. See the control chain diagram on page 380.	0.00 rpm
	-10000.00 10000.00 rpm	Speed reference correction.	See par. 46.01
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
	010000 ms	Speed error filtering time constant. 0 = filtering disabled.	1 = 1 ms

25 Speed control		Speed controller settings. See the control chain diagrams on pages 380 and 381.	
25.01	Torque reference speed control	Displays the speed controller output that is transferred to the torque controller. See the control chain diagram on page 380. This parameter is read-only.	-
	-1600.01600.0%	Limited speed controller output torque.	See par. 46.03

No.	Name/Value	Description	Def/FbEq16
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.	10.00
	9	Gain = $K_p = 1$ $T_1 = Integration time = 0$ $T_D = Derivation time = 0$	
	Controller output = K _p × e	Controller output e =	Error value
		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.	
	0.00250.00	Proportional gain for speed controller.	100 = 1

No.	Name/Value	Description	Def/FbEq16
25.03	Speed integration time	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.	2.50 s
	% ^	Controller output Gain = $K_p = 1$ $T_1 = \text{Integration time} > 1$ $T_D = \text{Derivation time} = 0$	
	$K_p \times e \begin{cases} \vdots \\ \vdots \\ \vdots \\ \vdots \\ \vdots \end{cases}$	e = Error value	
	0.001000.00 s	Integration time for speed controller.	10 = 1 s

No.	Name/Value	Description	Def/FbEq16
No. 25.04	Speed derivation time $ K_p \times T_D \times \frac{\Delta e}{T_s} \left\{ \begin{array}{l} \dots \\ K_p \end{array} \right. $ K_p	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.	0.000 s
	$ au_{D}$	= Integration time > 0 = Derivation time > 0	
	•	= Sample time period = 250 μs = Error value change between two samples	
	0.00010.000 s	Derivation time for speed controller.	1000 = 1 s
25.05	Derivation filter time	·	
	010000 ms	Derivation filter time constant.	1 = 1 ms

No.	Name/Value	Description	Def/FbEq16	
No. 25.06	Acc comp derivation time	Defines the derivation time for acceleration(/deceleration) compensation. In order to compensate for a high inertia load during acceleration, a derivative of the reference is added to the output of the speed controller. The principle of a derivative action is described under parameter 25.04 Speed derivation time. Note: As a general rule, set this parameter to the value between 50 and 100% of the sum of the mechanical time constants of the motor and the driven machine. The figure below shows the speed responses when a high inertia load is accelerated along a ramp. No acceleration compensation: - Speed reference Actual speed Time Acceleration compensation:	0.00 s	
		- Speed reference - Actual speed		
	0.001000.00 s	Acceleration compensation derivation time.	10 = 1 s	
25.07	Acc comp filter time	Defines the acceleration (or deceleration) compensation filter time constant. See parameters 25.04 Speed derivation time and 25.06 Acc comp derivation time.	8.0 ms	
	0.01000.0 ms	Acceleration/deceleration compensation filter time.	1 = 1 ms	
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	1.00250.00	Proportional gain upon an emergency stop.	100 = 1	

No.	Name/Value	Description	Def/FbEq16
25.53	Torque prop reference	Displays the output of the proportional (P) part of the speed controller. See the control chain diagram on page 380. This parameter is read-only.	-
	-30000.0 30000.0%	P-part output of speed controller.	See par. 46.03
25.54	Torque integral reference	Displays the output of the integral (I) part of the speed controller. See the control chain diagram on page 380. This parameter is read-only.	-
	-30000.0 30000.0%	I-part output of speed controller.	See par. 46.03
25.55	Torque deriv reference	Displays the output of the derivative (D) part of the speed controller. See the control chain diagram on page 380. This parameter is read-only.	-
	-30000.0 30000.0%	D-part output of speed controller.	See par. 46.03
25.56	Torque acc compensation	Displays the output of the acceleration compensation function. See the control chain diagram on page 380. This parameter is read-only.	-
	-30000.0 30000.0%	Output of acceleration compensation function.	See par. 46.03
28 Fre	quency reference	Settings for the frequency reference chain. See the control chain diagrams on pages 383 and 377.	
28.01	Frequency ref ramp input	Displays the used frequency reference before ramping. See the control chain diagram on page 383. This parameter is read-only.	-
	-500.00500.00 Hz	Frequency reference before ramping.	See par. 46.02
28.02	Frequency ref ramp output	Displays the final frequency reference (after selection, limitation and ramping). See the control chain diagram on page 383. This parameter is read-only.	-
	-500.00500.00 Hz	Final frequency reference.	See par. 46.02
28.11	Ext1 frequency ref1	Selects Ext1 frequency reference source 1.	Al1 scaled
	Zero	None.	0
	Al1 scaled	12.12 Al1 scaled value (see page 117).	1
	Al2 scaled	12.22 Al2 scaled value (see page 118).	2
	Reserved		3
	FB A ref1	03.05 FB A reference 1 (see page 100).	4
	FB A ref2	03.06 FB A reference 2 (see page 100).	5
	Reserved		67
	EFB ref1	03.09 EFB reference 1 (see page 100).	8
	EFB ref2	03.10 EFB reference 2 (see page 100).	9
	Reserved		1014
	Motor potentiometer	22.80 Motor potentiometer ref act (output of the motor potentiometer).	15

No.	p. Name/Value Description		Def/FbEq16
	PID	40.01 Process PID output actual (output of the process PID controller).	16
	Frequency input	11.38 Freq in 1 actual value (when DI5 is used as a frequency input).	17
	Control panel (ref saved)	Panel reference (03.01 Panel reference, see page 99) saved by the control system for the location where the control returns is used as the reference. Reference Ext1 reference Ext2 reference Active reference I hactive reference	18
	Control panel (ref copied)	Panel reference (03.01 Panel reference, see page 99) 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. Reference Ext1 reference Ext2 reference Active reference Inactive reference	19
	Other	Source selection (see <i>Terms and abbreviations</i> on page 94).	-
28.15	Ext2 frequency ref1	Selects Ext2 frequency reference source 1.	Zero
	Zero	None.	0
	Al1 scaled	12.12 Al1 scaled value (see page 117).	1
	Al2 scaled	12.22 Al2 scaled value (see page 118).	2
	Reserved		3
	FB A ref1	03.05 FB A reference 1 (see page 100).	4
	FB A ref2	03.06 FB A reference 2 (see page 100).	5
	Reserved		67
	EFB ref1	03.09 EFB reference 1 (see page 100).	8
	EFB ref2	03.10 EFB reference 2 (see page 100).	9
	Reserved		1014
	Motor potentiometer	22.80 Motor potentiometer ref act (output of the motor potentiometer).	15
	PID	40.01 Process PID output actual (output of the process PID controller).	16
	Frequency input	11.38 Freq in 1 actual value (when DI5 is used as a frequency input).	17

	Name/	Value	Description	Def/FbEq16
	Control saved)	panel (ref	Panel reference (03.01 Panel reference, see page 99) saved by the control system for the location where the control returns is used as the reference. Reference Ext1 reference Ext2 reference Active reference Inactive reference	18
Control panel (ref copied)			Panel reference (03.01 Panel reference, see page 99) 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. Reference Ext1 reference Ext2 reference Active reference Inactive reference	19
	Other		Source selection (see <i>Terms and abbreviations</i> on page 94).	-
28.21	Constant frequency function		Determines how constant frequencies are selected, and whether the rotation direction signal is considered or not when applying a constant frequency.	0001b
			, , ,	
	Bit	Name	Information	
	Bit 0	Name Const freq mode	Information 1 = Packed: 7 constant frequencies are selectable using t sources defined by parameters 28.22, 28.23 and 28.24. 0 = Separate: Constant frequencies 1, 2 and 3 are separaby the sources defined by parameters 28.22, 28.23 and 2 respectively. In case of conflict, the constant frequency winumber takes priority.	ately activated 8.24
		Const freq	1 = Packed: 7 constant frequencies are selectable using t sources defined by parameters 28.22, 28.23 and 28.24. 0 = Separate: Constant frequencies 1, 2 and 3 are separate by the sources defined by parameters 28.22, 28.23 and 2 respectively. In case of conflict, the constant frequency winumber takes priority. 1 = Start dir: To determine running direction for a constant sign of the constant speed setting (parameters 22.2622 multiplied by the direction signal (forward: +1, reverse: -1) effectively allows the drive to have 14 (7 forward, 7 revers speeds if all values in 22.2622.32 are positive. WARNING: If the direction signal is reverse and the constant speed is negative, the drive will run in the direction. 0 = Accord Par: The running direction for the constant speed determined by the sign of the constant speed setting (parameters).	ately activated 8.24 th the smaller at speed, the 2.32) is b. This is constant are active a forward seed is
	1	Const freq mode Direction enable	1 = Packed: 7 constant frequencies are selectable using t sources defined by parameters 28.22, 28.23 and 28.24. 0 = Separate: Constant frequencies 1, 2 and 3 are separa by the sources defined by parameters 28.22, 28.23 and 2 respectively. In case of conflict, the constant frequency winumber takes priority. 1 = Start dir: To determine running direction for a constant sign of the constant speed setting (parameters 22.2622 multiplied by the direction signal (forward: +1, reverse: -1) effectively allows the drive to have 14 (7 forward, 7 revers speeds if all values in 22.2622.32 are positive. WARNING: If the direction signal is reverse and the constant speed is negative, the drive will run in the direction. 0 = Accord Par: The running direction for the constant speed.	ately activated 8.24 th the smaller at speed, the 2.32) is b. This is constant are active a forward active
	0	Const freq mode Direction	1 = Packed: 7 constant frequencies are selectable using t sources defined by parameters 28.22, 28.23 and 28.24. 0 = Separate: Constant frequencies 1, 2 and 3 are separate by the sources defined by parameters 28.22, 28.23 and 2 respectively. In case of conflict, the constant frequency winumber takes priority. 1 = Start dir: To determine running direction for a constant sign of the constant speed setting (parameters 22.2622 multiplied by the direction signal (forward: +1, reverse: -1) effectively allows the drive to have 14 (7 forward, 7 revers speeds if all values in 22.2622.32 are positive. WARNING: If the direction signal is reverse and the constant speed is negative, the drive will run in the direction. 0 = Accord Par: The running direction for the constant speed determined by the sign of the constant speed setting (parameters).	ately activated 8.24 th the smaller at speed, the 2.32) is b. This is constant are active a forward active
	215	Const freq mode Direction enable	1 = Packed: 7 constant frequencies are selectable using t sources defined by parameters 28.22, 28.23 and 28.24. 0 = Separate: Constant frequencies 1, 2 and 3 are separate by the sources defined by parameters 28.22, 28.23 and 2 respectively. In case of conflict, the constant frequency winumber takes priority. 1 = Start dir: To determine running direction for a constant sign of the constant speed setting (parameters 22.2622 multiplied by the direction signal (forward: +1, reverse: -1) effectively allows the drive to have 14 (7 forward, 7 revers speeds if all values in 22.2622.32 are positive. WARNING: If the direction signal is reverse and the constant speed is negative, the drive will run in the direction. 0 = Accord Par: The running direction for the constant speed determined by the sign of the constant speed setting (parameters).	ately activated 8.24 th the smaller at speed, the 2.32) is b. This is constant are active a forward active

No.	Name/Value	Description	Def/FbEq16
28.22	Constant frequency sel1	When bit 0 of parameter 28.21 Constant frequency function is 0 (Separate), selects a source that activates constant frequency 1. When bit 0 of parameter 28.21 Constant frequency function is 1 (Packed), this parameter and parameters 28.23 Constant frequency sel2 and 28.24 Constant frequency sel3 select three sources whose states activate constant frequencies as follows:	DI3

Source defined by par. 28.22	Source defined by par. 28.23	Source defined by par. 28.24	Constant frequency active
0	0	0	None
1	0	0	Constant frequency 1
0	1	0	Constant frequency 2
1	1	0	Constant frequency 3
0	0	1	Constant frequency 4
1	0	1	Constant frequency 5
0	1	1	Constant frequency 6
1	1	1	Constant frequency 7

	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		817
	Timed function 1	Bit 0 of 34.01 Timed functions status (see page 189).	18
	Timed function 2	Bit 1 of 34.01 Timed functions status (see page 189).	19
	Timed function 3	Bit 2 of 34.01 Timed functions status (see page 189).	20
	Reserved		2123
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 182).	24
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 182).	25
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 182).	26
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 94).	-
28.23	Constant frequency sel2	When bit 0 of parameter 28.21 Constant frequency function is 0 (Separate), selects a source that activates constant frequency 2. When bit 0 of parameter 28.21 Constant frequency function is 1 (Packed), this parameter and parameters 28.22 Constant frequency sel1 and 28.24 Constant frequency sel3 select three sources that are used to activate constant frequencies. See table at parameter 28.22 Constant frequency sel1. For the selections, see parameter 28.22 Constant frequency sel1.	D14

No.	Name/Value	Description	Def/FbEq16
28.24	Constant frequency sel3	When bit 0 of parameter 28.21 Constant frequency function is 0 (Separate), selects a source that activates constant frequency 3. When bit 0 of parameter 28.21 Constant frequency function is 1 (Packed), this parameter and parameters 28.22 Constant frequency sel1 and 28.23 Constant frequency sel2 select three sources that are used to activate constant frequencies. See table at parameter 28.22 Constant frequency sel1. For the selections, see parameter 28.22 Constant frequency sel1.	Not selected
28.26	Constant frequency 1	Defines constant frequency 1 (the frequency the motor will turn when constant frequency 1 is selected).	5.00 Hz
	-500.00500.00 Hz	Constant frequency 1.	See par. 46.02
28.27	Constant frequency 2	Defines constant frequency 2.	10.00 Hz
	-500.00500.00 Hz	Constant frequency 2.	See par. 46.02
28.28	Constant frequency 3	Defines constant frequency 3.	15.00 Hz
	-500.00500.00 Hz	Constant frequency 3.	See par. 46.02
28.29	Constant frequency 4	Defines constant frequency 4.	20.00 Hz
	-500.00500.00 Hz	Constant frequency 4.	See par. 46.02
28.30	Constant frequency 5	Defines constant frequency 5.	25.00 Hz
	-500.00500.00 Hz	Constant frequency 5.	See par. 46.02
28.31	Constant frequency 6	Defines constant frequency 6.	40.00 Hz
	-500.00500.00 Hz	Constant frequency 6.	See par. 46.02
28.32	Constant frequency 7	Defines constant frequency 7.	50.00 Hz
	-500.00500.00 Hz	Constant frequency 7.	See par. 46.02
28.41	Frequency ref safe	Defines a safe frequency reference value that is used with supervision functions such as 12.03 AI supervision function 49.05 Communication loss action 50.02 FBA A comm loss func.	0.00 Hz
	-500.00500.00 Hz	Safe frequency reference.	See par. 46.02

No.	Name/V	/alue	Des	scription	Def/FbEq16
28.51	Critical function	frequency	dete rota	ables/disables the critical frequencies function. Also ermines whether the specified ranges are effective in both sting directions or not. e also section Critical speeds/frequencies (page 50).	0000b
	Bit	Name		Information	
	0	Crit freq		1 = Enable: Critical frequencies enabled.	
				0 = Disable: Critical frequencies disabled.	
	1	Sign mode		1 = According to par: The signs of parameters 28.5228.4 into account.	o/ are taken
				0 = Absolute: Parameters 28.5228.57 are handled as abs Each range is effective in both directions of rotation.	solute values.
	0000b	.0011b	Crit	ical frequencies configuration word.	1 = 1
28.52	Critical low	frequency 1	Not	ines the low limit for critical frequency 1. ie: This value must be less than or equal to the value of 53 Critical frequency 1 high.	0.00 Hz
	-500.00 Hz	500.00	Low	v limit for critical frequency 1.	See par. 46.02
28.53	Critical i	frequency 1	Not	ines the high limit for critical frequency 1. te: This value must be greater than or equal to the value of 52 Critical frequency 1 low.	0.00 Hz
	-500.00 Hz	500.00	Higl	h limit for critical frequency 1.	See par. 46.02
28.54	low		Not	ines the low limit for critical frequency 2. ie: This value must be less than or equal to the value of 55 Critical frequency 2 high.	0.00 Hz
	-500.00 Hz	500.00	Low	v limit for critical frequency 2.	See par. 46.02
28.55	Critical high	frequency 2	Not	ines the high limit for critical frequency 2. te: This value must be greater than or equal to the value of 64 Critical frequency 2 low.	0.00 Hz
	-500.00 Hz	500.00	Higl	h limit for critical frequency 2.	See par. 46.02
28.56	Critical low	frequency 3	Not	ines the low limit for critical frequency 3. te: This value must be less than or equal to the value of 57 Critical frequency 3 high.	0.00 Hz
	-500.00 Hz	500.00	Low	v limit for critical frequency 3.	See par. 46.02
28.57	Critical i	frequency 3	Not	ines the high limit for critical frequency 3. te: This value must be greater than or equal to the value of 66 Critical frequency 3 low.	0.00 Hz
	-500.00 Hz	500.00	Higl	h limit for critical frequency 3.	See par. 46.02

No.	Name/Value	Description	Def/FbEq16
28.72	Freq acceleration time 1	Defines acceleration time 1 as the time required for the frequency to change from zero to the frequency defined by parameter 46.02 Frequency scaling. After this frequency has been reached, the acceleration continues with the same rate to the value defined by parameter 30.14 Maximum frequency. If the reference increases faster than the set acceleration rate, the motor will follow the acceleration rate. If the reference increases slower than the set acceleration rate, the motor frequency will follow the reference. If the acceleration time is set too short, the drive will automatically prolong the acceleration in order not to exceed the drive torque limits.	20.000 s
	0.0001800.000 s	Acceleration time 1.	10 = 1 s
28.73	Freq deceleration time 1	Defines deceleration time 1 as 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. If there is any doubt about the deceleration time being too short, ensure that DC overvoltage control (30.30 Overvoltage control) is on. Note: 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
	0.0001800.000 s	Deceleration time 1.	10 = 1 s
28.76	Freq ramp in zero source	Selects a source that forces the frequency reference to zero. 0 = Force frequency reference to zero 1 = Normal operation	Inactive
	Active	0.	0
	Inactive	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 <i>Terms and abbreviations</i> on page 94).	-

No.	Name/Value	Description	Def/FbEq16
8.82 28.82	Shape time 1	Defines the shape of the acceleration and deceleration ramps used with the set 1. 0.000 s: Linear ramp. Suitable for steady acceleration or deceleration and for slow ramps. 0.0011000.000 s: S-curve ramp. S-curve ramps are ideal for lifting applications. The S-curve consists of symmetrical curves at both ends of the ramp and a linear part in between. Acceleration: Linear ramp: 28.82 = 0 s S-curve ramp: 28.82 > 0 s Time	0.100 s
		Deceleration: Speed S-curve ramp: 28.82 > 0 s Linear ramp: 28.82 > 0 s Linear ramp: 28.82 > 0 s Time	
	0.0001800.000 s	Ramp shape at start and end of acceleration and deceleration.	10 = 1 s
28.92	Frequency ref act 3	Displays the frequency reference after the function applied by parameter (if any), and after selection (19.11 Ext1/Ext2 selection). See the control chain diagram on page 383. This parameter is read-only.	-
	-500.00500.00	Frequency reference after selection.	See par. 46.02

No.	Name/Value	Description	Def/FbEq16
28.96	Frequency ref act 7	Displays the frequency reference after application of constant frequencies, control panel reference, etc. See the control chain diagram on page 383. This parameter is read-only.	-
	-500.00500.00 Hz	Frequency reference 7.	See par. 46.02
28.97	Frequency ref unlimited	Displays the frequency reference after application of critical frequencies, but before ramping and limiting. See the control chain diagram on page 377. This parameter is read-only.	-
	-500.00500.00 Hz	Frequency reference before ramping and limiting.	See par. 46.02
30 Limits Drive operation limits.			

30 Limits	Drive operation limits.	
30.01 Limit word 1	Displays limit word 1.	-
	This parameter is read-only.f	

Bit	Name	Description
0	Torq lim	Drive torque is being limited by the motor control (undervoltage control, current control, load angle control or pull-out control), or by the torque limits defined by parameters.
12	Reserved	
3	Torq ref max	1 = Torque reference is being limited by 30.20 Maximum torque 1
4	Torq ref min	1 = Torque reference is being limited by 30.19 Minimum torque 1
5	Tlim max speed	1 = Torque reference is being limited by the rush control because of maximum speed limit (30.12 Maximum speed)
6	Tlim min speed	1 = Torque reference is being limited by the rush control because of minimum speed limit (30.11 Minimum speed)
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
1115	Reserved	

0000hFFFFh	Limit word 1.	1 = 1

No.	Name/Value	Description	Def/FbEq16
30.02	Torque limit status	Displays the torque controller limitation status word.	-
		This parameter is read-only.	

Bit	Name	Description
0	Undervoltage	*1 = Intermediate DC circuit undervoltage
1	Overvoltage	*1 = Intermediate DC circuit overvoltage
2	Minimum torque	*1 = Torque is being limited by 30.19 Minimum torque 1, 30.26 Power motoring limit or 30.27 Power generating limit
3	Maximum torque	*1 = Torque is being limited by 30.20 Maximum torque 1, 30.26 Power motoring limit or 30.27 Power generating limit
4	Internal current	1 = An inverter current limit (identified by bits 811) is active
5	Load angle	(With permanent magnet motors and reluctance motors only) 1 = Load angle limit is active, ie. the motor cannot produce any more torque
6	Motor pullout	(With asynchronous motors only) Motor pull-out limit is active, ie. the motor cannot produce any more torque
7	Reserved	
8	Thermal	1 = Input current is being limited by the main circuit thermal limit
9	Max current	*1 = Maximum output current (I _{MAX}) is being limited
10	User current	*1 = Output current is being limited by 30.17 Maximum current
11	Thermal IGBT	*1 = Output current is being limited by a calculated thermal current value
1215	Reserved	•
*Only or	ne out of bits 03,	and one out of bits 911 can be on simultaneously. The bit typically

*Only one out of bits 0...3, and one out of bits 9...11 can be on simultane indicates the limit that is exceeded first.

	0000hFFFFh	Torque limitation status word.	1 = 1
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).	-1500.00 rpm
	-30000.00 30000.00 rpm	Minimum allowed speed.	See par. 46.01
30.12	Maximum speed	Defines the maximum allowed speed. Note: This parameter does not affect the speed acceleration and deceleration ramp times. See parameter 46.01 Speed scaling. 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).	1500.00 rpm
	-30000.00 30000.00 rpm	Maximum speed.	See par. 46.01

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No.	Name/Value	Description	Def/FbEq16
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.	-50.00 Hz
	-500.00500.00 Hz	Minimum frequency.	See par. 46.02
30.14	Maximum frequency	Defines the maximum allowed frequency. Note: This parameter does not affect the frequency acceleration and deceleration ramp times. See parameter 46.02 Frequency scaling. WARNING! This value must not be lower than 30.13 Minimum frequency. WARNING! in frequency control mode only.	50.00 Hz
	-500.00500.00 Hz	Maximum frequency.	See par. 46.02
30.17	Maximum current	Defines the maximum allowed motor current.	0.00 A
	0.0030000.00 A	Maximum motor current.	1 = 1 A

No.	Name/Value	Description	Def/FbEq16				
30.18	Torq lim sel	Selects a source that switches between two different predefined minimum torque limit sets. 0 = minimum torque limit defined by 30.19 and maximum torque limit defined by 30.20 are active 1 = minimum torque limit selected by 30.21 and maximum torque limit defined by 30.22 are active The user can define two sets of torque limits, and switch between the sets using a binary source such as a digital input. The first set of limits is defined by parameters 30.19 and 30.20. The second set has selector parameters for both the minimum (30.21) and maximum (30.22) limits that allows the use of a selectable analog source (such as an analog input).	Torque limit set 1				
		30.21 Al1 Al2 PID 30.23 Other 30.19 User-defined minimum torque limit					
		30.22 Al1 Al2 PID 30.24 Other User-defined maximum torque limit					
		Note: In addition to the user-defined limits, torque may be limited for other reasons (such as power limitation). Refer to the block diagram on page 382.					
	Torque limit set 1	0 (minimum torque limit defined by 30.19 and maximum torque limit defined by 30.20 are active).	0				
	Torque limit set 2	et 2 1 (minimum torque limit selected by 30.21 and maximum torque limit defined by 30.22 are active).					
	DI1	Digital input DI1 (10.02 DI delayed status, bit 0).					
	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	DI6 Digital input DI6 (10.02 DI delayed status, bit 5).					
	Reserved		810				
	EFB	Only for the DCU profile. DCU control word bit 15 received through the embedded fieldbus interface.	11				
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 94).	-				

No.	Name/Value	Description	Def/FbEq16		
30.19	Minimum torque 1	Defines a minimum torque limit for the drive (in percent of nominal motor torque). See diagram at parameter 30.18 Torq lim sel. The limit is effective when the source selected by 30.18 Torq lim sel is 0, or 30.18 is set to Torque limit set 1.			
	-1600.00.0%	Minimum torque limit 1.	See par. 46.03		
30.20	Maximum torque 1	que 1 Defines a maximum torque limit for the drive (in percent of nominal motor torque). See diagram at parameter 30.18 Torq lim sel. The limit is effective when • the source selected by 30.18 Torq lim sel is 0, or • 30.18 is set to Torque limit set 1.			
	0.01600.0%	Maximum torque 1.	See par. 46.03		
30.21	Min torque 2 source	Defines the source of the minimum torque limit for the drive (in percent of nominal motor torque) when • the source selected by parameter 30.18 Torq lim sel is 1, or • 30.18 is set to Torque limit set 2. See diagram at 30.18 Torq lim sel. Note: Any positive values received from the selected source are inverted.	Minimum torque 2		
	Zero	None.	0		
	Al1 scaled	12.12 Al1 scaled value (see page 117).	1		
	Al2 scaled	12.22 Al2 scaled value (see page 118).	2		
	Reserved		314		
	PID	40.01 Process PID output actual (output of the process PID controller).	15		
	Minimum torque 2	30.23 Minimum torque 2.	16		
	Other	Source selection (see <i>Terms and abbreviations</i> on page 94).	-		
30.22	Max torque 2 source	Defines the source of the maximum torque limit for the drive (in percent of nominal motor torque) when • the source selected by parameter 30.18 Torq lim sel is 1, or • 30.18 is set to Torque limit set 2. See diagram at 30.18 Torq lim sel. Note: Any negative values received from the selected source are inverted.	Maximum torque 2		
	Zero	None.	0		
	Al1 scaled	12.12 Al1 scaled value (see page 117).	1		
	Al2 scaled	12.22 Al2 scaled value (see page 118).	2		
	Reserved		314		
	PID	40.01 Process PID output actual (output of the process PID controller).	15		
	Maximum torque 2	30.24 Maximum torque 2.	16		
	Other	Source selection (see <i>Terms and abbreviations</i> on page 94).	-		

No.	Name/Value	Description	Def/FbEq16
30.23	Minimum torque 2	Defines the minimum torque limit for the drive (in percent of nominal motor torque) when • the source selected by 30.18 Torq lim sel is 1, or • 30.18 is set to Torque limit set 2 and • 30.21 Min torque 2 source is set to Minimum torque 2. See diagram at 30.18 Torq lim sel.	-300.0%
	-1600.00.0%	Minimum torque limit 2.	See par. 46.03
30.24	Maximum torque 2	Maximum torque 2 Defines the maximum torque limit for the drive (in percent of nominal motor torque) when The limit is effective when • the source selected by 30.18 Torq lim sel is 1, or • 30.18 is set to Torque limit set 2 and • 30.22 Max torque 2 source is set to Maximum torque 2. See diagram at 30.18 Torq lim sel.	
	0.01600.0%	Maximum torque limit 2.	See par. 46.03
30.26	Power motoring limit	Defines the maximum allowed power fed by the inverter to the motor in percent of nominal motor power.	300.00%
	0.00600.00%	Maximum motoring power.	1 = 1%
30.27	Power generating limit	Defines the maximum allowed power fed by the motor to the inverter in percent of nominal motor power.	-300.00%
	-600.000.00%	Maximum generating power.	1 = 1%
30.30 Overvoltage control		Enables the overvoltage control of the intermediate DC link. Fast braking of a high inertia load causes the voltage to rise to the overvoltage control limit. To prevent the DC voltage from exceeding the limit, the overvoltage controller automatically decreases the braking torque. Note: If the drive is equipped with a brake chopper and resistor, or a regenerative supply unit, the controller must be disabled.	Enable
	Disable	Overvoltage control disabled.	0
	Enable	Overvoltage control enabled.	1
30.31	Undervoltage control	Enables the undervoltage control of the intermediate DC link. If the DC voltage drops due to input power cut off, the undervoltage controller will automatically decrease the motor torque in order to keep the voltage above the lower limit. By decreasing the motor torque, the inertia of the load will cause regeneration back to the drive, keeping the DC link charged and preventing an undervoltage trip until the motor coasts to a stop. This will act as a power-loss ride-through functionality in systems with high inertia, such as a centrifuge or a fan.	Enable
	Disable	Undervoltage control disabled.	0
	Enable	Undervoltage control enabled.	1

No.	Name/Value	Description	Def/FbEq16			
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				
	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 <i>Terms and abbreviations</i> on page 94).	-			
31.02	External event 1 type	rnal event 1 Selects the type of external event 1.				
	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)			
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			

No.	Name/Value	Description	Def/FbEq16			
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	Fault reset Selects the source of an external fault reset signal. The signal				
	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		817			
	Timed function 1	Bit 0 of 34.01 Timed functions status (see page 189).	18			
	Timed function 2	Bit 1 of 34.01 Timed functions status (see page 189).	19			
	Timed function 3	med function 3 Bit 2 of 34.01 Timed functions status (see page 189).				
	Reserved		2123			
	Supervision 1	24				
	Supervision 2	pervision 2 Bit 1 of 32.01 Supervision status (see page 182).				
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 182).	26			
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 94).	-			

No.	Name/Value Description						
31.12	Autores	set selection	Selects faults that are automatically reset. The parameter is a 16-bit word with each bit corresponding to a fault type. Whenever a bit is set to 1, the corresponding fault is automatically reset. WARNING! Before you activate the function, make sure that no dangerous situations can occur. The function restarts the drive automatically and continues operation after a fault. The bits of this binary number correspond to the following faults:	Def/FbEq16			
	Bit	Fault		1			
	0	Overcurren	t				
	1 Overvoltage						
	2	Undervoltag	ge				
	3 Al supervision fault						
	49	Reserved					
	10		fault (see parameter 31.13 Selectable fault)				
	11		ult 1 (from source selected by parameter 31.01 External event 1				
	12		ult 2 (from source selected by parameter 31.03 External event 2 ult 3 (from source selected by parameter 31.05 External event 3	,			
	13						
	14	External fac					
	External fault 5 (from source selected by parameter 31.09 External event 5 st						
	0000hFFFFh		Automatic reset configuration word.	1 = 1			
31.13	31.13 Selectable fault		Defines the fault that can be automatically reset using parameter 31.12 Autoreset selection, bit 10. Faults are listed in chapter Fault tracing (page 326).	0000h			
	0000hFFFFh		Fault code.	10 = 1			
31.14 Number of trials		r of trials	Defines the number of automatic fault resets the drive performs within the time defined by parameter 31.15 Total trials time.	0			
	05		Number of automatic resets.	10 = 1			
31.15	5 Total trials time		Defines the time the automatic reset function will attempt to reset the drive. During this time, it will perform the number of automatic resets defined by 31.14 Number of trials.	30.0 s			
	1.060	0.0 s	Time for automatic resets.	10 = 1 s			
31.16	Delay time		Defines the time that the drive will wait after a fault before attempting an automatic reset. See parameter 31.12 Autoreset selection.				
	0.012	20.0 s	Autoreset delay.	10 = 1 s			
31.19	Motor phase loss		Selects how the drive reacts when a motor phase loss is detected.	Fault			
	No action	on	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.				
	No action		No action taken.	0			
	Warning		The drive generates an A2B3 Earth leakage warning.	1			

No.	Name/Value	Descri	Description						
	Fault	The dr	ive trip	s on fault 2330 Earth lea	akage.	2			
31.21	Supply phase loss		Selects how the drive reacts when a supply phase loss is detected.						
	No action	No act	ion tak	en.		0			
	Fault	The dr	ive trip	s on fault 3130 Input pha	ase loss.	1			
Selects which indications are given when one or both Storque off (STO) signals are switched off or lost. The indications also depend on whether the drive is running stopped when this occurs. The tables at each selection below show the indications generated with that particular setting. Notes: This parameter does not affect the operation of the Sfunction itself. The STO function will operate regardle the setting of this parameter: a running drive will stop removal of one or both STO signals, and will not start both STO signals are restored and all faults reset. The loss of only one STO signal always generates a as it is interpreted as a malfunction. For more information on the STO, see chapter The Safe					off or lost. The ne drive is running or now the indications operation of the STO ill operate regardless of ning drive will stop upon s, and will not start until all faults reset. ways generates a fault h. e chapter <i>The Safe</i>	Fault/Fault			
	Fault/Fault	torque	torque off function in the Hardware manual of the drive.						
	rauivrauit	Inp	uto	1		0			
		IN1							
		0							
		0	Faults 5091 Safe torque off and						
		1	0		fe torque off and torque off 2				
		1	1	(Normal o	operation)				
	Fault/Warning					1			
		Inp			ation				
		IN1	IN2	Running Fault 5091 Safe torque	Stopped				
0 0 off					Warning A5A0 Safe torque off				
	Faults 5091 Safe Warning A5/ 0 1 torque off and FA81 torque off and Safe torque off 1 FA81 Safe torque								
		1	Faults 5091 Safe torque off and FA82 Safe torque off 2 FA82 Safe torque off 2						
	1 1 (Normal operation)								

No.	Name/Value Description							
	Fault/Event					2		
			uts	Indication				
		IN1	IN2	Running	Stopped			
		0	0	Fault 5091 Safe torque off	Event <i>B5A0 Safe</i> torque off			
		0	1	Faults 5091 Safe torque off and FA81 Safe torque off 1	Event <i>B5A0 Safe</i> torque off and fault <i>FA81 Safe torque off 1</i>			
		1	0	Faults 5091 Safe torque off and FA82 Safe torque off 2	Event B5A0 Safe torque off and fault FA82 Safe torque off 2			
		1	1	(Normal o	pperation)			
	Warning/Warning					3		
	warriing/warriing	Inp	uts IN2	Indication (runr	ing or stopped)	3		
		0	0	Warning A5A0	Safe torque off			
		0	1		rque off and fault FA81 que off 1			
		1	0		rque off and fault FA82 que off 2			
		1	1	(Normal o	operation)			
31.23	Wiring or earth fault	motor	cable c	the drive reacts to incorrection (ie. input power onnection).		Fault		
	No action	No act	ion tak	en.		0		
	Fault	The dr	ive trip	s on fault 3181 Wiring or	earth fault.	1		
31.24	Stall function	A stall The limit the 31.2 leve	Selects how the drive reacts to a motor 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.					
	No action	None (stall su	pervision disabled).		0		
	Warning	The dr	ive ger	nerates an A780 Motor s	tall warning.	1		
	Fault	The dr	ive trip	s on fault 7121 Motor sta	all.	2		
31.25	Stall current limit		Stall current limit in percent of the nominal current of the motor. See parameter 31.24 Stall function.					
	0.01600.0%	Stall cu	Stall current limit.					
31.26	Stall speed limit	Stall sp	er 31.24 Stall function.	150.00 rpm				
	0.0010000.00 rpm	Stall sp	oeed lir	mit.		See par. 46.01		
31.27	Stall frequency limit		Stall frequency limit. See parameter 31.24 Stall function. Note: Setting the limit below 10 Hz is not recommended.					
	0.001000.00 Hz	Stall fre	equenc	cy limit.		See par. 46.02		

No.	Name/Value	Description	Def/FbEq16
31.28	Stall time	Stall time. See parameter 31.24 Stall function.	20 s
	03600 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 (24.02 Used 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. Speed (24.02) Overspeed trip level 31.30 30.12 Time 30.11	500.00 rpm
	0.0010000.00 rpm	Overspeed trip margin.	See par. 46.01
31.32	Emergency ramp supervision	Parameters 31.32 Emergency ramp supervision and 31.33 Emergency ramp supervision delay, together with the derivative of 24.02 Used speed feedback, provide a supervision function for emergency stop modes Off1 and Off3. The supervision is based on either • observing the time within which the motor stops, or • comparing the actual and expected deceleration rates. If this parameter is set to 0%, the maximum stop time is directly set in parameter 31.33. Otherwise, 31.32 defines the maximum allowed deviation from the expected deceleration rate, which is calculated from parameters 23.1223.13 (Off1) or 23.23 Emergency stop time (Off3). If the actual deceleration rate (24.02) deviates too much from the expected rate, the drive trips on 73B0 Emergency ramp failed, sets bit 8 of 06.17 Drive status word 2, and coasts to a stop. If 31.32 is set to 0% and 31.33 is set to 0 s, the emergency stop ramp supervision is disabled. See also parameter 21.04 Emergency stop mode.	0%
			l

No.	Name/Va	Name/Value Description			Def/FbEq16
31.33	Emergen supervisi	ocy ramp ion delay	If parameter 3 this parameter (mode Off1 or stopped when Emergency ra 2, and coasts If 31.32 is set I defines a delay command and recommended change rate to	0 s	
	0100 s	;	Maximum ram	p-down time, or supervision activation delay.	1 = 1 s
31.36	Temporarily suppresses auxiliary fan faults. Certain drive types (especially those protected to IP55) have an auxiliary fan built into the front cover as standard. If the fan is sticking or disconnected, the control program generates a fault (5081 Auxiliary fan broken). If it is necessary to operate the drive without the front cover (for example, during commissioning), this parameter can be activated to temporarily generate a warning (A582 Auxiliary fan missing) instead of the fault. Notes: The parameter must be activated within 2 minutes of drive reboot (either by cycling the power or by parameter 96.08). The parameter will be in effect until the auxiliary fan is reconnected and detected, or until the next control unit reboot.			Off	
	Off		Normal operat	0	
	Tempora bypassed		The auxiliary fan fault is temporarily replaced by a warning indication. The setting will revert automatically to Off.		1
32 Sup	ervision		Configuration of signal supervision functions 16. 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 86).		
32.01 Supervision status		ion status	Indicates whet supervision fur limits. Note: This work	sion status word. her the values monitored by the signal notions are within or outside their respective rd is independent of the drive actions defined 32.06, 32.16, 32.26, 32.36, 32.46 and 32.56.	0000b
	Bit	Name	Description		
	0 Supervision		•		
	1	Supervision		1 = Signal selected by 32.17 is outside its limits	
	2	Supervision		1 = Signal selected by 32.27 is outside its limits	
	3	Supervision		1 = Signal selected by 32.37 is outside its limits	
	4	Supervision		1 = Signal selected by 32.47 is outside its limits	
	5	Supervision	6 active	1 = Signal selected by 32.27 is outside its limits	
	615	Reserved			
	00000	111b	Signal supervis	sion status word.	1 = 1

No.	Name/Value	Description	Def/FbEq16
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 the signal falls below its lower limit.	1
	High	Action is taken whenever the signal rises above its upper limit.	2
	Abs low	Action is taken whenever the absolute value of the signal falls below its (absolute) lower limit.	3
	Abs high	Action is taken whenever the absolute value of the signal rises above its (absolute) upper limit.	4
	Both	Action is taken whenever the signal falls below its low limit or rises above its high limit.	5
	Abs both	Action is taken whenever the absolute value of the signal falls below its (absolute) low limit or rises above its (absolute) high limit.	6
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	o action No warning or fault generated.	
	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 97).	1
	Reserved		2
	Frequency	01.06 Output frequency (page 97).	3
	Current	01.07 Motor current (page 97).	4
	Reserved		5
	Torque	01.10 Motor torque (page 97).	6
	DC voltage	01.11 DC voltage (page 97).	7
	Output power	01.14 Output power (page 98).	8
	Al1	12.11 Al1 actual value (page 117).	9
	Al2	12.21 Al2 actual value (page 118).	10
	Reserved		1117
	Speed ref ramp in	23.01 Speed ref ramp input (page 154).	18
	Speed ref ramp out	23.02 Speed ref ramp output (page 154).	19
	Speed ref used	24.01 Used speed reference (page 156).	20
	Freq ref used	28.02 Frequency ref ramp output (page 162).	22

No.	Name/Value	Description	Def/FbEq16	
	Inverter temperature	05.11 Inverter temperature (page 101).	23	
	Process PID output	40.01 Process PID output actual (page 212).	24	
	Process PID feedback	40.02 Process PID feedback actual (page 212).	25	
	Process PID setpoint	40.03 Process PID setpoint actual (page 212).	26	
	Process PID deviation	40.04 Process PID deviation actual (page 213).	27	
	Other	Source selection (see <i>Terms and abbreviations</i> on page 94).	-	
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	
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	11 Supervision 1 Defines the hysteresis for the signal monitored by signal supervision 1.		0.00	
	0.00100000.00	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 the signal falls below its lower limit.	1	
	High	Action is taken whenever the signal rises above its upper limit.	2	
	Abs low	Action is taken whenever the absolute value of the signal falls below its (absolute) lower limit.	3	
	Abs high	Action is taken whenever the absolute value of the signal rises above its (absolute) upper limit.	4	
	Both	Action is taken whenever the signal falls below its low limit or rises above its high limit.	5	
	Abs both	Action is taken whenever the absolute value of the signal falls below its (absolute) low limit or rises above its (absolute) high limit.	6	
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	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 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
	0.00100000.00 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 the signal falls below its lower limit.	
	High	Action is taken whenever the signal rises above its upper limit.	2
	Abs low	Action is taken whenever the absolute value of the signal falls below its (absolute) lower limit.	3
	Abs high	Action is taken whenever the absolute value of the signal rises above its (absolute) upper limit.	4
	Both	Action is taken whenever the signal falls below its low limit or rises above its high limit.	
	Abs both	Action is taken whenever the absolute value of the signal falls below its (absolute) low limit or rises above its (absolute) high limit.	6
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

No. Name/Value		Description	Def/FbEq16	
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 Upper limit.		-	
32.31	Supervision 3 hysteresis	eresis supervision 3.		
	0.00100000.00	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 the signal falls below its lower limit.	1	
	High Action is taken whenever the signal rises above its upper limit.		2	
	Abs low	Action is taken whenever the absolute value of the signal falls below its (absolute) lower limit.	3	
	Abs high	Action is taken whenever the absolute value of the signal rises above its (absolute) upper limit.	4	
	Both	Action is taken whenever the signal falls below its low limit or rises above its high limit.	5	
	Abs both	Action is taken whenever the absolute value of the signal falls below its (absolute) low limit or rises above its (absolute) high limit.	6	
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	

No.	Name/Value	Description	Def/FbEq16
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
	0.00100000.00	Hysteresis.	-
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	Signal supervision 5 not in use.	0
	Low	Action is taken whenever the signal falls below its lower limit.	1
	High	Action is taken whenever the signal rises above its upper limit.	2
	Abs low	Action is taken whenever the absolute value of the signal falls below its (absolute) lower limit.	3
	Abs high	Action is taken whenever the absolute value of the signal rises above its (absolute) upper limit.	4
	Both	Action is taken whenever the signal falls below its low limit or rises above its high limit.	5
	Abs both	Action is taken whenever the absolute value of the signal falls below its (absolute) low limit or rises above its (absolute) high limit.	6
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
32.49	Supervision 5 low	Defines the lower limit for signal supervision 5.	0.00
	-21474836.00 21474836.00	Low limit.	-

No.	Name/Value	Description	Def/FbEq16
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
	0.00100000.00	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 the signal falls below its lower limit.		1
	High	Action is taken whenever the signal rises above its upper limit.	2
	Abs low	Action is taken whenever the absolute value of the signal falls below its (absolute) lower limit.	3
	Abs high	Action is taken whenever the absolute value of the signal rises above its (absolute) upper limit.	4
	Both Action is taken whenever the signal falls below its low limit or rises above its high limit.		5
	Abs both	Action is taken whenever the absolute value of the signal falls below its (absolute) low limit or rises above its (absolute) high limit.	6
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
	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.	-

	Name/	ne/Value Description			Def/FbEq16
32.61	Supervision 6 hysteresis		Defines the hy supervision 6.	steresis for the signal monitored by signal	0.00
	0.00	100000.00	0000.00 Hysteresis.		-
34 Tin	ned fun	ctions		of the timed functions. on <i>Motor control</i> (page <i>65</i>).	
34.01 Timed functions status		functions		combined timers. The status of a combined gical OR of all timers connected to it. er is read-only.	-
	Bit	Name		Description	
	0	Timed fund	tion 1	1 = Active.	
	1	Timed fund	tion 2	1 = Active.	
	2	Timed fund	tion 3	1 = Active.	
	315	Reserved			
	0000h.	0FFFFh	Status of comb	bined timers 13.	1 = 1
34.02	Timer status		Status of timer This parameter		-
	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 4 Timer 5		1 = Active. 1 = Active.	
	4 5	Timer 4 Timer 5 Timer 6		1 = Active. 1 = Active. 1 = Active.	
	4 5 6	Timer 4 Timer 5 Timer 6 Timer 7		1 = Active.	
	4 5 6 7	Timer 4 Timer 5 Timer 6 Timer 7 Timer 8		1 = Active.	
	4 5 6 7 8	Timer 4 Timer 5 Timer 6 Timer 7 Timer 8 Timer 9		1 = Active.	
	4 5 6 7 8 9	Timer 4 Timer 5 Timer 6 Timer 7 Timer 8 Timer 9 Timer 10		1 = Active. 1 = Active. 1 = Active. 1 = Active. 1 = Active. 1 = Active. 1 = Active.	
	4 5 6 7 8 9	Timer 4 Timer 5 Timer 6 Timer 7 Timer 8 Timer 9 Timer 10 Timer 11		1 = Active.	
	4 5 6 7 8 9 10	Timer 4 Timer 5 Timer 6 Timer 7 Timer 8 Timer 9 Timer 10 Timer 11 Timer 12		1 = Active. 1 = Active. 1 = Active. 1 = Active. 1 = Active. 1 = Active. 1 = Active.	
	4 5 6 7 8 9	Timer 4 Timer 5 Timer 6 Timer 7 Timer 8 Timer 9 Timer 10 Timer 11 Timer 12		1 = Active.	

No.	Name/	Value	Description		Def/FbEq16
34.04	Season/exception day status		holiday. Only be a workday	sons 13, exception weekday and exception one season can be active at a time. A day can and a holiday at the same time. ter 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.	
	49	Reserved			
	10	Exception	,	1 = Active.	
	11	Exception I	noliday	1 = Active.	
	121	Reserved			
	0000hFFFFh		Status of the	seasons and exception weekday and holiday.	1 = 1
34.10	Timed enable	functions		Selects the source for the timed functions enable signal. 0 = Disabled. 1 = Enabled.	
	Not selected Selected		0.		0
			1.		1
	DI1		Digital input [Digital input DI1 (10.02 DI delayed status, bit 0).	
	DI2		Digital input [DI2 (10.02 DI delayed status, bit 1).	3
	DI3		Digital input [Digital input DI3 (10.02 DI delayed status, bit 2).	
	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]		1		

No.	Name/V	/alue	Description		Def/FbEq16
34.11	Timer 1 configui	Timer 1 Defines whe configuration		is active.	0111 1000 0000b
	Bit	Name	Descri	Description	
	0 Monday		1 = Mo	nday is an active start day.	
	1	Tuesday	1 = Tue	esday is an active start day.	
	2	Wednesday	1 = We	dnesday is an active start day.	
	3	Thursday		ursday is an active start day.	
	4	Friday		day is an active start day.	
	5	Saturday		urday is an active start day.	
	6	Sunday		nday is an active start day.	
	7	Season 1		ner is active in season 1.	
	8	Season 2		ner is active in season 2.	
	9	Season 3		ner is active in season 3.	
	10	Season 4		ner is active in season 4.	
	11	Exceptions		ceptions days are disabled.	
	' '	Exceptions			aro takon
				1 = Exception days are enabled. Bits 12 and 13 are taken into account.	
	12	Holidays	"Holida	0 = Timer is inactive on exception days configured as "Holiday".	
				1 = Timer is active on exception days configured as "Holiday".	
	13	Workdays	0 = Tin "Workd	ner is inactive on exception days configuay".	red as
			1 = Tim "Workd	ner is active on exception days configure ay".	d as
	1415	Reserved			
	0000h	FFFFh	Configuration of timer	1	1 = 1
34.12	Timer 1 start time			time of timer 1. The time can be	00:00:00
54.72	rimer r	start time	changed in second start The timer can be start E.g. if the timer's durat	eps. ed at an other time than the start time. ion is more than one day and the active he time, the timer is started at 00:00	00.00.00
	00:00:00	023:59:59	Daily start time of the	timer.	1 = 1
34.13	Timer 1	duration		f timer 1. The duration can be changed	00:00
	The duration exception da midnight. In t day stays act duration is los		The duration can exte exception day become midnight. In the same day stays active only to	nd over the change of the day but if an as active, the period is interrupted at way the period started on an exception until the end of the day, even if the timer will continue after a break if there	
	00:00	007 00:00	Timer duration.		1 = 1
34.14	Timer 2 configur		See 34.11 Timer 1 con	nfiguration.	0111 1000 0000b
34.15	Timer 2	start time	See 34.12 Timer 1 sta	rt time.	00:00:00
34.16	Timer 2	duration	See 34.13 Timer 1 du	ration.	00:00
34.17	Timer 3 configur		See 34.11 Timer 1 con	nfiguration.	0111 1000 0000b

No.	Name/Value	Description	Def/FbEq16
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.	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.	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
34.26	Timer 6 configuration	See 34.11 Timer 1 configuration.	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.	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.	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.	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.	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.	0111 1000 0000b
34.42	Timer 11 start time	See 34.12 Timer 1 start time.	00:00:00
34.43	Timer 11 duration	See 34.13 Timer 1 duration.	00 00:00
34.44	Timer 12 configuration	See 34.11 Timer 1 configuration.	0111 1000 0000b
34.45	Timer 12 start time	See 34.12 Timer 1 start time.	00:00:00
34.46	Timer 12 duration	See 34.13 Timer 1 duration.	00 00:00

34.60	Name	Value	Description		Def/FbEq16
34.00	Season	n 1 start date	is the number The season chat a time. Time are not inside The season st order to use al the season is in increasing companies.	art date of season 1 in format dd.mm, where dd of the day and mm is the number of the month. nanges at midnight. One season can be active ers are started on exception days even if they the active season. art dates (14) must be given in increasing Il seasons. The default value is interpreted that not configured. If the season start dates are not order and the value is something else than the a season configuration warning is given.	01.01.
	01.01	31.12	Season start of	late.	
34.61	Seasoi	n 2 start date		art date of season 2. ason 1 start date.	01.01.
34.62	Seasoi	n 3 start date		art date of season 3. ason 1 start date.	01.01.
34.63	Seasoi	n 4 start date		art date of season 4. ason 1 start date.	01.01.
34.70	Numbe except	er of active ions	the last active Exceptions 1 exceptions 4 Example: If the	nany of the exceptions are active by specifying one. All preceding exceptions are active. .3 are periods (duration can be defined) and .16 are days (duration is always 24 hours). le value is 4, exceptions 14 are active, and .16 are not active.	3
	016		Number of act	ive exception periods or days.	-
34.71	Except	tion types		pes of exceptions 116 as workday or holiday.	0000b
				.3 are periods (duration can be defined) and .16 are days (duration is always 24 hours).	
	Bit	Name		.16 are days (duration is always 24 hours).	
	Bit 0	Name Exception 1	exceptions 4	.16 are days (duration is always 24 hours). Description	
		Exception 1	exceptions 4	.16 are days (duration is always 24 hours). Description 0 = Workday. 1 = Holiday	
		Exception 1	exceptions 4	.16 are days (duration is always 24 hours). Description 0 = Workday. 1 = Holiday 0 = Workday. 1 = Holiday	
	0	Exception 1	exceptions 4	.16 are days (duration is always 24 hours). Description 0 = Workday. 1 = Holiday 0 = Workday. 1 = Holiday 0 = Workday. 1 = Holiday	
	0 1 2	Exception 2 Exception 3	exceptions 4	.16 are days (duration is always 24 hours). Description 0 = Workday. 1 = Holiday 0 = Workday. 1 = Holiday	
	0 1 2 3	Exception 2 Exception 3 Exception 3	exceptions 4	Description 0 = Workday. 1 = Holiday	
	0 1 2 3 4	Exception 1 Exception 2 Exception 3 Exception 4 Exception 5	exceptions 4	Description 0 = Workday. 1 = Holiday	
	0 1 2 3 4 5	Exception 1 Exception 2 Exception 3 Exception 4 Exception 5 Exception 6	exceptions 4	Description 0 = Workday. 1 = Holiday	
	0 1 2 3 4 5	Exception 2 Exception 2 Exception 2 Exception 5 Exception 6 Exception 6 Exception 7	exceptions 4	Description 0 = Workday. 1 = Holiday	
	0 1 2 3 4 5 6 7	Exception 2 Exception 3 Exception 3 Exception 4 Exception 5 Exception 6 Exception 7 Exception 8	exceptions 4	Description 0 = Workday. 1 = Holiday	
	0 1 2 3 4 5 6 7	Exception 1 Exception 2 Exception 3 Exception 4 Exception 5 Exception 6 Exception 7 Exception 8 Exception 8	exceptions 4	Description 0 = Workday. 1 = Holiday	
	0 1 2 3 4 5 6 7 8 9 10	Exception 1 Exception 2 Exception 3 Exception 4 Exception 5 Exception 6 Exception 7 Exception 8 Exception 9 Exception 1	exceptions 4	Description 0 = Workday. 1 = Holiday	
	0 1 2 3 4 5 6 7 8 9 10 11	Exception 1 Exception 2 Exception 3 Exception 4 Exception 5 Exception 6 Exception 8 Exception 9 Exception 1 Exception 1	exceptions 4	Description 0 = Workday. 1 = Holiday	
	0 1 2 3 4 5 6 7 8 9 10 11 12	Exception 1 Exception 2 Exception 3 Exception 4 Exception 6 Exception 7 Exception 8 Exception 9 Exception 1 Exception 1 Exception 1 Exception 1 Exception 1 Exception 1	exceptions 4	Description 0 = Workday. 1 = Holiday	
	0 1 2 3 4 5 6 7 8 9 10 11 12 13	Exception 1 Exception 2 Exception 3 Exception 4 Exception 6 Exception 7 Exception 8 Exception 9 Exception 1	exceptions 4	Description 0 = Workday. 1 = Holiday 0 = Workday. 1 = Holiday	
	0 1 2 3 4 5 6 7 8 9 10 11 12	Exception 1 Exception 2 Exception 3 Exception 4 Exception 6 Exception 7 Exception 8 Exception 9 Exception 1 Exception 1 Exception 1 Exception 1 Exception 1 Exception 1	exceptions 4	Description 0 = Workday. 1 = Holiday	
	0 1 2 3 4 5 6 7 8 9 10 11 12 13	Exception 1 Exception 2 Exception 3 Exception 4 Exception 6 Exception 7 Exception 8 Exception 9 Exception 1	exceptions 4	Description 0 = Workday. 1 = Holiday 0 = Workday. 1 = Holiday	

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No.	Name/Value	Description	Def/FbEq16
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.
	01.0131.12.	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
	060 d	Length of exception period 1.	1 = 1
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
34.78	Exception day 4	Defines the date of exception day 4.	01.01.
	01.0131.12.	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

No.	Name/V	alue	Description		Def/FbEq1
34.100	Timed function 1		0 = Not conne 1 = Connecte		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.	
	1215	Reserved			
	0000h	FFFFh	Timers conne	cted to combined timer 1.	1 = 1
34.101	Timed fu	ınction 2		n timers are connected to combined timer 2. med functions status.	0000b
34.102	Timed fu	ınction 3		n timers are connected to combined timer 3. med functions status.	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.		0000b
	Bit	Name		Description	
	0	Timed fund	tion 1	0 = Inactive. 1 = Active.	
	1	Timed fund	tion 2	0 = Inactive. 1 = Active.	
	2	Timed fund	tion 3	0 = Inactive. 1 = Active.	
	315	Reserved			
	0000h	FFFFh	Combined tim	ners including the extra timer.	1 = 1
34.111		ne n source	Selects the so 0 = Disabled. 1 = Enabled.	ource of extra time activation signal.	Off
	Off		0.		0
	On		1.		1
	DI1		Digital input D	DI1 (10.02 DI delayed status, bit 0).	2
	DI2		Digital input D	DI2 (10.02 DI delayed status, bit 1).	3
	DI3		Digital input D	DI3 (10.02 DI delayed status, bit 2).	4
	DI4		Digital input D	014 (10.02 DI delayed status, bit 3).	5
	DI5		Digital input D	DI5 (10.02 DI delayed status, bit 4).	6

No.	Name/Value	Description	Def/FbEq16
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 94).	-
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 00:0000 00:00	Extra time duration.	1 = 1

35 Mor protec	tor thermal tion	Motor thermal protection settings such as temperature measurement configuration, load curve definition and motor fan control configuration. See also section <i>Motor thermal protection</i> (page 78).	
35.01	Motor estimated temperature	Displays the motor temperature as estimated by the internal motor thermal protection model (see parameters 35.5035.55). The unit is selected by parameter 96.16 Unit selection. This parameter is read-only.	-
	-601000 °C or -761832 °F	Estimated motor temperature.	1 = 1°
35.02	Measured temperature 1	Displays the 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.	-
	-605000 °C or -769032 °F, 0 ohm or [35.12] ohm	Measured temperature 1.	1 = 1 unit
35.03	Measured temperature 2	Displays the 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.	-
	-605000 °C or -769032 °F, 0 ohm or [35.22] ohm	Measured temperature 2.	1 = 1 unit
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

No.	Name/Value	Description	Def/FbEq16
	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 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. Will be available later.	2
	Reserved		34
	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
	PTC DI6	PTC sensor is connected to DI6. 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.	8
	Reserved		910
	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

No.	Name/Value	Description	Def/FbEq16
	KTY83 analog I/O	KTY83 sensor connected to the 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. Will be available later.	12
	1 × Pt1000 analog I/O	Pt1000 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. Will be available later.	13
	2 × Pt1000 analog I/O	As selection 1 × Pt1000 analog I/O, but with two sensors connected in series. Using multiple sensors improves measurement accuracy significantly. Will be available later.	14
	3 × Pt1000 analog I/O	As selection 1 × Pt1000 analog I/O, but with three sensors connected in series. Using multiple sensors improves measurement accuracy significantly. Will be available later.	15

No.	Name/Value	Description	Def/FbEq16
	Ni1000	Ni1000 sensor connected to the 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. Will be available later.	16
	Reserved	711120 01011001	1718
	PTC extension module	PTC is connected to the CMOD-02 multifunction extension module, which is installed in drive slot 2. See chapter Optional I/O extension modules, section CMOD-02 multifunction extension module (external 24 V AC/DC and isolated PTC interface) in the Hardware manual of the drive).	19
	Reserved		20
	Therm(0)	PTC sensor or a normally closed thermistor connected relay to digital input DI6. The motor is overheated when the digital input is 0.	21
	Therm(1)	Normally open thermistor relay connected to digital input DI6. The motor is overheated when the digital input is 1.	22
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. Note: With a PTC sensor, changing the value of this parameter has no effect on fault generation. When PTC is over the triggering threshold of the CMOD-02 (see the Hardware manual), the drive trips on the fault and when PTC has decreased below recovery threshold of the CMOD-02 (see the Hardware manual), the fault is reset.	130 °C or 266 °F
	-605000 °C or -769032 °F	Fault limit for temperature monitoring function 1.	1 = 1 unit
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. Note: With a PTC sensor, changing the value of this parameter has no effect on warning generation. When PTC is over the triggering threshold of the CMOD-02 (see the Hardware manual), the drive trips on the fault and when PTC has decreased below recovery threshold of the CMOD-02 (see the Hardware manual), the fault is reset.	110 °C or 230 °F
	-605000 °C or -769032 °F	Warning limit for temperature monitoring function 1.	1 = 1 unit

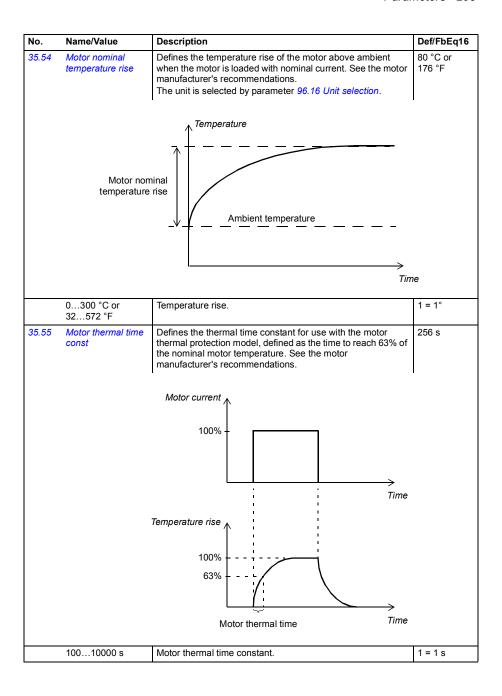
No.	Name/Value	Description	Def/FbEq16
35.14	Temperature 1 AI source	Specifies the analog input when the setting of 35.11 Temperature 1 source requires measurement through an analog input.	Not selected
	Not selected	None.	0
	Al1 actual value	Analog input Al1 on the control unit.	1
	Al2 actual value	Analog input Al2 on the control unit.	2
	Other	Source selection (see <i>Terms and abbreviations</i> on page 94).	-
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	Disabled
		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	None. Temperature monitoring function 2 is disabled.	0
	Estimated temperature	Estimated motor temperature (see parameter 35.01 Motor estimated temperature).	1
		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.	
	Reserved	 KTY84 sensor connected to the 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. Will be available later. 	34
		Didoo	
	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

No.	Name/Value	Description	Def/FbEq16
	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
	PTC DI6	PTC sensor is connected to DI6. 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.	8
	Reserved		1910
	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
	KTY83 analog I/O	KTY83 sensor connected to the 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 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. Will be available later.	12
	1 × Pt1000 analog I/O	Pt1000 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 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. Will be available later.	13
	2 × Pt1000 analog I/O	As selection 1 × Pt1000 analog I/O, but with two sensors connected in series. Using multiple sensors improves measurement accuracy significantly. Will be available later.	14

No.	Name/Value	Description	Def/FbEq16
	3 × Pt1000 analog I/O	As selection 1 × Pt1000 analog I/O, but with three sensors connected in series. Using multiple sensors improves measurement accuracy significantly. Will be available later.	15
	Ni1000	Ni1000 sensor connected to the 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 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. Will be available later.	16
	Reserved		1718
	PTC extension module	PTC is connected to the CMOD-02 multifunction extension module, which is installed in drive slot 2. See chapter Optional I/O extension modules, section CMOD-02 multifunction extension module (external 24 V AC/DC and isolated PTC interface) in the Hardware manual of the drive).	19
	Reserved		20
	Therm(0)	PTC sensor or a normally closed thermistor connected relay to digital input DI6. The motor is overheated when the digital input is 0.	21
	Therm(1)	Normally open thermistor relay connected to digital input DI6. The motor is overheated when the digital input is 1.	22
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. Note: With a PTC sensor, changing the value of this parameter has no effect on fault generation. When PTC is over the triggering threshold of the CMOD-02 (see the Hardware manual), the drive trips on the fault and when PTC has decreased below recovery threshold of the CMOD-02 (see the Hardware manual), the fault is reset.	130 °C or 266 °F
	-605000 °C or -769032 °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. Note: With a PTC sensor, changing the value of this parameter has no effect on warning generation. When PTC is over the triggering threshold of the CMOD-02 (see the Hardware manual), the drive trips on the fault and when PTC has decreased below recovery threshold of the CMOD-02 (see the Hardware manual), the fault is reset.	110 °C or 230 °F
	-605000 °C or -769032 °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
	Al1 actual value	Analog input Al1 on the control unit.	1
	Al2 actual value	Analog input Al2 on the control unit.	2
	Other	Source selection (see <i>Terms and abbreviations</i> on page 94).	-
35.50	Motor ambient temperature	Defines the ambient temperature of the motor for the motor thermal protection model. The unit is selected by parameter 96.16 Unit selection. The motor thermal protection model estimates the motor temperature on the basis of parameters 35.5035.55. 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
	-60100 °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%
	// _N (%) 150 +	I = Motor currentI_N = Nominal motor current	
	100	35.51	
	35.52	35.53 Drive output frequency	ut
		, ,	1
	50150%	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%
	50150%	Zero speed load for the motor load curve.	1 = 1%
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
	1.00500.00 Hz	Break point for the motor load curve.	See par. 46.02



No.	Name/Value	Description	Def/FbEq16
36 Loa	nd analyzer	Peak value and amplitude logger settings. See also section <i>Load analyzer</i> (page 87).	
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 36.1036.15. The peak value logger can be reset using parameter 36.09 Reset loggers. The logger is also reset whenever the signal source is changed. 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 (page 97).	1
	Reserved		2
	Output frequency	01.06 Output frequency (page 97).	3
	Motor current	01.07 Motor current (page 97).	4
	Reserved		5
	Motor torque	01.10 Motor torque (page 97).	6
	DC voltage	01.11 DC voltage (page 97).	7
	Output power	01.14 Output power (page 98).	8
	Reserved		9
	Speed ref ramp in	23.01 Speed ref ramp input (page 154).	10
	Speed ref ramp out	23.02 Speed ref ramp output (page 154).	11
	Speed ref used	24.01 Used speed reference (page 156).	12
	Reserved		13
	Freq ref used	28.02 Frequency ref ramp output (page 162).	14
	Reserved		15
	Process PID out	40.01 Process PID output actual (page 212).	16
	Other	Source selection (see <i>Terms and abbreviations</i> on page 94).	-
36.02	PVL filter time	Peak value logger filtering time. See parameter 36.01 PVL signal source.	2.00 s
	0.00120.00 s	Peak value logger filtering time.	100 = 1 s
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 36.4036.49. 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 logger is also reset whenever the signal source or scaling is changed. 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
36.07	AL2 signal scaling	Defines the signal value that corresponds to 100% amplitude.	100.00
	0.0032767.00	Signal value corresponding to 100%.	1 = 1

No.	Name/Value	Description	Def/FbEq16
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	Peak value recorded by the peak value logger.	0.00
	-32768.00 32767.00	Peak value.	1 = 1
36.11	PVL peak date	The date on which the peak value was recorded.	01.01.1980
	-	Peak occurrence date.	-
36.12	PVL peak time	The time at which the peak value was recorded.	00:00:01
	=	Peak occurrence time.	-
36.13	PVL current at peak	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	Voltage in the intermediate DC circuit of the drive at the moment the peak value was recorded.	0.00 V
	0.002000.00 V	DC voltage at peak.	10 = 1 V
36.15	PVL speed at peak	Motor speed at the moment the peak value was recorded.	0.00 rpm
	-30000.00 30000.00 rpm	Motor speed at peak.	See par. 46.01
36.16	PVL reset date	The date on which the peak value logger was last reset.	01.01.1980
	=	Last reset date of the peak value logger.	-
36.17	PVL reset time	The time at which the peak value logger was last reset.	00:00:01
	=	Last reset time of the peak value logger.	-
36.20	AL1 0 to 10%	Percentage of samples recorded by amplitude logger 1 that fall between 0 and 10%. 100% corresponds to the $l_{\rm max}$ value given in the ratings table in chapter Technical data in the Hardware manual.	0.00%
	0.00100.00%	Amplitude logger 1 samples between 0 and 10%.	1 = 1%
36.21	AL1 10 to 20%	Percentage of samples recorded by amplitude logger 1 that fall between 10 and 20%.	0.00%
	0.00100.00%	Amplitude logger 1 samples between 10 and 20%.	1 = 1%
36.22	AL1 20 to 30%	Percentage of samples recorded by amplitude logger 1 that fall between 20 and 30%.	0.00%
	0.00100.00%	Amplitude logger 1 samples between 20 and 30%.	1 = 1%
36.23	AL1 30 to 40%	Percentage of samples recorded by amplitude logger 1 that fall between 30 and 40%.	0.00%
	0.00100.00%	Amplitude logger 1 samples between 30 and 40%.	1 = 1%
36.24	AL1 40 to 50%	Percentage of samples recorded by amplitude logger 1 that fall between 40 and 50%.	0.00%
	0.00100.00%	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%
	0.00100.00%	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%
	0.00100.00%	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%
	0.00100.00%	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%
	0.00100.00%	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%
	0.00100.00%	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%
	0.00100.00%	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%
	0.00100.00%	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%
	0.00100.00%	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%
	0.00100.00%	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%
	0.00100.00%	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%
	0.00100.00%	Amplitude logger 2 samples between 50 and 60%.	1 = 1%
36.46	AL2 60 to 70%	Percentage of samples recorded by amplitude logger 2 that fall between 60 and 70%.	0.00%
	0.00100.00%	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%
	0.00100.00%	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%
	0.00100.00%	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%
	0.00100.00%	Amplitude logger 2 samples over 90%.	1 = 1%

No.	Name/Value	Description	Def/FbEq16
36.50	AL2 reset date	The date on which amplitude logger 2 was last reset.	01.01.1980
	-	Last reset date of amplitude logger 2.	-
36.51	AL2 reset time	The time at which amplitude logger 2 was last reset.	00:00:01
	-	Last reset time of amplitude logger 2.	-

37 User load curve		Settings for user load curve. See also section <i>DC voltage control</i> (page 73).	
37.01	ULC output status word	Displays the status of the monitored signal.	0000h

Bit	Name	Description
0	Under load limit	1 = Signal lower than the underload curve.
1	Within load range	1 = Signal between the underload and overload curve.
2	Overload limit	1 = Signal higher than the overload curve.
315	Reserved	

	0000hFFFFh	Status of the monitored signal.	1 = 1
37.02	ULC supervision signal	Selects the signal to be supervised.	Motor torque %
	Not selected	No signal selected. ULC disabled.	0
	Motor speed %	01.03 Motor speed % (page 97).	1
	Motor current %	01.08 Motor current % of motor nom (page 97).	2
	Motor torque %	01.10 Motor torque (page 97).	3
	Output power % of motor nominal	01.15 Output power % of motor nom (page 98).	4
	Output power % of drive nominal	01.16 Output power % of drive nom (page 98).	5
	Other	Source selection (see <i>Terms and abbreviations</i> on page 94).	-
37.03	ULC overload actions	Selects an action taken if the signal stays over the overload curve for a defined time.	Disabled
	Disabled	No warnings or fault generated.	0
	Warning	The drive generates an A8C1 ULC overload warning if the signal has been continuously over the overload curve for a time defined by parameter 37.41 ULC overload timer.	1
	Fault	The drive generates an 8002 ULC overload fault if the signal has been continuously over the overload curve for a time defined by parameter 37.41 ULC overload timer.	2
	Warning/Fault	The drive generates an A8C1 ULC overload warning if the signal has been continuously over the overload curve for half of the time defined by parameter 37.41 ULC overload timer. The drive generates an 8002 ULC overload fault if the signal has been continuously over the overload curve for a time defined by parameter 37.41 ULC overload timer.	3
37.04	ULC underload actions	Selects an action taken if the signal stays under the underload curve for a defined time.	Disabled
	Disabled	No warnings or fault generated.	0

No.	Name/Value	Description	Def/FbEq16
	Warning	The drive generates an A8C4 ULC underload warning if the signal has been continuously under the underload curve for a time defined by parameter 37.42 ULC underload timer.	1
	Fault	The drive generates an 8001 ULC underload fault if the signal has been continuously under the underload curve for a time defined by parameter 37.42 ULC underload timer.	2
	Warning/Fault	The drive generates an A8C4 ULC underload warning if the signal has been continuously under the underload curve for half of the time defined by parameter 37.42 ULC underload timer. The drive generates an 8001 ULC underload fault if the signal has been continuously under the underload curve for a time defined by parameter 37.42 ULC underload timer.	3
37.11	ULC speed table point 1	Defines the first of the five speed points on the X-axis of the user load curve. The values of the parameters must satisfy: $-30000.0 \text{ rpm} \leq 37.11 \text{ ULC}$ speed table point $1 < 37.12 \text{ ULC}$ speed table point $2 < 37.13 \text{ ULC}$ speed table point $3 < 37.14 \text{ ULC}$ speed table point $3 < 37.14 \text{ ULC}$ speed table point $4 < 37.15 \text{ ULC}$ speed table point $4 < 3$	150.0 rpm
	-30000.030000.0 rpm	Speed.	1 = 1 rpm
37.12	ULC speed table point 2	Defines the second speed point. See parameter 37.11 ULC speed table point 1.	750.0 rpm
	-30000.030000.0 rpm	Speed.	1 = 1 rpm
37.13	ULC speed table point 3	Defines the third speed point. See parameter 37.11 ULC speed table point 1.	1290.0 rpm
	-30000.030000.0 rpm	Speed.	1 = 1 rpm
37.14	ULC speed table point 4	Defines the fourth speed point. See parameter 37.11 ULC speed table point 1.	1500.0 rpm
	-30000.030000.0 rpm	Speed.	1 = 1 rpm
37.15	ULC speed table point 5	Defines the fifth speed point. See parameter 37.11 ULC speed table point 1.	1800.0 rpm
	-30000.030000.0 rpm	Speed.	1 = 1 rpm
37.16	ULC frequency table point 1	Defines the first of the five frequency points on the X-axis of the user load curve. The values of the parameters must satisfy: -500.0 Hz \leq 37.16 ULC frequency table point 1 < 37.17 ULC frequency table point 2 < 37.18 ULC frequency table point 3 < 37.19 ULC frequency table point 4 < 37.20 ULC frequency table point 5 \leq 500.0 Hz. Frequency points are used if parameter 99.04 Motor control mode is set to Scalar and the reference unit is Hz.	5.0 Hz
	-500.0500.0 Hz	Frequency.	1 = 1 Hz

No.	Name/Value	Description	Def/FbEq16
37.17	ULC frequency table point 2	Defines the second frequency point. See parameter 37.16 ULC frequency table point 1.	25.0 Hz
	-500.0500.0 Hz	Frequency.	1 = 1 Hz
37.18	ULC frequency table point 3	Defines the third frequency point. See parameter 37.16 ULC frequency table point 1.	43.0 Hz
	-500.0500.0 Hz	Frequency.	1 = 1 Hz
37.19	ULC frequency table point 4	Defines the fourth frequency point. See parameter 37.16 ULC frequency table point 1.	50.0 Hz
	-500.0500.0 Hz	Frequency.	1 = 1 Hz
37.20	ULC frequency table point 5	Defines the fifth frequency point. See parameter 37.16 ULC frequency table point 1.	60.0 Hz
	-500.0500.0 Hz	Frequency.	1 = 1 Hz
37.21	ULC underload point 1	Defines the first of the five points on the Y-axis that together with the corresponding point on the X-axis (37.11 ULC speed table point 137.15 ULC speed table point 5 or 37.15 ULC speed table point 537.20 ULC frequency table point 5) define the underload (lower) curve. The following conditions must be fulfilled: • 37.21 ULC underload point 1 <= 37.31 ULC overload point 1 • 37.22 ULC underload point 2 <= 37.32 ULC overload point 2 • 37.23 ULC underload point 3 <= 37.33 ULC overload point 3 • 37.24 ULC underload point 4 <= 37.34 ULC overload point 4 • 37.25 ULC underload point 5 <= 37.35 ULC overload point 5	10.0%
	-1600.01600.0%	Underload point.	1 = 1%
37.22	ULC underload point 2	Defines the second underload point. See parameter 37.21 ULC underload point 1.	15.0%
	-1600.01600.0%	Underload point.	1 = 1%
37.23	ULC underload point 3	Defines the third underload point. See parameter 37.21 ULC underload point 1	25.0%
	-1600.01600.0%	Underload point.	1 = 1%
37.24	ULC underload point 4	Defines the fourth underload point. See parameter 37.21 ULC underload point 1	30.0%
	-1600.01600.0%	Underload point.	1 = 1%
37.25	ULC underload point 5	Defines the fifth underload point. See parameter 37.21 ULC underload point 1	30.0%
	-1600.01600.0%	Underload point.	1 = 1%
37.31	ULC overload point 1	Defines the first of the five points on the Y-axis that together with the corresponding point on the X-axis (37.11 ULC speed table point 137.15 ULC speed table point 5 or 37.15 ULC speed table point 537.20 ULC frequency table point 5) define the overload (higher) curve. At each of the five points the value of the underload curve point must be equal to or smaller than the value of the overload curve point. See parameter 37.21 ULC underload point 1.	300.0%
	-1600.01600.0%	Overload point.	1 = 1%
37.32	ULC overload point 2	Defines the second overload point. See parameter 37.31 ULC overload point 1.	300.0%
	-1600.01600.0%	Overload point.	1 = 1%

No.	Name/Value	Description	Def/FbEq16
37.33	ULC overload point 3	Defines the third overload point. See parameter 37.31 ULC overload point 1.	300.0%
	-1600.01600.0%	Overload point.	1 = 1%
37.34	ULC overload point 4	Defines the fourth overload point. See parameter 37.31 ULC overload point 1.	300.0%
	-1600.01600.0%	Overload point.	1 = 1%
37.35	ULC overload point 5	Defines the fifth overload point. See parameter 37.31 ULC overload point 1.	300.0%
	-1600.01600.0%	Overload point.	1 = 1%
37.41	ULC overload timer	Defines the time period for which time the monitored signal must remain continuously over the overload curve.	20.0 s
	0.010000.0 s	Time.	1 = 1 s
37.42	ULC underload timer	Defines the time period for which time the monitored signal must remain continuously below the underload curve.	20.0 s
	0.010000.0 s	Time.	1 = 1 s
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. Two different parameter sets can be defined for the process PID. One parameter set is in use at a time. The first set is made up of parameters 40.0740.50, the second set is defined by the parameters in group 41 Process PID set 2. The binary source that defines which set is used is selected by parameter 40.57 PID set1/set2 selection. See also the control chain diagrams on pages 383 and 384. To set the PID customer unit, select Menu - Primary settings - PID - Unit on the panel.	
40.01	Process PID output actual	Displays the output of the process PID controller. See the control chain diagram on page 384.	-

This parameter is read-only.

diagram on page 383.
This parameter is read-only.

diagram on page 384.
This parameter is read-only.

Setpoint for process PID controller.

Process feedback.

Process PID controller output.

Displays the value of process feedback after source

selection, mathematical function (parameter 40.10 Set 1 feedback function), and filtering. See the control chain

Displays the value of process PID setpoint after source

selection, mathematical function (40.18 Set 1 setpoint function), limitation and ramping. See the control chain

1 = 1 PID

1 = 1 PID

1 = 1 PID

customer unit

customer unit

customer unit

-32768.00...

32767.00 PID

customer units

Process PID

-32768.00...

32767.00 PID

customer units

setpoint actual

Process PID

-32768.00...

32767.00 PID

customer units

feedback actual

40.02

40.03

No.	Name/Value	Description	Def/FbEq16
40.04	Process PID deviation actual	Displays the process PID deviation. By default, this value equals setpoint - feedback, but deviation can be inverted by parameter 40.31 Set 1 deviation inversion. See the control chain diagram on page 384. This parameter is read-only.	-
	-32768.00 32767.00 PID customer units	PID deviation.	1 = 1 PID customer unit
40.06	Process PID status word	Displays status information on process PID control. This parameter is read-only.	-

Bit	Name	Value		
0	PID active	1 = Process PID control active.		
1	Setpoint frozen	1 = Process PID setpoint frozen.		
2	Output frozen	1 = Process PID controller output frozen.		
3	PID sleep mode	1 = Sleep mode active.		
4	Sleep boost	1 = Sleep boost active.		
5	Reserved			
6	Tracking mode	1 = Tracking function active.		
7	Output limit high	1 = PID output is being limited by par. 40.37.		
8	Output limit low	1 = PID output is being limited by par. 40.36.		
9	Reserved			
10	PID set	0 = Parameter set 1 in use. 1 = Parameter set 2 in use.		
11	Reserved			
12	Internal setpoint active	1 = Internal setpoint active (see par. 40.1640.16)		
1315	Reserved	•		

	0000hFFFFh Process PID control status word.		1 = 1	
40.07	Process PID operation mode	Activates/deactivates process PID control. Note: Process PID control is only available in external control; see section <i>Local control vs. external control</i> (page 39).	Off	
	Off	Process PID control inactive.	0	
	On	Process PID control active.		
	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. See the control chain diagram on page 383.	AI2 percent	
	Not selected	None.	0	
	Al1 scaled	12.12 Al1 scaled value (see page 117).	1	
	Al2 scaled	12.22 Al2 scaled value (see page 118).	2	
Res Al1	Freq in scaled	11.39 Freq in 1 scaled value (see page 114).	3	
	Reserved		47	
	Al1 percent	12.101 Al1 percent value (see page 119)	8	
	Al2 percent	12.102 Al2 percent value (see page 119)	9	
Feedback data storage		40.91 Feedback data storage (see page 223),	10	

No.	Name/Value	Description	Def/FbEq16
	Other	Source selection (see <i>Terms and abbreviations</i> on page 94).	-
40.09	Set 1 feedback 2 source	Selects the second source of process feedback. The second source is used only if the setpoint function requires two inputs. For the selections, see parameter 40.08 Set 1 feedback 1 source.	Not selected
40.10	Set 1 feedback function	Defines how process feedback is calculated from the two feedback sources selected by parameters 40.08 Set 1 feedback 1 source and 40.09 Set 1 feedback 2 source.	In1
	ln1	Source 1.	0
	ln1+ln2	Sum of sources 1 and 2.	1
	In1-In2	Source 2 subtracted from source 1.	2
	In1*In2	Source 1 multiplied by source 2.	3
	ln1/ln2	Source 1 divided by source 2.	4
	MIN(In1,In2)	Smaller of the two sources.	5
	MAX(In1,In2)	Greater of the two sources.	6
	AVE(In1,In2)	Average of the two sources.	7
	sqrt(In1)	Square root of source 1.	8
	sqrt(In1-In2)	Square root of (source 1 - source 2).	9
	sqrt(In1+In2)	Square root of (source 1 + source 2).	10
	sqrt(In1)+sqrt(In2)	Square root of source 1 + square root of source 2.	11
	k*sqrt(In1)	Square root of source 1 multiplied by factor k	12
	k*sqrt(In1-In2)	Square root of (source 1 - source 2) multiplied by factor k.	13
40.11	Set 1 feedback filter time	Defines the filter time constant for process feedback.	0.000 s
	0.00030.000 s	Feedback filter time.	1 = 1 s
40.16	Set 1 setpoint 1 source	Selects the primary source of process PID setpoint. See the control chain diagram on page 383.	Al1 percent
	Not selected	None.	0
	Reserved		1
	Internal setpoint	Internal setpoint. See parameter 40.19 Set 1 internal setpoint sel1.	2
	Al1 scaled	12.12 Al1 scaled value (see page 117).	3
	Al2 scaled	12.22 Al2 scaled value (see page 118).	4
	Reserved		57
	Motor potentiometer	22.80 Motor potentiometer ref act (output of the motor potentiometer).	8
	Reserved		9
	Freq in scaled	11.39 Freq in 1 scaled value (see page 114).	10
	Al1 percent	12.101 Al1 percent value (see page 119)	11
	Al2 percent	12.102 Al2 percent value (see page 119)	12

No.	Name/Value	Def/FbEq16	
	Control panel (ref saved)	Panel reference (03.01 Panel reference, see page 99) saved by the control system for the location where the control returns is used as the reference. Reference Ext1 reference Ext2 reference Active reference Inactive reference	13
	Control panel (ref copied)	Panel reference (03.01 Panel reference, see page 99) 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. Reference Ext1 reference Ext2 reference Active reference Inactive reference	14
	FB A ref1	03.05 FB A reference 1 (see page 100).	15
	FB A ref2	03.06 FB A reference 2 (see page 100).	16
	Reserved		1718
	EFB ref1	03.09 EFB reference 1 (see page 100).	19
	EFB ref2	03.10 EFB reference 2 (see page 100).	20
	Reserved		2123
	Setpoint data storage	40.92 Setpoint data storage (see page 223)	24
	Other Source selection (see Terms and abbreviations on page 94)		-
40.17	Set 1 setpoint 2 source	Selects the second source of process setpoint. The second source is used only if the setpoint function requires two inputs. For the selections, see parameter 40.16 Set 1 setpoint 1 source.	Not selected
40.18	Set 1 setpoint function	Selects a function between the setpoint sources selected by parameters 40.16 Set 1 setpoint 1 source and 40.17 Set 1 setpoint 2 source.	In1
	In1	Source 1.	0
	ln1+ln2	Sum of sources 1 and 2.	1
	ln1-ln2	Source 2 subtracted from source 1.	2
	In1*In2	Source 1 multiplied by source 2.	3
	ln1/ln2	Source 1 divided by source 2.	4
	MIN(In1,In2)	Smaller of the two sources.	5
	MAX(In1,In2)	Greater of the two sources.	6
	AVE(In1,In2)	Average of the two sources.	7
	sqrt(In1)	Square root of source 1.	8

No.	Name/Value	Description	Def/FbEq16		
	sqrt(In1-In2)	Square root of (so	urce 1 - source 2).		9
	sqrt(In1+In2)	Square root of (source 1 + source 2).			10
	sqrt(In1)+sqrt(In2)	Square root of source 1 + square root of source 2.			11
40.19	Set 1 internal setpoint sel1	Selects together winternal setpoint or 40.2140.23. Note: Parameters Set 1 setpoint 2 so	Not selected		
		Source defined by par. 40.19	Source defined by par. 40.20	Setpoint preset active	
		0	0	Setpoint source	
		1	0	1 (par. 40.21)	
		0	1	2 (par. 40.22)	
		1	1	3 (par. 40.23)	
	Not selected	0.			0
	Selected	1.			1
	DI1	Digital input DI1 (1	10.02 DI delayed s	tatus, bit 0).	2
	DI2	Digital input DI2 (1	10.02 DI delayed s	tatus, bit 1).	3
	DI3	Digital input DI3 (1	Digital input DI3 (10.02 DI delayed status, bit 2).		
	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 (1	7		
	Reserved		817		
	Timed function 1	Bit 0 of 34.01 Time	18		
	Timed function 2	Bit 1 of 34.01 Time	19		
	Timed function 3	Bit 2 of 34.01 Time	20		
	Supervision 1	Bit 0 of 32.01 Sup	21		
	Supervision 2	Bit 1 of 32.01 Sup	22		
	Supervision 3	Bit 2 of 32.01 Sup	23		
	Other [bit]	Source selection (-		
40.20	Set 1 internal setpoint sel2	Selects together with 40.19 Set 1 internal setpoint sel1 the internal setpoint used out of the three internal setpoints defined by parameters 40.2140.23. See table at 40.19 Set 1 internal setpoint sel1.			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 (1	10.02 DI delayed s	tatus, bit 4).	6
	DI6	Digital input DI6 (1			7
	Reserved				817

No.	Name/Value	Description	Def/FbEq16
	Timed function 1	Bit 0 of 34.01 Timed functions status (see page 189).	18
	Timed function 2	Bit 1 of 34.01 Timed functions status (see page 189).	19
	Timed function 3	Bit 2 of 34.01 Timed functions status (see page 189).	20
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 182).	21
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 182).	22
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 182).	23
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 94).	-
40.21	Set 1 internal setpoint 1	Internal process setpoint 1. See parameter 40.19 Set 1 internal setpoint sel1.	0.00 PID customer units
	-32768.00 32767.00 PID customer units	Internal process setpoint 1.	1 = 1 PID customer unit
40.22	Set 1 internal setpoint 2	Internal process setpoint 2. See parameter 40.19 Set 1 internal setpoint sel1.	0.00 PID customer units
	-32768.00 32767.00 PID customer units	Internal process setpoint 2.	1 = 1 PID customer unit
40.23	Set 1 internal setpoint 3	Internal process setpoint 3. See parameter 40.19 Set 1 internal setpoint sel1.	0.00 PID customer units
	-32768.00 32767.00 PID customer units	Internal process setpoint 3.	1 = 1 PID customer unit
40.26	Set 1 setpoint min	Defines a minimum limit for the process PID controller setpoint.	0.00
	-32768.00 32767.00	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.	32767.00
	-32768.00 32767.00	Maximum limit for process PID controller setpoint.	1 = 1
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
	0.01800.0 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
	0.01800.0 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.	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

No.	Name/Value	Description	Def/FbEq16
	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		817
	Timed function 1	Bit 0 of 34.01 Timed functions status (see page 189).	18
	Timed function 2	Bit 1 of 34.01 Timed functions status (see page 189).	19
	Timed function 3	Bit 2 of 34.01 Timed functions status (see page 189).	20
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 182).	21
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 182).	22
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 182).	23
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 94).	-
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 Sleep and boost functions for process PID control (page 56).	Not inverted (Ref - Fbk)
	Not inverted (Ref - Fbk)	0.	0
	Inverted (Fbk - Ref)	1.	1
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 94).	-
40.32	Set 1 gain	Defines the gain for the process PID controller. See parameter 40.33 Set 1 integration time.	1.00
	0.10100.00	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. Error/Controller output G × I 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
	0.09999.0 s	Integration time.	1 = 1 s

No.	Name/Value	Description	Def/FbEq16
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
	0.00010.000 s	Derivation time.	1000 = 1 s
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. "Unfiltered signal O = I × (1 - e ^{-t/T}) I = filter input (step) O = filter output t = time T = filter time constant	0.0 s
	0.010.0 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.	0.0
	-32768.0 32767.0	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.	100.0
	-32768.0 32767.0	Maximum limit for process PID controller output.	1 = 1
40.38	Set 1 output freeze	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
	DI4	Digital input DI4 (10.02 DI delayed status, bit 3).	5

No.	Name/Value	Description	Def/FbEq16
	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		817
	Timed function 1	Bit 0 of 34.01 Timed functions status (see page 189).	18
	Timed function 2	Bit 1 of 34.01 Timed functions status (see page 189).	19
	Timed function 3	Bit 2 of 34.01 Timed functions status (see page 189).	20
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 182).	21
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 182).	22
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 182).	23
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 94).	-
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
	0.032767.0	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 s
	0.03600.0 s	Sleep start delay.	1 = 1 s
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 s
	0.03600.0 s	Sleep boost time.	1 = 1 s
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.	0.0 PID customer units
	0.032767.0 PID customer units	Sleep boost step.	1 = 1 PID customer unit
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 PID customer units
	-32768.00 32767.00 PID customer units	Wake-up level (as deviation between process setpoint and feedback).	1 = 1 PID customer unit
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 s
	0.0060.00 s	Wake-up delay.	1 = 1 s

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 58). 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
	Reserved		817
	Timed function 1	Bit 0 of 34.01 Timed functions status (see page 189).	18
	Timed function 2	Bit 1 of 34.01 Timed functions status (see page 189).	19
	Timed function 3	Bit 2 of 34.01 Timed functions status (see page 189).	20
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 182).	21
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 182).	22
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 182).	23
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 94).	-
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
	Al1 scaled	12.12 Al1 scaled value (see page 117).	1
	Al2 scaled	12.22 Al2 scaled value (see page 118).	2
	FB A ref1	03.05 FB A reference 1 (see page 100).	3
	FB A ref2	03.06 FB A reference 2 (see page 100).	4
	Other	Source selection (see <i>Terms and abbreviations</i> on page 94).	-
40.57	PID set1/set2 selection	Selects the source that determines whether process PID parameter set 1 (parameters 40.0740.50) or set 2 (group 41 Process PID set 2) is used.	PID set 1
	PID set 1	0. Process PID parameter set 1 in use.	0
	PID set 2	1. Process PID parameter set 2 in use.	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		817
	Timed function 1	Bit 0 of 34.01 Timed functions status (see page 189).	18
	Timed function 2	Bit 1 of 34.01 Timed functions status (see page 189).	19

No.	Name/Value	Description	Def/FbEq16
	Timed function 3	Bit 2 of 34.01 Timed functions status (see page 189).	20
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 182).	21
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 182).	22
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 182).	23
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 94).	-
40.58	Set 1 increase prevention	Prevention of PID integration term increase for PID set 1.	No
	No	Increase prevention not in use.	0
	Limiting	The PID integration term is not increased if the maximum value for the PID output is reached. This parameter is valid for the PID set 1.	1
	Ext PID min lim	The process PID integration term is not increased when the output of the external PID has reached its minimum limit. In this setup, the external PID is used as a source for the process PID. This parameter is valid for the PID set 1.	2
	Ext PID max lim	The process PID integration term is not increased when the output of the external PID has reached its maximum limit. In this setup, the external PID is used as a source for the process PID. This parameter is valid for the PID set 1.	3
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 94).	-
40.59	Set 1 decrease prevention	Prevention of PID integration term decrease for PID set 1.	No
	No	Decrease prevention not in use.	0
	Limiting	The PID integration term is not decreased if the minimum value for the PID output is reached. This parameter is valid for the PID set 1.	1
	Ext PID min lim	The process PID integration term is not decreased when the output of the external PID has reached its minimum limit. In this setup, the external PID is used as a source for the process PID. This parameter is valid for the PID set 1.	2
	Ext PID max lim	The process PID integration term is not decreased when the output of the external PID has reached its maximum limit. In this setup, the external PID is used as a source for the process PID. This parameter is valid for the PID set 1.	3
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 94).	-
40.62	PID internal setpoint actual	Displays the value of the internal setpoint. See the control chain diagram on page <i>384</i> . This parameter is read-only.	-
	-32768.00 32767.00 PID customer units	Process PID internal setpoint.	1 = 1 PID customer unit
40.90	Set 1 feedback multiplier k	Defines the multiplier used in formulas of parameter 40.10 Set 1 feedback function.	-
	-100000.00 100000.00	Multiplier.	1 = 1

No.	Name/Value	Description	Def/FbEq16
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 (58.10158.114) to Feedback data storage. In 40.08 Set 1 feedback 1 source (or 40.09 Set 1 feedback 2 source), select Feedback data storage.	-
	-327.68327.67	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 (58.10158.114)) to Setpoint data storage. In 40.16 Set 1 setpoint 1 source (or 40.17 Set 1 setpoint 2 source), select Setpoint data storage.	-
	-327.68327.67	Storage parameter for process setpoint.	100 = 1

41 Pro	ocess PID set 2	A second set of parameter values for process PID control. The selection between this set and first set (parameter group 40 Process PID set 1) is made by parameter 40.57 PID set1/set2 selection. See also parameters 40.0140.06, and the control chain diagrams on pages 383 and 384.	
41.08	Set 2 feedback 1 source	See parameter 40.08 Set 1 feedback 1 source.	Al2 percent
41.09	Set 2 feedback 2 source	See parameter 40.09 Set 1 feedback 2 source.	Not selected
41.10	Set 2 feedback function	See parameter 40.10 Set 1 feedback function.	In1
41.11	Set 2 feedback filter time	See parameter 40.11 Set 1 feedback filter time.	0.000 s
41.16	Set 2 setpoint 1 source	See parameter 40.16 Set 1 setpoint 1 source.	Al1 percent
41.17	Set 2 setpoint 2 source	See parameter 40.17 Set 1 setpoint 2 source.	Not selected
41.18	Set 2 setpoint function	See parameter 40.18 Set 1 setpoint function.	In1
41.19	Set 2 internal setpoint sel1	See parameter 40.19 Set 1 internal setpoint sel1.	Not selected
41.20	Set 2 internal setpoint sel2	See parameter 40.20 Set 1 internal setpoint sel2.	Not selected
41.21	Set 2 internal setpoint 1	See parameter 40.21 Set 1 internal setpoint 1.	0.00 PID customer units
41.22	Set 2 internal setpoint 2	See parameter 40.22 Set 1 internal setpoint 2.	0.00 PID customer units
41.23	Set 2 internal setpoint 3	See parameter 40.23 Set 1 internal setpoint 3.	0.00 PID customer units
41.26	Set 2 setpoint min	See parameter 40.26 Set 1 setpoint min.	0.00
41.27	Set 2 setpoint max	See parameter 40.27 Set 1 setpoint max.	32767.00

No.	Name/Value	Description	Def/FbEq16
41.28	Set 2 setpoint increase time	See parameter 40.28 Set 1 setpoint increase time.	0.0 s
41.29	Set 2 setpoint decrease time	See parameter 40.29 Set 1 setpoint decrease time.	0.0 s
41.30	Set 2 setpoint freeze enable	See parameter 40.30 Set 1 setpoint freeze enable.	Not selected
41.31	Set 2 deviation inversion	See parameter 40.31 Set 1 deviation inversion.	Not inverted (Ref - Fbk)
41.32	Set 2 gain	See parameter 40.32 Set 1 gain.	1.00
41.33	Set 2 integration time	See parameter 40.33 Set 1 integration time.	60.0 s
41.34	Set 2 derivation time	See parameter 40.34 Set 1 derivation time.	0.000 s
41.35	Set 2 derivation filter time	See parameter 40.35 Set 1 derivation filter time.	0.0 s
41.36	Set 2 output min	See parameter 40.36 Set 1 output min.	0.0
41.37	Set 2 output max	See parameter 40.37 Set 1 output max.	100.0
41.38	Set 2 output freeze	See parameter 40.38 Set 1 output freeze.	Not selected
41.43	Set 2 sleep level	See parameter 40.43 Set 1 sleep level.	0.0
41.44	Set 2 sleep delay	See parameter 40.44 Set 1 sleep delay.	60.0 s
41.45	Set 2 sleep boost time	See parameter 40.45 Set 1 sleep boost time.	0.0 s
41.46	Set 2 sleep boost step	See parameter 40.46 Set 1 sleep boost step.	0.0 PID customer units
41.47	Set 2 wake-up deviation	See parameter 40.47 Set 1 wake-up deviation.	0.00 PID customer units
41.48	Set 2 wake-up delay	See parameter 40.48 Set 1 wake-up delay.	0.50 s
41.49	Set 2 tracking mode	See parameter 40.49 Set 1 tracking mode.	Not selected
41.50	Set 2 tracking ref selection	See parameter 40.50 Set 1 tracking ref selection.	Not selected
41.58	Set 2 increase prevention	See parameter 40.58 Set 1 increase prevention.	No
41.59	Set 2 decrease prevention	See parameter 40.59 Set 1 decrease prevention.	No
41.90	Set 2 feedback multiplier k	Defines the multiplier used in formulas of parameter 41.10 Set 2 feedback function.	-
	-100000.00 100000.00	Multiplier.	1 = 1

No.	Name/Value	Description	Def/FbEq16
	Overvoltage peak protection	Brake chopper control enabled in an overvoltage condition. This setting is intended for situations where • the braking chopper is not needed for runtime operation, ie. to dissipate the inertial energy of the motor, • the motor is able to store a considerable amount magnetic energy in its windings, and • the motor might, deliberately or inadvertently, be stopped by coasting. In such a situation, the motor would potentially discharge enough magnetic energy towards the drive to cause damage. To protect the drive, the brake chopper can be used with a small resistor dimensioned merely to handle the magnetic energy (not the inertial energy) of the motor. With this setting, the brake chopper is activated only whenever the DC voltage exceeds the overvoltage limit. During normal use, the brake chopper is not operating.	3
45 Ene	ergy efficiency	Settings for the energy saving calculators. See also section <i>Energy saving calculators</i> (page 86).	
45.01	Saved GW hours	Energy saved in GWh compared to direct-on-line motor connection. This parameter is incremented when 45.02 Saved MW hours rolls over. This parameter is read-only (see parameter 45.21 Energy calculations reset).	-
	065535 GWh	Energy savings in GWh.	1 = 1 GWh
45.02	Saved MW hours	Energy saved in MWh compared to direct-on-line motor connection. This parameter is incremented when 45.03 Saved kW hours rolls over. When this parameter rolls over, parameter 45.01 Saved GW hours is incremented. This parameter is read-only (see parameter 45.21 Energy calculations reset).	-
	0999 MWh	Energy savings in MWh.	1 = 1 MWh
45.03	Saved kW hours	Energy saved in kWh compared to direct-on-line motor connection. If the internal brake chopper of the drive is enabled, all energy fed by the motor to the drive is assumed to be converted into heat, but the calculation still records savings made by controlling the speed. If the chopper is disabled, then regenerated energy from the motor is also recorded here. When this parameter rolls over, parameter 45.02 Saved MW hours is incremented. This parameter is read-only (see parameter 45.21 Energy calculations reset).	-
	0.0999.9 kWh	Energy savings in kWh.	10 = 1 kWh
45.04	Saved energy	Energy saved in kWh compared to direct-on-line motor connection. If the internal brake chopper of the drive is enabled, all energy fed by the motor to the drive is assumed to be converted into heat. This parameter is read-only (see parameter 45.21 Energy calculations reset).	-
	0.0214748364.0 kWh	Energy savings in kWh.	1 = 1 kWh

No.	Name/Value	Description	Def/FbEq16
45.05	Saved money x1000	Monetary savings in thousands compared to direct-on-line motor connection. This parameter is incremented when 45.06 Saved money rolls over. Specify the currency as text in Main menu - Primary settings - Clock, region display - Units - Currency. This parameter is read-only (see parameter 45.21 Energy	-
	04294967295	calculations reset). Monetary savings in thousands of units.	1 = 1 unit
	thousands		
45.06	Saved money	Monetary savings compared to direct-on-line motor connection. This value is a calculated by multiplying the saved energy in kWh by the currently active energy tariff (45.14 Tariff selection). When this parameter rolls over, parameter 45.05 Saved money x1000 is incremented.	-
		Specify the currency as text in Main menu - Primary settings - Clock, region display - Units - Currency.	
		This parameter is read-only (see parameter 45.21 Energy calculations reset).	
	0.00999.99 units	Monetary savings.	1 = 1 unit
45.07	Saved amount	Monetary savings compared to direct-on-line motor connection. This value is a calculated by multiplying the saved energy in kWh by the currently active energy tariff (45.14 Tariff selection). Specify the currency as text in Main menu - Primary settings - Clock, region display - Units - Currency.	-
		This parameter is read-only (see parameter 45.21 Energy calculations reset).	
	0.00 21474830.08 units	Monetary savings.	1 = 1 unit
45.08	CO2 reduction in kilotons	Reduction in CO ₂ emissions in metric kilotons compared to direct-on-line motor connection. This value is incremented when parameter 45.09 CO2 reduction in tons rolls over. This parameter is read-only (see parameter 45.21 Energy calculations reset).	-
	065535 metric	Reduction in CO ₂ emissions in metric kilotons.	1 = 1 metric
45.09	CO2 reduction in tons	Reduction in CO ₂ emissions in metric tons compared to direct-on-line motor connection. This value is calculated by multiplying the saved energy in MWh by the value of parameter 45.18 CO2 conversion factor (by default, 0.5 metric tons/MWh). When this parameter rolls over, parameter 45.08 CO2 reduction in kilotons is incremented. This parameter is read-only (see parameter 45.21 Energy calculations reset).	-
	0.0999.9 metric tons	Reduction in CO ₂ emissions in metric tons.	1 = 1 metric ton
45.10	Total saved CO2	Reduction in CO ₂ emissions in metric tons compared to direct-on-line motor connection. This value is calculated by multiplying the saved energy in MWh by the value of parameter 45.18 CO2 conversion factor (by default, 0.5 metric tons/MWh). This parameter is read-only (see parameter 45.21 Energy calculations reset).	-

No.	Name/Value	Description	Def/FbEq16
	0.0214748300.8 metric tons	Reduction in CO ₂ emissions in metric tons.	1 = 1 metric ton
45.11	Energy optimizer	Enables/disables the energy optimization function. The function optimizes the motor flux so that total energy consumption and motor noise level are reduced when the drive operates below the nominal load. The total efficiency (motor and drive) can be improved by 120% depending on load torque and speed. Note: With a permanent magnet motor or a synchronous reluctance motor, energy optimization is always enabled regardless of this parameter.	Disable
	Disable	Energy optimization disabled.	0
	Enable	Energy optimization enabled.	1
45.12	Energy tariff 1	Defines energy tariff 1 (price of energy per kWh). Depending on the setting of parameter 45.14 Tariff selection, either this value or 45.13 Energy tariff 2 is used for reference when monetary savings are calculated. Specify the currency as text in Main menu - Primary settings - Clock, region display - Units - Currency. Note: Tariffs are read only at the instant of selection, and are not applied retroactively.	0.100 units
	0.000 4294966.296 units	Energy tariff 1.	-
45.13	Energy tariff 2	Defines energy tariff 2 (price of energy per kWh). See parameter 45.12 Energy tariff 1.	0.200 units
	0.000 4294966.296 units	Energy tariff 2.	-
45.14	Tariff selection	Selects (or defines a source that selects) which pre-defined energy tariff is used. 0 = 45.12 Energy tariff 1 1 = 45.13 Energy tariff 2	Energy tariff 1
	Energy tariff 1	0.	0
	Energy tariff 2	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 <i>Terms and abbreviations</i> on page 94).	-
45.18	CO2 conversion factor	Defines a factor for conversion of saved energy into CO ₂ emissions (kg/kWh or tn/MWh).	0.500 tn/MWh (metric ton)
	0.00065.535 tn/MWh	Factor for conversion of saved energy into CO ₂ emissions.	1 = 1 tn/MWh

No.	Name/Value	Description	Def/FbEq16
45.19	Actual power that the motor absorbs when connected direct- on-line and operating the application. The value is used for reference when energy savings are calculated. Note: The accuracy of the energy savings calculation is directly dependent on the accuracy of this value. If nothing is entered here, then the nominal motor power is used by the calculation, but that may inflate the energy savings reported as many motors do not absorb nameplate power.		0.00 kW
	0.0010000000.00 kW	Motor power.	1 = 1 kW
45.21	Energy calculations reset	Resets the savings counter parameters 45.0145.10.	Done
	Done	Reset not requested (normal operation), or reset complete.	0
	Reset	Reset the savings counter parameters. The value reverts automatically to <i>Done</i> .	1

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; 1800.00 rpm (95.20 b0)
	0.1030000.00 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; 60.00 Hz (95.20 b0)
	0.101000.00 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%
	0.11000.0%	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
	0.1030000.00 kW or 0.1040200.00 hp	Power corresponding to 10000 on fieldbus.	1 = 1 unit
46.05	Current scaling	Defines the 16-bit scaling of current parameters. The value of this parameter corresponds to 10000 in fieldbus communication.	10000 A
	030000 A		

No.	Name/Value	Description	Def/FbEq16
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 020000 would correspond to a speed of 500[46.01] 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
46.11	Filter time motor speed	Defines a filter time for signals 01.01 Motor speed used and 01.02 Motor speed estimated.	500 ms
	220000 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
	220000 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
	220000 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
	220000 ms	Output power signal filter time.	1 = 1 ms
46.21	At speed hysteresis	Defines the "at setpoint" limits for speed control of the drive. When the difference between reference (22.87 Speed reference act 7) and the speed (24.02 Used 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
		24.02 (rpm)	
Drive at setpoint (06.11 bit 8 = 1)		Drive at setpoint (06.11 bit 8 = 1) 22.87 + 46.21 (rpm) 22.87 (rpm) 22.87 - 46.21 (rpm)	
		0 rpm	
	0.0030000.00 rpm	Limit for "at setpoint" indication in speed control.	See par. 46.01

No.	Name/Value	Description	Def/FbEq16
46.22	At frequency hysteresis	Defines the "at setpoint" limits for frequency control of the drive. When the absolute difference between reference (28.96 Frequency ref ramp input) 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
		01.06 (Hz)	
		Drive at setpoint (06.11 bit 8 = 1) 28.96 + 46.22 (Hz) 28.96 (Hz) 28.96 - 46.22 (Hz)	
		⊥ _{0 Hz}	
	0.001000.00 Hz	Limit for "at setpoint" indication in frequency control.	See par. 46.02
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
	0.0030000.00 rpm	"Above limit" indication trigger level for speed control.	See par. 46.01
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
	0.001000.00 Hz	"Above limit" indication trigger level for frequency control.	See par. 46.02
46.33	Above torque limit	Defines the trigger level for "above limit" indication in torque control. When actual torque exceeds the limit, bit 10 of 06.17 Drive status word 2 is set.	300.0%
	0.01600.0%	"Above limit" indication trigger level for torque control.	See par. 46.03
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
47 Data storage		Data storage parameters that can be written to and read from using other parameters' source and target settings. Note that there are different storage parameters for different data types. See also section <i>Data storage parameters</i> (page <i>90</i>).	
47.01	Data storage 1 real32	Data storage parameter 1.	0.000
	-2147483.000 2147483.000	32-bit data.	-
47.02	Data storage 2 real32	Data storage parameter 2.	0.000
	-2147483.000 2147483.000	32-bit data.	-

No.	Name/Value	Description	Def/FbEq16
47.03	Data storage 3 real32	Data storage parameter 3.	0.000
	-2147483.000 2147483.000	32-bit data.	-
47.04	Data storage 4 real32	Data storage parameter 4.	0.000
	-2147483.000 2147483.000	32-bit data.	-
47.11	Data storage 1 int32	Data storage parameter 9.	0
	-2147483648 2147483647	32-bit data.	-
47.12	Data storage 2 int32	Data storage parameter 10.	0
	-2147483648 2147483647	32-bit data.	-
47.13	Data storage 3 int32	Data storage parameter 11.	0
	-2147483648 2147483647	32-bit data.	-
47.14	Data storage 4 int32	Data storage parameter 12.	0
	-2147483648 2147483647	32-bit data.	-
47.21	Data storage 1 int16	Data storage parameter 17.	0
	-3276832767	16-bit data.	1 = 1
47.22	Data storage 2 int16	Data storage parameter 18.	0
	-3276832767	16-bit data.	1 = 1
47.23	Data storage 3 int16	Data storage parameter 19.	0
	-3276832767	16-bit data.	1 = 1
47.24	Data storage 4 int16	Data storage parameter 20.	0
	-3276832767	16-bit data.	1 = 1
		Ta	

49 Panel port communication		Communication settings for the control panel port on the drive.	
49.01	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
	132	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

No.	Io. Name/Value Description		Def/FbEq16
	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
	0.33000.0 s	Panel/PC tool communication timeout.	10 = 1 s
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
	Last speed	Drive generates an ATEE Panel loss warning and freezes the speed to the level the drive was operating at. The speed is determined on the basis of actual speed using 850 ms low-pass filtering. WARNING! Make sure that it is safe to continue operation in case of a communication break.	2
	Speed ref safe	Drive generates an A7EE Panel loss warning and sets the speed to the speed defined by parameter 22.41 Speed ref safe (or 28.41 Frequency ref safe when frequency reference is being used). WARNING! Make sure that it is safe to continue operation in case of a communication break.	3
49.06	Refresh settings	Applies the settings of parameters 49.0149.05. 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 49.0149.05. The value reverts automatically to <i>Done</i> .	1
	dbus adapter	Fieldbus communication configuration.	
(FBA)		See also chapter <i>Fieldbus control through a fieldbus adapter</i> (page <i>363</i>).	
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
		<u> </u>	L

No.	Name/Value	Description		Def/FbEq16
	Last speed	Communication break detection communication break, the drive FBA A communication) and fred drive was operating at. The spe of actual speed using 850 ms le WARNING! Make sure operation in case of a co	e generates a warning (A7C1 ezes the speed to the level the eed is determined on the basis ow-pass filtering. that it is safe to continue	2
	Speed ref safe	Speed ref safe Communication break detection active. Upon a communication break, the drive generates a warning (A7C1 FBA A communication) and sets the speed to the value defined by parameter 22.41 Speed ref safe (or 28.41 Frequency ref safe when frequency reference is being used). WARNING! Make sure that it is safe to continue operation in case of a communication break.		3
	Fault always	Drive trips on 7510 FBA A com though no control is expected f		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
50.03	FBA A comm loss t out	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.		0.3 s
	0.36553.5 s	Time delay.		1 = 1 s
50.04	FBA A ref1 type	Selects the type and scaling of fieldbus adapter A. The scaling parameters 46.0146.04, depressed type is selected by this parameters.	of the reference is defined by ending on which reference	Speed or frequency
	Speed or frequency	Type and scaling is chosen aut currently active operation mode		0
		Operation mode (see par. 19.01) Speed control Torque control Frequency control	Reference 1 type Speed Speed Frequency	
	Transparent	No scaling is applied.		1
	General	Generic reference without a sp	ecific unit.	2
	Torque	The scaling is defined by paran	neter 46.03 Torque scaling.	3
	Speed	The scaling is defined by paran	neter 46.01 Speed scaling.	4
	Frequency	The scaling is defined by paran	neter 46.02 Frequency scaling.	5

No.	Name/Value	Description		Def/FbEq16	
50.05	FBA A ref2 type	fieldbus adapter A. The scaling parameters 46.0146.04, dep	Selects the type and scaling of reference 2 received from fieldbus adapter A. The scaling of the reference is defined by parameters 46.0146.04, depending on which reference type is selected by this parameter.		
	Speed or frequency		Type and scaling is chosen automatically according to the currently active operation mode as follows:		
		Operation mode (see par. 19.01)	Reference 2 type		
		Speed control	Torque		
		Torque control	Torque		
		Frequency control	Torque		
	Transparent	No scaling is applied.		1	
	General	Generic reference without a sp	ecific unit.	2	
	Torque	The scaling is defined by parar	meter 46.03 Torque scaling.	3	
	Speed	The scaling is defined by parar	meter 46.01 Speed scaling.	4	
	Frequency	The scaling is defined by paran	meter 46.02 Frequency scaling.	5	
50.06	FBA A SW sel	Selects the source of the Status word to be sent to the fieldbus network through fieldbus adapter A.		Auto	
	Auto	Source of the Status word is ch	0		
	Transparent mode	The source selected by parametransparent source is transmitted fieldbus network through fieldbus	1		
50.07	FBA A actual 1 type	Selects the type and scaling of the fieldbus network through fit of the value is defined by parar depending on which actual valuparameter.	Speed or frequency		
	Speed or frequency		Type and scaling is chosen automatically according to the currently active operation mode as follows:		
		Operation mode (see par. 19.01)	Actual value 1 type		
		Speed control	Speed		
		Torque control	Speed		
		Frequency control	Frequency		
	Transparent	No scaling is applied.		1	
	General	Generic reference without a specific unit.		2	
	Torque	The scaling is defined by parar	meter 46.03 Torque scaling.	3	
	Speed	The scaling is defined by parar	meter 46.01 Speed scaling.	4	
	Frequency	The scaling is defined by paran	5		

No.	Name/Value	Description		Def/FbEq16
50.08	FBA A actual 2 type	Selects the type and scaling of the fieldbus network through fie of the value is defined by parar depending on which actual valu parameter.	Speed or frequency	
	Speed or frequency	Type and scaling is chosen aut currently active operation mode		0
		Operation mode (see par. 19.01)	Actual value 2 type	
		Speed control	Torque	
		Torque control	Torque	
		Frequency control	Torque	
	Transparent	No scaling is applied.		1
	General	Generic reference without a sp	ecific unit.	2
	Torque	The scaling is defined by parar	meter 46.03 Torque scaling.	3
	Speed	The scaling is defined by parar	neter 46.01 Speed scaling.	4
	Frequency	The scaling is defined by paran	neter 46.02 Frequency scaling.	5
50.09	FBA A SW transparent source	Selects the source of the fieldb parameter 50.06 FBA A SW se		Not selected
	Not selected	No source selected.	-	
	Other	Source selection (see Terms at	-	
50.10	FBA A act1 transparent source	When parameter 50.07 FBA A Transparent, this parameter sel 1 transmitted to the fieldbus net A.	Not selected	
	Not selected	No source selected.	-	
	Other	Source selection (see <i>Terms and abbreviations</i> on page 94).		-
50.11	FBA A act2 transparent source	When parameter 50.08 FBA A actual 2 type is set to Transparent, this parameter selects the source of actual value 2 transmitted to the fieldbus network through fieldbus adapter A.		Not selected
	Not selected	No source selected.		-
	Other	Source selection (see Terms at	nd abbreviations on page 94).	-
50.12	FBA A debug mode	This parameter enables debug (unmodified) data received from A in parameters 50.1350.18.	Disable	
	Disable	Debug mode disabled.		0
	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	Displays the 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.		-
	00000000h FFFFFFFh	Control word sent by master to	fieldbus adapter A.	-

No.	Name/Value Description		Def/FbEq16
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.	-
	-2147483648 2147483647	Raw REF1 sent by master to fieldbus adapter A.	-
50.15	FBA A reference 2	Displays raw (unmodified) reference REF2 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.	-
	-2147483648 2147483647	Raw REF2 sent by master to fieldbus adapter A.	-
50.16	FBA A status word	Displays the 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.	-
	00000000h FFFFFFFh	Status word sent by fieldbus adapter A to master.	-
50.17	FBA A actual value 1	Displays 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.	-
	-2147483648 2147483647	Raw ACT1 sent by fieldbus adapter A to master.	-
50.18	FBA A actual value 2	Displays raw (unmodified) actual value ACT2 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.	-
	-2147483648 2147483647	Raw ACT2 sent by fieldbus adapter A to master.	-
51 FBA	A A settings	Fieldbus adapter A configuration.	
51.01	FBA A type	Displays the 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; 37 = DeviceNet; 128 = Ethernet; 132 = PROFInet IO; 135 = EtherCAT; 136 = ETH Pwrlink; 485 = RS-485 comm; 101 = ControlNet; 47808 = BACnet. This parameter is read-only.	-
51.02	FBA A Par2	Parameters 51.0251.26 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.	-
	065535	Fieldbus adapter configuration parameter.	1 = 1
51.26	FBA A Par26	See parameter 51.02 FBA A Par2.	-
	065535	Fieldbus adapter configuration parameter.	1 = 1

No.	No. Name/Value Description		Def/FbEq16	
51.27	FBA A par refresh	Validates any changed fieldbus adapter module configuration settings. After refreshing, the value reverts automatically to <i>Done</i> . Note: This parameter cannot be changed while the drive is	Done	
		running.		
	Done	Refreshing done.	0	
	Configure	Refreshing.	1	
51.28	FBA A par table ver	Displays the 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.	-	
		Parameter table revision of adapter module.	-	
51.29	FBA A drive type code	Displays the drive type code in the fieldbus adapter module mapping file (stored in the memory of the drive). This parameter is read-only.	-	
	065535	Drive type code stored in the mapping file.	1 = 1	
51.30	FBA A mapping file ver	Displays the fieldbus adapter module mapping file revision stored in the memory of the drive in decimal format. This parameter is read-only.	-	
	065535	Mapping file revision.	1 = 1	
51.31	D2FBA A comm status	Displays the status of the fieldbus adapter module communication.	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	Displays the 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.		
		Common program revision of adapter module.	-	
51.33	FBA A appl SW ver	Displays the 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.		
		Application program version of adapter module.	-	

No.	Name/Value	Description	Def/FbEq16
52 FB	A 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 52.0152.12 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
	Reserved		710
	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		1723
	SW2 16bit	Status Word 2 (16 bits)	24
	Other	Source selection (see <i>Terms and abbreviations</i> on page 94).	-
52.12	FBA A data in12	See parameter 52.01 FBA A data in1.	None
53 FB	A 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 53.0153.12 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
	Reserved		710
	CW 32bit	Control Word (32 bits)	11
	Ref1 32bit	Reference REF1 (32 bits)	12
	Ref2 32bit	Reference REF2 (32 bits)	13
	Reserved		1420
	CW2 16bit	Control Word 2 (16 bits)	21

No.	Name/Value	Description	
	Other	Source selection (see <i>Terms and abbreviations</i> on page 94).	-
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 <i>Fieldbus control through the embedded fieldbus interface (EFB)</i> (page 335).	
58.01	Protocol	Enables/disables the embedded fieldbus interface and selects the protocol to use.	None
	None	None (communication disabled).	0
	Modbus RTU	Embedded fieldbus interface is enabled and is used for Modbus RTU protocol.	1
	IPC communication	Embedded fieldbus interface is enabled and is used for IPC communication.	4
58.02	Protocol ID	Displays the 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 1247 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
	0255	Node address (values 1247 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 58.0158.05, 58.1458.17, 58.25, 58.2858.34) and takes changed EFB configuration settings in use. Reverts automatically to <i>Enabled</i> .	1
	Silent mode	Activates silent mode (no messages are transmitted). Silent mode can be terminated by activating the <i>Refresh settings</i> selection of this parameter.	2
58.07	Communication diagnostics	Displays the status of the EFB communication. This parameter is read-only. Note that the name is only visible when the error is present (bit value is 1).	-

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)	
1214	Reserved		

	0000hFFFFh	EFB communication status.	1 = 1
58.08	Received packets	Displays 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.	-
	04294967295	Number of received packets addressed to the drive.	1 = 1
58.09	Transmitted packets	Displays 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.	-
	04294967295	Number of transmitted packets.	1 = 1
58.10	All packets	Displays 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.	-
	04294967295	Number of all received packets.	1 = 1

No.	Name/Value	Description	Def/FbEq16
58.11	UART errors	Displays 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.	-
	04294967295	Number of UART errors.	1 = 1
58.12	CRC errors	Displays 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.	-
	04294967295	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.	Fault
	No action	No action taken (monitoring disabled).	0
	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
	Last speed	Drive generates an A7CE EFB comm loss warning and freezes the speed to the level the drive was operating at. The speed is determined on the basis of actual speed using 850 ms low-pass filtering. This occurs if control or reference is expected from the EFB. WARNING! Make sure that it is safe to continue operation in case of a communication break.	2
	Speed ref safe	Drive generates an A7CE EFB comm loss warning and sets the speed to the speed defined by parameter 22.41 Speed ref safe (or 28.41 Frequency ref safe when frequency reference is being used). This occurs if control or reference is expected from the EFB. WARNING! Make sure that it is safe to continue operation in case of a communication break.	3
	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.	Cw / Ref1 / Ref2
	Any message	Any message addressed to the drive resets the timeout.	1

No.	Name/Value	Description		Def/FbEq16	
	Cw / Ref1 / Ref2	A write of the control word or a	reference resets the timeout.	2	
58.16	Communication loss time	break lasts longer than the time parameter 58.14 Communication Changes to this parameter take rebooted or the new settings von Communication control (Refres	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.		
	0.06000.0 s	EFB communication timeout.		1 = 1	
58.17	Transmit delay	Defines a minimum response of delay imposed by the protocol. Changes to this parameter take rebooted or the new settings va Communication control (Refres	e effect after the control unit is alidated by parameter 58.06	0 ms	
	065535 ms	Minimum response delay.		1 = 1	
58.18	EFB control word	Displays the raw (unmodified) s the Modbus controller. For deb This parameter is read-only.		-	
	0000hFFFFh	Control word sent by Modbus of	controller to the drive.	1 = 1	
58.19	EFB status word	Displays the raw (unmodified) purposes. This parameter is read-only.	• •		
	0000hFFFFh	Status word sent by the drive to	the Modbus controller.	1 = 1	
58.25	Control profile	Changes to this parameter take rebooted or the new settings varieties.	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).		
	ABB Drives	ABB Drives control profile (with	a 16-bit control word)	0	
	DCU Profile	DCU control profile (with a 16 o	or 32-bit control word)	5	
58.26	EFB ref1 type	Selects the type and scaling of the embedded fieldbus interfac The scaled reference is display	e.	Speed or frequency	
	Speed or frequency	Type and scaling is chosen aut currently active operation mode		0	
		Operation mode (see par. 19.01)	Reference 1 type		
		Speed control	Speed		
		Torque control Frequency control	Speed Frequency		
		r requericy control	Trequency		
	Transparent	No scaling is applied.	1		
	General	Generic reference without a specific unit. Scaling: 1 = 100.		2	
	Reserved		3		
	Speed	Speed reference. The scaling is Speed scaling.	4		
	Frequency	Frequency reference. The scal 46.02 Frequency scaling.	ing is defined by parameter	5	

No.	Name/Value	Description	Def/FbEq16	
58.27	EFB ref2 type	Selects the type and scaling of the embedded fieldbus interfac The scaled reference is display		
58.28	EFB act1 type	Selects the type of actual value 1.		Speed or frequency
	Speed or frequency	Type and scaling is chosen aut currently active operation mode		0
		Operation mode (see par. 19.01)	Actual 1 type	
		Speed control	Speed	
		Torque control	Speed	
		Frequency control	Frequency	
	Transparent	No scaling is applied.		1
	General	Generic reference without a sp	ecific unit. Scaling: 1 = 100.	2
	Reserved			3
	Speed	Scaling is defined by paramete	r 46.01 Speed scaling.	4
	Frequency	Scaling is defined by paramete	r 46.02 Frequency scaling.	5
58.29	EFB act2 type	Selects the type of actual value For the selections, see parame		Transparent
58.31	EFB act1 transparent source	Selects the source of actual va EFB act1 type is set to Transpa	Not selected	
	Not selected	None.		0
	Other	Source selection (see Terms a	nd abbreviations on page 94).	-
58.32	EFB act2 transparent source	Selects the source of actual value 2 when parameter 58.29 EFB act2 type is set to Transparent.		Other (par. 01.07 Motor current)
Not selected N		None.		0
	Other	Source selection (see Terms at	nd abbreviations on page 94).	-
58.33	Addressing mode	Defines the mapping between parameters and holding registers in the 400101465535 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 199. indexes 199): Register address = 400000 + 100 × parameter group + parameter index. For example, parameter 22.80 would be mapped to register 400000 + 2200 + 80 = 402280. 32-bit values (groups 199, indexes 199): Register address = 420000 + 200 × parameter group + 2 × parameter index. For example, parameter 22.80 would be mapped to register 420000 + 4400 + 160 = 424560.		0	
	Mode 1	16-bit values (groups 1255, indexes 1255): Register address = 400000 + 256 × parameter group + parameter index. For example, parameter 22.80 would be mapped to register 400000 + 5632 + 80 = 405712.		1
	Mode 2 32-bit values (groups 1127, indexes 1255): Register address = 400000 + 512 × parameter group + 2 × parameter index. For example, parameter 22.80 would be mapped to register 400000 + 11264 + 160 = 411424.			2

No.	Name/Value	Description	Def/FbEq16
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	LO-HI
		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).	
	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
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 <i>None</i> .	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		710
	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		1720
	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		2530
	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		3439
	Feedback data storage	Parameter 40.91 Feedback data storage.	40

No.	Name/Value	Description	Def/FbEq16
	Setpoint data storage	Parameter 40.92 Setpoint data storage.	41
	Other	Source selection (see <i>Terms and abbreviations</i> on page 94).	-
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.	Ref1 16bit
		For the selections, see parameter 58.101 Data I/O 1.	
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.	SW 16bit
		For the selections, see parameter 58.101 Data I/O 1.	
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

71 Ext	ernal PID1	Configuration of external PID.	
71.01	External PID act value	See parameter 40.01 Process PID output actual.	-
71.02	Feedback act value	See parameter 40.02 Process PID feedback actual.	-
71.03	Setpoint act value	See parameter 40.03 Process PID setpoint actual.	-
71.04	Deviation act value	See parameter 40.04 Process PID deviation actual.	-

No.	Name/Value		Description		Def/FbEq16		
71.06	PID status word			ys status information on process external PID control. arameter is read-only.	-		
	Bit	Name		Value			
	0	0 PID active		1 = Process PID control active.			
	1	Reserved					
	2	Output frozen		1 = Process PID controller output frozen. Bit is set if parameter 71.38 Output freeze enable is TRUE, or the deadband function is active (bit 9 is set).			
	36						
	7	Output limit high		1 = PID output is being limited by par. 40.37.			
	8	Output limit low		1 = PID output is being limited by par. 40.36.			
	9	Deadband active		1 = Deadband is active.			
	1011	Reserved					
	12	Internal setpoint active		1 = Internal setpoint active (see par. 40.1640.16)			
	1315	Reserved					
	0000h	.FFFFh	Proces	ss PID control status word.	1 = 1		
71.07	PID ope	eration mode	See pa	arameter 40.07 Process PID operation mode.	Off		
71.08		ck 1 source	See parameter 40.08 Set 1 feedback 1 source.		Al2 percent		
71.11	Feedba	ck filter time	See pa	See parameter 40.11 Set 1 feedback filter time.			
71.14	Setpoint scaling		general scaling setpoir used a parame nominal In effect deviation Note: 71.15. the sar	s, together with parameter 71.15 Output scaling, a ll scaling factor for the external PID control chain. The is can be utilized when, for example, the process it is input in Hz, and the output of the PID controller is an rpm value in speed control. In this case, this eter might be set to 50, and parameter 71.15 to the all motor speed at 50 Hz. Let, the output of the PID controller [71.15] when on (setpoint - feedback) = [71.14] and [71.32] = 1. The scaling is based on the ratio between 71.14 and For example, the values 50 and 1500 would produce the scaling as 1 and 3.	1500.00		
	-32768.0 32767.0		Proces	s setpoint base.	1 = 1		
71.15	Output s	scaling	See pa	See parameter 71.14 Setpoint scaling.			
	-32768.0 32767.0						
71.16	Setpoint	t 1 source	See pa	See parameter 40.16 Set 1 setpoint 1 source.			
71.19	Internal sel1	setpoint	See pa	See parameter 40.19 Set 1 internal setpoint sel1.			
71.20	Internal sel2	setpoint	See pa	arameter 40.20 Set 1 internal setpoint sel2.	Not selected		
71.21	Internal	Internal setpoint 1 See parameter 40.21 Set 1 internal setpoint 1.			0.00 PID customer units		
71.22	Internal	setpoint 2	See pa	arameter 40.22 Set 1 internal setpoint 2.	0.00 PID customer units		

No.	Name/Value	Description	Def/FbEq16
71.23	Internal setpoint 3	See parameter 40.23 Set 1 internal setpoint 3.	0.00 PID customer units
71.26	Setpoint min	See parameter 40.26 Set 1 setpoint min.	0.00
71.27	Setpoint max	See parameter 40.27 Set 1 setpoint max.	32767.00
71.31	Deviation inversion	See parameter 40.31 Set 1 deviation inversion.	Not inverted (Ref - Fbk)
71.32	Gain	See parameter 40.32 Set 1 gain.	1.00
71.33	Integration time	See parameter 40.33 Set 1 integration time.	60.0 s
71.34	Derivation time	See parameter 40.34 Set 1 derivation time.	0.000 s
71.35	Derivation filter time	See parameter 40.35 Set 1 derivation filter time.	0.0 s
71.36	Output min	See parameter 40.36 Set 1 output min.	-32768.0
71.37	Output max	See parameter 40.37 Set 1 output max.	32767.0
71.38	Output freeze enable	See parameter 40.38 Set 1 output freeze.	Not selected
71.39	Deadband range	The control program compares the absolute value of parameter 71.04 Deviation act value to the deadband range defined by this parameter. If the absolute value is within the deadband range for the time period defined by parameter 71.40 Deadband delay, PID's deadband mode is activated and 71.06 PID status word bit 9 Deadband active is set. Then PID's output is frozen and 71.06 PID status word bit 2 Output frozen is set. If the absolute value is equal or greater than the deadband range, PID's deadband mode is deactivated.	0.0
	0.032767.0	Range	1 = 1
71.40	Deadband delay	Defines the deadband delay for the deadband function. See parameter 71.39 Deadband range.	0.0 s
	0.03600.0 s	Delay	1 = 1 s
71.58	Increase prevention	See parameter 40.58 Set 1 increase prevention.	No
71.59	Decrease prevention	See parameter 40.59 Set 1 decrease prevention.	No
71.62	Internal setpoint actual	See parameter 40.62 PID internal setpoint actual.	-

No.	Name/	me/Value Description			Def/FbEq16		
76 Multipump configuration			See sections Inte	juration parameters. Illigent pump control (IPC) on page 59 and trol (PFC) on page 62. is supported only with option +N845 and 2.01.100.12.			
76.01	PFC status		Displays the running/stopped status of the PFC motors. PFC1, PFC2, PFC3, PFC4, PFC5 and PFC6 always correspond to the 1st6th motor of the PFC system. If 76.74 Autochange auxiliary PFC auxiliary PFC is set to Aux motors only, PFC1 represents the motor connected to the drive and PFC2 the first auxiliary motor (the 2nd motor of the system). If 76.74 is set to All motors, PFC1 is the first motor, PFC2 the 2nd. The drive can be connected to any of these motors depending on the Autochange functionality.		-		
	Bit	Name		Value			
	0	PFC 1 runr	nina	0 = Stop, 1 = Start			
	1	PFC 2 runr	0	0 = Stop, 1 = Start			
	2	PFC 3 runr		0 = Stop, 1 = Start			
	3	PFC 4 runr		0 = Stop, 1 = Start			
	4	PFC 5 runr	U	0 = Stop, 1 = Start			
	5	PFC 6 runr		0 = Stop, 1 = Start			
	615	<u> </u>					
	0000h.	FFFFh	Status of the PF0	C relay outputs.	1 = 1		
76.02	Multipu status			us of multipump system in text form.	PFC disabled		
76.11	Pump status 1		Shows the status of pump or fan 1.		-		
	Bit	Name		Value			
	0	Ready		0 = False, 1 = True			
	1	CRC mism	atch	0 = False, 1 = True			
	2	Running		0 = False, 1 = True			
	34	Reserved					
	5	In PFC control		0 = False, 1 = True			
	6	In IPC control		0 = False, 1 = True			
	7	Master ena	ble	0 = False, 1 = True			
	8	Active mas	ter	0 = False, 1 = True			
	910	Reserved		•			
	11	Interlocked		0 = False, 1 = True			
	12	Local mode		0 = False, 1 = True			
	13	Reserved					
	14	Drive start active		0 = False, 1 = True			
	15	15 Max stationary time elapsed		0 = False, 1 = True			
	0000h.	FFFFh	Status of pump 1.		1 = 1		
76.12	Pump s	status 2	See parameter 7	6.11 Pump status 1.	-		
76.13	Pump s	status 3	See parameter 7	6.11 Pump status 1.	-		
76.14	Pump status 4 S		1	6.11 Pump status 1.	i		

No.	Name/Value	Description	Def/FbEq16
76.15	Pump status 5	See parameter 76.11 Pump status 1.	-
76.16	Pump status 6	See parameter 76.11 Pump status 1.	-
76.17	Pump status 7	See parameter 76.11 Pump status 1.	-
76.18	Pump status 8	See parameter 76.11 Pump status 1.	-
76.21	Multipump configuration	Selects the multipump mode.	Off
	Off	All multipump control modes are disabled.	0
	IPC	IPC enabled. See Intelligent pump control (IPC) on page 59.	1
	PFC	PFC enabled. One pump at a time is controlled by the drive. The remaining pumps are direct-on-line pumps that are started and stopped by the drive logic The frequency (group 28 Frequency reference chain) / speed (group 22 Speed reference selection) reference must be defined as PID for the PFC functionality to work properly.	2
	SPFC	SPFC enabled. See section Soft pump control (SPFC) on page 63.	3
76.22	Multipump node number	Node number of the drive on inverter-to-inverter link. Note: Each drive on the link has a unique node number. If the drive is not given a priority class, the node number is also used in determining the starting order of the pumps.	1
	18	IPC node number.	
76.23	Master enable	Selects if this pump operate as a master drive of the IPC system. The master drive must have sensor connection in order to control the process.	Selected
	Not selected	The drive can only be a follower on a inverter-to-inverter link.	
	Selected	The drive can be a master on a inverter-to-inverter link.	
76.25	Number of motors	Total number of motors used in the application, including the motor connected directly to the drive.	1
	18	Number of motors.	1 = 1
76.26	Min number of motors allowed	Minimum number of motors running simultaneously.	1
	08	Minimum number of motors.	1 = 1
76.27	Max number of motors allowed	Maximum number of motors running simultaneously.	1
	18	Maximum number of motors.	1 = 1

No.	Name/Value	Description	Def/FbEq16
76.30	Start speed 1	Defines the start speed (Hz/rpm) for the first follower pump/auxiliary motor. As the motor speed or frequency exceeds the limit defined by this parameter, a new follower pump/auxiliary motor is started. To avoid nuisance starts of the follower pump/second auxiliary motor, the speed of the variable speed motor should be higher than the start speed for the duration defined by parameter 76.55 Start delay. If the speed decreases below the start speed, the follower pump/auxiliary motor is not started. To maintain the process conditions during the start of the second auxiliary motor, a speed hold on time can be defined with parameter 76.57 PFC speed hold on. Certain pump types do not produce significant flow with low frequencies. The speed hold on time can be used to compensate the time needed to accelerate the second auxiliary motor to a speed where it produces flow. The start of the second auxiliary motor is not aborted if the speed of the first auxiliary motor decreases	Vector: 1300 rpm; Scalar 48 Hz; 58 Hz (95.20 b0)
	Speed	, 76.55	
	76.30 76.41 Min. speed ON OFF ON OFF	76.57 76.58 Tim Increasing flow Decreasing flow	3
	0 22767 rpm/Uz	Stop IIIOW	1 = 1 unit
76.31	032767 rpm/Hz	Speed/frequency.	1 = 1 unit
10.31	Start speed 2	Defines the start speed (Hz/rpm) for the second follower pump/auxiliary motor. See parameter 76.30 Start speed 1.	Vector: 1300 rpm; Scalar 48 Hz; 58 Hz (95.20 b0)
76.32	Start speed 3	Defines the start speed (Hz/rpm) for the third follower pump/auxiliary motor. See parameter 76.30 Start speed 1.	Vector: 1300 rpm; Scalar 48 Hz; 58 Hz (95.20 b0)

No.	Name/Value	Description	Def/FbEq16
76.33	Start speed 4	Defines the start speed (Hz/rpm) for the fourth follower pump/auxiliary motor. See parameter 76.30 Start speed 1.	Vector: 1300 rpm; Scalar 48 Hz; 58 Hz (95.20 b0)
76.34	Start speed 5	Defines the start speed (Hz/rpm) for the fifth follower pump/auxiliary motor. See parameter 76.30 Start speed 1.	Vector: 1300 rpm; Scalar 48 Hz; 58 Hz (95.20 b0)
76.35	Start speed 6	Defines the start speed (Hz/rpm) for the sixth follower pump/auxiliary motor. See parameter 76.30 Start speed 1.	Vector: 1300 rpm; Scalar 48 Hz; 58 Hz (95.20 b0)
76.36	Start speed 7	Defines the start speed (Hz/rpm) for the seventh follower pump/auxiliary motor. See parameter 76.30 Start speed 1.	Vector: 1300 rpm; Scalar 48 Hz; 58 Hz (95.20 b0)
76.41	Stop speed 1	Defines the stop speed (Hz/rpm) for the first follower pump/auxiliary motor. When the speed of the motor connected directly to the drive falls below this value and follower pump/one auxiliary motor is running, the stop delay defined by parameter 76.56 Stop delay is started. If the speed is still at the same level or lower when the stop delay elapses, the first follower pump/auxiliary motor stops. The running speed of the drive is increased by [Start speed 1 - Stop speed 1] after the follower pump/auxiliary motor stops.	Vector: 800 rpm; Scalar 25 Hz; 30 Hz (95.20 b0)
	032767 rpm/Hz	Speed/frequency	1 = 1 unit
76.42	Stop speed 2	Defines the stop speed (Hz/rpm) for the second follower pump/auxiliary motor. See parameter 76.41 Stop speed 1.	Vector: 800 rpm; Scalar 25 Hz; 30 Hz (95.20 b0)
76.43	Stop speed 3	Defines the stop speed (Hz/rpm) for the third follower pump/auxiliary motor. See parameter 76.41 Stop speed 1.	Vector: 800 rpm; Scalar 25 Hz; 30 Hz (95.20 b0)
76.44	Stop speed 4	Defines the stop speed (Hz/rpm) for the fourth follower pump/auxiliary motor. See parameter 76.41 Stop speed 1.	Vector: 800 rpm; Scalar 25 Hz; 30 Hz (95.20 b0)
76.45	Stop speed 5	Defines the stop speed (Hz/rpm) for the fifth follower pump/auxiliary motor. See parameter 76.41 Stop speed 1.	Vector: 800 rpm; Scalar 25 Hz; 30 Hz (95.20 b0)
76.46	Stop speed 6	Defines the stop speed (Hz/rpm) for the sixth follower pump/auxiliary motor. See parameter 76.41 Stop speed 1.	Vector: 800 rpm; Scalar 25 Hz; 30 Hz (95.20 b0)

30 Hz	No.	Name/Value	Description	Def/FbEq16
76.30 Start speed 1. 1 = 1 s 76.56 Stop delay Defines a stop delay for auxiliary motors. See parameter 76.41 Stop speed 1. 0.0012600.00 s Time delay. 1 = 1 s 76.57 PFC speed hold on Hold time for auxiliary motor switch-on. See parameter 76.30 Start speed 1. 0.001000.00 s Time. 1 = 1 s 76.58 PFC speed hold off Stop speed 1. 1 = 1 s 76.59 PFC contactor delay Start delay for the motor that is directly controlled by the drive. This does not affect the starting of the auxiliary motors. WARNING! There must always be a delay set if the motors are equipped with star-delta starters. The delay must be set longer than the time setting of the starter, and then back to delta before the motor is connected to the drive. 1 = 1 s 76.60 PFC ramp acceleration time 76.61 PFC ramp deceleration time 76.62 PFC ramp deceleration time 76.63 PFC ramp deceleration time 76.64 PFC ramp deceleration time 76.65 PFC ramp deceleration time 76.66 PFC ramp deceleration time 76.67 PFC ramp deceleration time 76.68 PFC ramp deceleration time 76.69 PFC ramp deceleration time 76.60 PFC ramp deceleration time 76.61 PFC ramp deceleration time 76.62 PFC ramp deceleration time 76.63 PFC ramp deceleration time 76.64 PFC ramp deceleration time 76.65 PFC ramp deceleration time 76.66 PFC ramp deceleration time 76.67 PFC ramp deceleration time 76.68 PFC ramp deceleration time 76.69 PFC ramp deceleration time 76.60 PFC ramp deceleration time 76.61 PFC ramp deceleration time 76.62 PFC ramp deceleration time 76.63 PFC ramp deceleration time 76.64 PFC ramp deceleration time 76.65 PFC ramp deceleration time the the drive motor to accelerate after an autochange has occurred. 76.66 The parameter sets the ramp-up time as seconds from maximum to zero frequency (not from the previous reference to the new reference). 76.67 PFC ramp deceleration time 76.68 PFC ramp deceleration time the deceleration time for the drive motor speed compensation, when an auxiliary motor is started. This ramp time is also used for the drive				800 rpm; Scalar 25 Hz;
76.56 Stop delay Defines a stop delay for auxiliary motors. See parameter 76.41 Stop speed 1. Time delay. 1 = 1 s 76.57 PFC speed hold on Hold time for auxiliary motor switch-on. See parameter 76.30 0.00 s Start speed 1. 1 = 1 s 1 = 1 s 76.58 PFC speed hold off Hold time for auxiliary motor switch-off. See parameter 76.41 0.00 s Stop speed 1. 0.001000.00 s Time. 76.59 PFC contactor delay WARNING1 There must laways be a delay set if the motors are equipped with star-delta starters. The delay must be set longer than the time setting of the starter. After the motor is switched on by the relay output of the drive, there must be enough time for the star-delta starter to first switch to star and then back to delta before the motor is connected to the drive. Time delay. Defines the acceleration time for the drive motor is speed compensation, when an auxiliary motor is stopped. This ramp time is also used for the drive motor to accelerate after an autochange has occurred. The parameter sets the ramp-up time as seconds from zero to maximum frequency (not from the previous reference to the new reference). 76.61 PFC ramp deceleration time Defines the deceleration time for the drive motor is started. This ramp time is also used for the drive motor to accelerate after an autochange has occurred. The parameter sets the ramp-up time as seconds from zero to maximum frequency (not from the previous reference to the new reference). Defines the deceleration time for the drive motor is started. This ramp time is also used for the drive motor to decelerate after an autochange has occurred. The parameter sets the ramp-up time as seconds from maximum to zero frequency (not from the previous reference to the new reference). Defines the ramp time of a new starting pump. A pump that is started by current master follows the speed until all the pumps rotate at the same speed and master role is changed. The smooth acceleration time must be longer than the time defined with parameter 40.33 Set 1 integration time	76.55	Start delay		10.00 s
76.41 Stop speed 1. 76.57 PFC speed hold on Hold time for auxiliary motor switch-on. See parameter 76.30 start speed 1. 76.58 PFC speed hold off Stop speed 1. 76.59 PFC contactor delay 76.59 PFC contactor delay 76.59 PFC contactor delay 76.50 PFC contactor delay 76.60 PFC ramp acceleration time 76.60 PFC ramp deceleration time 76.61 PFC ramp deceleration time 76.62 PFC ramp deceleration time 76.63 PFC ramp deceleration time 76.64 PFC ramp deceleration time 76.65 Defines the deceleration time for the drive motor speed compensation, when an auxiliary motor is stopped. This ramp time is also used for the drive motor to accelerate after an autochange has occurred. 76.61 PFC ramp deceleration time 76.62 PFC ramp deceleration time 76.63 PFC ramp deceleration time 76.64 PFC ramp deceleration time 76.65 Defines the deceleration time for the drive motor speed compensation, when an auxiliary motor is started. This ramp time is also used for the drive motor to accelerate after an autochange has occurred. 76.66 The parameter sets the ramp-up time as seconds from maximum to zero frequency (not from the previous reference to the new reference). 76.62 PFC smooth acceleration time 76.63 PFC smooth acceleration time for the drive motor becelerated after an autochange has occurred. 76.64 PFC smooth acceleration time acceleration time 76.65 PFC smooth acceleration time acceleration time 76.66 PFC smooth acceleration time acceleration time 76.67 PFC smooth acceleration time acceleration time being time the starter being time the starter being time the starter being time the stop time the starter being time the starter being time the starter		0.0012600.00 s	Time delay.	1 = 1 s
Telegraph Time Telegraph Telegrap	76.56	Stop delay		10.00 s
Time. 1 = 1 s 76.59 PFC contactor delay Start speed 1. 0.001000.00 s Time. 1 = 1 s 76.59 PFC contactor delay Start delay for the motor that is directly controlled by the drive. This does not affect the starting of the auxiliary motors. WARNING! There must always be a delay set if the motor is acceleration time of the drive, there must be enough time for the starter. The delay must be set longer than the time setting of the starter. After the motor is switched on by the relay output of the drive, there must be enough time for the star-delta starter to first switch to star and then back to delta before the motor is connected to the drive. 0.20600.00 s Time delay. 1 = 1 s Defines the acceleration time for the drive motor speed compensation, when an auxiliary motor is stopped. This ramp time is also used for the drive motor to accelerate after an autochange has occurred. The parameter sets the ramp-up time as seconds from zero to maximum frequency (not from the previous reference to the new reference). 1 = 1 s 76.61 PFC ramp deceleration time Defines the deceleration time for the drive motor speed compensation, when an auxiliary motor is started. This ramp time is also used for the drive motor to accelerate after an autochange has occurred. The parameter sets the ramp-up time as seconds from maximum to zero frequency (not from the previous reference to the new reference). 1 = 1 s 76.61 PFC ramp deceleration time On the drive motor to decelerate after an autochange has occurred. The parameter sets the ramp-up time as seconds from maximum to zero frequency (not from the previous reference to the new reference). 1 = 1 s 76.62 IPC smooth acceleration time One the drive motor to decelerate after an autochange has occurred. The parameter sets the ramp-up time as seconds from maximum to zero frequency (not from the previous reference to the new reference). 1 = 1 s 76.62 IPC smooth acceleration time of a new starting pump. A pump that is started by current master follows the speed until all the pumps		0.0012600.00 s	Time delay.	1 = 1 s
76.58 PFC speed hold off Stop speed 1. 0.00 s 1 = 1 s	76.57	PFC speed hold on		0.00 s
Stop speed 1. 0.001000.00 s Time. 1 = 1 s		0.001000.00 s	Time.	1 = 1 s
Start delay for the motor that is directly controlled by the drive. This does not affect the starting of the auxiliary motors. MARNING! There must always be a delay set if the motor sare equipped with star-delta starters. The delay must be set longer than the time setting of the starter. After the motor is switched on by the relay output of the drive, there must be enough time for the star-delta starter to first switch to star and then back to delta before the motor is connected to the drive. 1 = 1 s 76.60 PFC ramp acceleration time Defines the acceleration time for the drive motor speed compensation, when an auxiliary motor is stopped. This ramp time is also used for the drive motor to accelerate after an autochange has occurred. The parameter sets the ramp-up time as seconds from zero to maximum frequency (not from the previous reference to the new reference). Defines the deceleration time for the drive motor speed compensation, when an auxiliary motor is started. This ramp time is also used for the drive motor to decelerate after an autochange has occurred. The parameter sets the ramp-up time as seconds from maximum to zero frequency (not from the previous reference to the new reference). Defines the ramp time of a new starting pump. A pump that is started by current master follows the speed until all the pumps rotate at the same speed and master role is changed. The smooth acceleration time must be longer than the time defined with parameter 40.33 Set 1 integration time. Note: Quick ramp overrides the smooth ramp. See parameter group 82 Pump protections on page 259.	76.58	PFC speed hold off		0.00 s
This does not affect the starting of the auxiliary motors. MARNING! There must always be a delay set if the motors are equipped with star-delta starters. The delay must be set longer than the time setting of the starter. After the motor is switched on by the relay output of the drive, there must be enough time for the star-delta starter to first switch to star and then back to delta before the motor is connected to the drive. 1 = 1 s 76.60 PFC ramp acceleration time Defines the acceleration time for the drive motor speed compensation, when an auxiliary motor is stopped. This ramp time is also used for the drive motor to accelerate after an autochange has occurred. The parameter sets the ramp-up time as seconds from zero to maximum frequency (not from the previous reference to the new reference). Defines the deceleration time for the drive motor speed compensation, when an auxiliary motor is started. This ramp time is also used for the drive motor speed compensation, when an auxiliary motor is started. This ramp time is also used for the drive motor to decelerate after an autochange has occurred. The parameter sets the ramp-up time as seconds from maximum to zero frequency (not from the previous reference to the new reference). 1 = 1 s 76.62 IPC smooth acceleration time Defines the ramp time of a new starting pump. A pump that is started by current master follows the speed until all the pumps rotate at the same speed and master role is changed. The smooth acceleration time must be longer than the time defined with parameter 40.33 Set 1 integration time. Note: Quick ramp overrides the smooth ramp. See parameter group 82 Pump protections on page 259.		0.001000.00 s	Time.	1 = 1 s
Defines the acceleration time for the drive motor speed compensation, when an auxiliary motor is stopped. This ramp time is also used for the drive motor to accelerate after an autochange has occurred. The parameter sets the ramp-up time as seconds from zero to maximum frequency (not from the previous reference to the new reference). Defines the deceleration time for the drive motor speed compensation, when an auxiliary motor is started. This ramp time is also used for the drive motor to decelerate after an autochange has occurred. The parameter sets the ramp-up time as seconds from maximum to zero frequency (not from the previous reference to the new reference). Defines the ramp time of a new starting pump. A pump that is started by current master follows the speed until all the pumps rotate at the same speed and master role is changed. The smooth acceleration time must be longer than the time defined with parameter 40.33 Set 1 integration time. Note: Quick ramp overrides the smooth ramp. See parameter group 82 Pump protections on page 259.	76.59		This does not affect the starting of the auxiliary motors. WARNING! There must always be a delay set if the motors are equipped with star-delta starters. The delay must be set longer than the time setting of the starter. After the motor is switched on by the relay output of the drive, there must be enough time for the star-delta starter to first switch to star and then back to delta before the motor	0.50 s
compensation, when an auxiliary motor is stopped. This ramp time is also used for the drive motor to accelerate after an autochange has occurred. The parameter sets the ramp-up time as seconds from zero to maximum frequency (not from the previous reference to the new reference). 76.61 PFC ramp deceleration time Defines the deceleration time for the drive motor speed compensation, when an auxiliary motor is started. This ramp time is also used for the drive motor to decelerate after an autochange has occurred. The parameter sets the ramp-up time as seconds from maximum to zero frequency (not from the previous reference to the new reference). 76.62 IPC smooth acceleration time Defines the ramp time of a new starting pump. A pump that is started by current master follows the speed until all the pumps rotate at the same speed and master role is changed. The smooth acceleration time must be longer than the time defined with parameter 40.33 Set 1 integration time. Note: Quick ramp overrides the smooth ramp. See parameter group 82 Pump protections on page 259.		0.20600.00 s	Time delay.	1 = 1 s
Defines the deceleration time for the drive motor speed compensation, when an auxiliary motor is started. This ramp time is also used for the drive motor to decelerate after an autochange has occurred. The parameter sets the ramp-up time as seconds from maximum to zero frequency (not from the previous reference to the new reference). Defines the ramp time of a new starting pump.	76.60		compensation, when an auxiliary motor is stopped. This ramp time is also used for the drive motor to accelerate after an autochange has occurred. The parameter sets the ramp-up time as seconds from zero to maximum frequency (not from the previous reference to	1.00 s
deceleration time compensation, when an auxiliary motor is started. This ramp time is also used for the drive motor to decelerate after an autochange has occurred. The parameter sets the ramp-up time as seconds from maximum to zero frequency (not from the previous reference to the new reference). 76.62 IPC smooth acceleration time Defines the ramp time of a new starting pump. A pump that is started by current master follows the speed until all the pumps rotate at the same speed and master role is changed. The smooth acceleration time must be longer than the time defined with parameter 40.33 Set 1 integration time. Note: Quick ramp overrides the smooth ramp. See parameter group 82 Pump protections on page 259.		0.001800.00 s	Time.	1 = 1 s
76.62 IPC smooth acceleration time Defines the ramp time of a new starting pump. A pump that is started by current master follows the speed until all the pumps rotate at the same speed and master role is changed. The smooth acceleration time must be longer than the time defined with parameter 40.33 Set 1 integration time. Note: Quick ramp overrides the smooth ramp. See parameter group 82 Pump protections on page 259.	76.61		compensation, when an auxiliary motor is started. This ramp time is also used for the drive motor to decelerate after an autochange has occurred. The parameter sets the ramp-up time as seconds from maximum to zero frequency (not from the previous reference	1.00 s
A pump that is started by current master follows the speed until all the pumps rotate at the same speed and master role is changed. The smooth acceleration time must be longer than the time defined with parameter 40.33 Set 1 integration time. Note: Quick ramp overrides the smooth ramp. See parameter group 82 Pump protections on page 259.		0.001800.00 s	Time.	1 = 1 s
3.001800.00 s IPC smooth acceleration time in seconds. 1 = 1 s	76.62		A pump that is started by current master follows the speed until all the pumps rotate at the same speed and master role is changed. The smooth acceleration time must be longer than the time defined with parameter 40.33 Set 1 integration time. Note: Quick ramp overrides the smooth ramp. See parameter	20.00
		3.001800.00 s	IPC smooth acceleration time in seconds.	1 = 1 s

No.	Name/Value	Description	Def/FbEq16
76.63	IPC smooth deceleration time	Defines the ramp time that is used to stop the pump. A pump that is stopped by current master follows the speed until it is stopped completely. The smooth deceleration time must be longer than the time defined with parameter 40.33 Set 1 integration time. Note: Quick ramps overrides the smooth ramp. See parameter group 82 Pump protections on page 259.	20.00
	3.001800.00 s	IPC smooth deceleration time in seconds.	1 = 1 s
76.70	PFC Autochange	Defines the way the autochange is triggered. In all cases except <i>Even wear</i> , the start order is moved one step forward each time the autochange occurs. If the start order initially is 1-2-3-4, after the first autochange the order will be 2-3-4-1, etc. For <i>Even wear</i> , the start order will be determined so that the	Not selected
		running times of all motors remain within the defined limit. Note: Autochange only occurs when the speed of the drive is below the speed defined by parameter 76.73 Autochange level. See also section Autochange on page 62. Note: This parameter is applicable for PFC/SPFC only.	
	Not selected	Autochange disabled.	0
	Selected	Rising edge starts the autochange if autochange conditions are met.	1
	DI1	Autochange triggered by the rising edge of digital input DI1 (10.02 DI delayed status, bit 0).	2
	DI2	Autochange triggered by the rising edge of digital input DI2 (10.02 DI delayed status, bit 1).	3
	DI3	Autochange triggered by the rising edge of digital input DI3 (10.02 DI delayed status, bit 2).	4
	DI4	Autochange triggered by the rising edge of digital input DI4 (10.02 DI delayed status, bit 3).	5
	DI5	Autochange triggered by the rising edge of digital input DI5 (10.02 DI delayed status, bit 4).	6
	DI6	Autochange triggered by the rising edge of digital input DI6 (10.02 DI delayed status, bit 5).	7
	Timed function 1	Autochange triggered by timed function 1 (bit 0 of 34.01 Timed functions status (see page 189)).	8
	Timed function 2	Autochange triggered by timed function 2 (bit 1 of 34.01 Timed functions status (see page 189)).	9
	Timed function 3	Autochange triggered by timed function 3 (bit 2 of 34.01 Timed functions status (see page 189)).	10
	Fixed interval	Autochange is done when the interval determined in the parameter 76.71 PFC Autochange interval has elapsed.	11
	All stop	Autochange is done when all the motors are stopped. The PID sleep feature (parameters 40.43 Set 1 sleep level 40.48 Set 1 wake-up delay) must be used for the drive to stop when the process demand is low.	12

No.	Name/Value	Def/FbEq16	
	Even wear	The running time of the motors are balanced by the drive. When the difference in running time between the motors with the least and most running hours exceeds the time defined by parameter 76.72 Maximum wear imbalance, the autochange occurs. The running hours of the motors can be found in group 77 Multipump maintenance and monitoring.	13
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 94).	-
76.71	PFC Autochange interval	Specifies the interval that is used in setting <i>Fixed interval</i> of parameter <i>76.70 PFC Autochange</i> . Note: This parameter is applicable for PFC/SPFC only.	1.00 h
	0.00 42949672.95 h	Time.	1 = 1 h
76.72	Maximum wear imbalance	Specifies the maximum wear imbalance, or difference in running times between any motor, used by the <i>Even wear</i> setting of parameter 76.70 PFC Autochange.	10.00 h
	0.00 1000000.00 h	Time.	1 = 1 h
76.73	Autochange level	Upper speed limit for the Autochange to occur. The Autochange occurs when: • the condition defined in 76.70 PFC Autochange is fulfilled and, • the speed of the drive motor 01.03 Motor speed % is below the speed limit defined in this parameter. Note: When the value is selected as 0%, this speed limit check is disabled.	100.0%
	0.0300.0%	Speed/frequency in percentage of the nominal speed or frequency of the drive motor.	1 = 1%
76.74	Autochange auxiliary PFC	Selects whether only auxiliary motors or all motors are included in the Autochange function. Note: This parameter is applicable for PFC/SPFC only.	Aux motors only
	All motors	All motors, including the one connected to the drive participates in the autochange. The Autochange logic will connect the drive to each of the motors according to setting of parameter 76.70 PFC Autochange. Note: The first motor (PFC1) also requires the appropriate hardware contactor connections and PFC1 must be defined in one of the relay output source parameters.	0
	Aux motors only	Only auxiliary (direct-on-line) motors are affected by the autochange function. Note: PFC1 refers to the motor that is fixed to the drive and must not be selected in any of the relay output source parameters. Only the starting order of the auxiliary motors will be rotated.	1
76.76	Max stationary time	Defines the maximum time that a low priority pump can be stationary. The IPC system uses pump priorities to start/stop the pumps. This parameter sets the upper limit for stationary time so that the pump blockage can be avoided.	0.0
	0.0214748368.0 h	Maximum stationary time in hours.	1 = 1 h

No.	Name/Value	Description	Def/FbEq16
76.77	Pump priority	Selects the priority of the pump in an IPC system. Note: Parameter 76.76 Max stationary time defines the maximum time that a low priority pump can be stationary.	Normal
	High	High priority pump. The IPC system prefers high priority pump.	
	Normal	Normal priority pump.	
	Low	Low priority pump. The low priority pump runs as little as possible. It is started only when the demand requires full pumping capacity.	
76.81	PFC 1 interlock	Defines if the PFC motor 1 can be started. An interlocked PFC motor cannot be started. 0 = Interlocked (not available), 1 = Available.	Available. PFC motor is available
	Interlocked. PFC motor is not in use	PFC motor is interlocked and not available.	0
	Available. PFC motor is available	PFC motor is available.	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
	Timed function 1	Bit 0 of 34.01 Timed functions status (see page 189).	8
	Timed function 2	Bit 1 of 34.01 Timed functions status (see page 189).	9
	Timed function 3	Bit 2 of 34.01 Timed functions status (see page 189).	10
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 94).	-
76.82	PFC 2 interlock	See parameter 76.81 PFC 1 interlock.	Available. PFC motor is available
76.83	PFC 3 interlock	See parameter 76.81 PFC 1 interlock.	Available. PFC motor is available
76.84	PFC 4 interlock	See parameter 76.81 PFC 1 interlock.	Available. PFC motor is available
76.85	PFC 5 interlock	See parameter 76.81 PFC 1 interlock.	Available. PFC motor is available
76.86	PFC 6 interlock	See parameter 76.81 PFC 1 interlock.	Available. PFC motor is available
76.95	Regulator bypass control	Defines if direct-on-line pumps are automatically started and stopped. This setting can be used in applications with a low number of sensors and low accuracy requirements. See section Automatic parameter synchronization on page 61.	Disable
	Disable	Automatic starting and stopping is disabled.	0
	Enable	Automatic starting and stopping is enabled.	1

No.	Name/Value	Description	Def/FbEq16
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 94).	-
76.101	IPC parameter synchronization	Defines parameter synchronization in IPC system.	Enable
	Enable	Parameter synchronization is enabled.	
	Disable	Parameter synchronization is disabled.	
76.102	IPC synchronization settings	Selects the settings that are synchronized between drives in inverter-to-inverter communication bus. The process PID and IPC parameters are synchronized. Note: This parameter does not synchronize AI parameters.	0b0110

Bit	Name	Value
0	Al parameters	Parameter group 12 Standard AI.
1	Process PID set 1 parameters	Parameter group 40 Process PID set 1. Parameters 19.11 Ext1/Ext2 selection, 20.06 Ext2 commands, 20.08 Ext2 in1 source, 22.18 Ext2 speed ref1 and 28.15 Ext2 frequency ref1.
2	IPC parameters	Parameter group 76 Multipump configuration and 77 Multipump maintenance and monitoring.
315	Reserved	

76.105	IPC synchronization checksum	Displays the calculated parameter checksum (CRC) of the parameter groups selected with parameter 76.102 IPC synchronization settings. If the value of this parameter is same on all the drives, then the configuration is also synchronized correctly.	
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77 Multipump maintenance and monitoring		Multipump maintenance and monitoring parameters. Note: Multipump is supported only with option +N845 and software version 2.01.100.12.	
77.10 PFC chan	runtime ge	Enables the reset, or arbitrary setting, of 77.11 Pump 1 running time 77.18 Pump 8 running time.	Done
Done	e	The parameter automatically reverts back to this value.	0
Set a time	any PFC run	Enables the setting of 77.11 Pump 1 running time 77.18 Pump 8 running time to an arbitrary value.	1
Rese time	et PFC1 run	Resets parameter 77.11 Pump 1 running time.	2
Rese time	et PFC2 run	Resets parameter 77.12 Pump 2 running time.	3
Rese time	et PFC3 run	Resets parameter 77.13 Pump 3 running time.	4
Rese time	et PFC4 run	Resets parameter 77.14 Pump 4 running time.	5
Rese time	et PFC5 run	Resets parameter 77.15 Pump 5 running time.	6
Rese time	et PFC6 run	Resets parameter 77.16 Pump 6 running time.	7
Rese time	et PFC7 run	Resets parameter 77.17 Pump 7 running time.	8
Rese time	et PFC8 run	Resets parameter 77.18 Pump 8 running time.	9

No.	Name/Value	D	escription		Def/FbEq16
77.11	Pump 1 runni time		unning time counter of parameter 77.10 PFC run	oump. Can be set or reset by natime change.	0.00 h
	0.00 42949672.95		ime		1 = 1 h
77.12	Pump 2 runni time	ing S	ee parameter 77.11 Pun	np 1 running time.	0.00 h
77.13	Pump 3 runni time	ing S	ee parameter 77.11 Pun	mp 1 running time.	0.00 h
77.14	Pump 4 runni time	ing S	ee parameter 77.11 Pun	np 1 running time.	0.00 h
77.15	Pump 5 runni time	ing S	See parameter 77.11 Pump 1 running time.		0.00 h
77.16	Pump 6 running time		See parameter 77.11 Pump 1 running time.		0.00 h
77.17	Pump 7 runni time	ing S	See parameter 77.11 Pump 1 running time.		0.00 h
77.18	Pump 8 runni time	ing S	ee parameter 77.11 Pur	mp 1 running time.	0.00 h
77.20	IPC online pu	in Fe	verter-to-inverter comm or example, in a three pu se each other but drive (h can establish connection through unication. ump system, drive 1 and drive 2 can 3 cannot see other drives. = 0011b, Drive 3 = 0100b	
	D:	18.1		In	
	Bit	Name Node		Descriptions Dump 4 is online	
	0	Node		Pump 1 is online. Pump 2 is online.	
	2	Node		Pump 2 is online.	

Bit	Name	Descriptions
0	Node 1	Pump 1 is online.
1	Node 2	Pump 2 is online.
2	Node 3	Pump 3 is online.
3	Node 4	Pump 4 is online.
4	Node 5	Pump 5 is online.
5	Node 6	Pump 6 is online.
6	Node 7	Pump 7 is online.
7	Node 8	Pump 8 is online.
815	Reserved	

77.21	IPC comm loss	Displays the drives communication loss status.	
	status	You can override default communication loss actions by	
		setting start interlock or constant speed based on the bit	
		values.	
		Note: Bits will reset to zero when communication is restored.	

ο.	Name/Valu	ue Description	Def/FbEc
	(a)	To.	In
	Bit	Name	Descriptions
	0	Running master in comm loss	The running master drive has lost the connection to other drives. By default, this driv continues as a running master.
	1	Running follower (master enable) in comm loss	The running follower drive which is set as master enabled drive has lost the connection to other drives. By default, this drive will be a master (offline).
	2	Standby master enabled in comm loss	The master enabled drive which is in standby mode has lost the connection to other drives. B default, this drive remains in standby mode if already running drives can maintain the proces
	3	Standby master disabled in comm loss	The master disabled drive which is in standby mode has lost the connection to other drives. B default, this drive remains in standby mode.
	415	Reserved	•

80 Flow calculation		Actual flow calculation.	
80.01	Actual flow	Shows the calculated flow.	0.00
	-200000.00 200000.00	Calculated flow.	1 = 1
80.02	Actual flow percentage	Shows the calculated flow percentage.	0.00
	-100.00100.00 %	Actual flow percentage.	1 = 1 %
80.11	Flow feedback 1 source	Selects the primary source of the flow feedback.	Not selected
	Not selected	None	0
	Al1 scaled	See parameter 12.12 Al1 scaled value on page 117.	1
	Al2 scaled	See parameter 12.22 Al2 scaled value on page 118.	2
	Freq in scaled	See parameter 11.39 Freq in 1 scaled value on page 114.	3
	Al1 percent	See parameter 12.101 Al1 percent value on page 119.	8
	Al2 percent	See parameter 12.102 Al2 percent value on page 119.	9
	Feedback data storage	See parameter 40.91 Feedback data storage on page 223.	10
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 94).	-
80.12	Flow feedback 2 source	See parameter 80.11 Flow feedback 1 source on page 258.	Not selected
80.13	Flow feedback function	Selects the function used to calculate the flow feedback.	In1
	ln1	Flow feedback 1.	0
	ln2	Flow feedback 2.	1
	sqrt(In1)	Square root of flow feedback 1.	8
	sqrt(In1-In2)	Square root of (flow feedback 1 - flow feedback 2).	9
80.14	Flow feedback multiplier	Defines the flow feedback multiplier.	1.0

100 = 1s10.00

100 = 1s

No.	Name/Value	Description	Def/FbEq16		
	-200000.00 200000.00	Flow feedback multiplier.	1 = 1		
80.15	Maximum flow	Defines the maximum flow used to calculate parameter 80.02 Actual flow percentage.	1000.0		
	-200000.00 200000.00	Maximum flow.	1 = 1		
82 Pu	mp protections	Settings for quick ramp functions. See section <i>Pump protections - Quick ramps</i> (page 48).			
82.01	Quick ramp mode	Enables quick ramp mode with quick ramp set 1 or set 2. Quick ramp set 1 consists of 82.05 Quick ramp 1 accel. time and 82.06 Quick ramp 1 decel. time. Quick ramp set 2 consists of 82.10 Quick ramp 2 accel. time and 82.11 Quick ramp 2 decel. time.	Disabled		
	Disabled	Quick ramp mode is disabled.	0		
	Use 1 quick ramp	Quick ramp set 1 is used.	1		
	Use 2 quick ramps	Both quick ramp set 1 and set 2 are used.	2		
82.05	Quick ramp 1 accel. time	Defines the quick ramp set 1 acceleration time. The time required for the speed to change from zero to the speed value defined by parameter 46.01 Speed scaling or 46.02 Frequency scaling. This ramp is effective from zero to speed/frequency defined by parameter 82.07 Quick ramp 1 upper limit.	1.00		
	0.105.00 s	Time	100 = 1s		
82.06	Quick ramp 1 decel. time	Defines the quick ramp set 1 deceleration time. The time required for the speed to change from the speed value to zero is defined by parameters 46.01 Speed scaling or 46.02 Frequency scaling. This ramp is effective from speed/frequency defined by parameter 82.07 Quick ramp 1 upper limit to zero.			
	0.105.00 s	Time	100 = 1s		
82.07	Quick ramp 1 upper limit	Defines the maximum speed/frequency for quick ramp 1. Above this speed/frequency, the drive uses either quick ramp 2 and normal ramp time or only normal ramp time depending on parameter 82.01 Quick ramp mode.	30		
	15100 Hz	Frequency/Speed limit	1 = 1Hz		
82.10	Quick ramp 2 accel.	ck ramp 2 accel. Defines the quick ramp set 2 acceleration time.			

The time required for the speed to change from zero to the speed value defined by parameter 46.01 Speed scaling or 46.02 Frequency scaling. This ramp is effective in speed/frequency range defined by parameters 82.07 Quick ramp 1 upper limit and 82.12 Quick ramp 2 upper limit.

The time required for the speed to change from the speed value to zero is defined by parameters 46.01 Speed scaling or 46.02 Frequency scaling. This ramp is effective in speed/frequency range defined by parameters 82.07 Quick ramp 1 upper limit and 82.12 Quick ramp 2 upper limit.

Defines the quick ramp set 2 deceleration time.

time

time

82.11

0.10...20.00 s

0.10...20.00 s

Quick ramp 2 decel.

Time

Time

No.	Name/Value	Description	Def/FbEq16
82.12	Quick ramp 2 upper limit	Defines the maximum speed/frequency for the quick ramp 2. Above this speed/frequency, the drive either uses quick ramp 2 or normal ramp time depending on selection in parameter 82.01 Quick ramp mode.	45
	15100 Hz	Frequency/Speed limit	1 = 1Hz

83 Pui	mp cleaning	Settings for the pump cleaning sequence. See section <i>Motor control</i> (page 65).	
83.01	Pump cleaning status	Displays the status of pump cleaning.	Disabled
	Disabled	Cleaning sequence is disabled.	0
	Pump clean	Cleaning sequence is active.	1
	No triggers configured	Triggers are not configured.	2
	Waiting for triggering	Waiting for triggering signal.	3
	Triggered	Cleaning sequence is triggered by parameter <i>83.11</i> specifies warning generation only.	4
83.02	Pump cleaning progress	Displays the pump cleaning progress.	0.0
	0.0100.0 %	Percentage	10 = 1%
83.03	Total cleaning count	Displays the total cleaning count.	0
	01000000	Total cleaning count.	1 = 1
83.10	Pump cleaning action	Enables the pump cleaning action.	Cleaning
	Off	Pump cleaning is disabled.	0
	Cleaning	Pump cleaning is started based on triggers.	1
	Warning only	Generates warning message based on triggers.	2

No.	Name/Value	Description	Def/FbEq16
83.11	Pump cleaning triggers	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.	060000

Bit	Name	Description
0	Reserved	·
1	Every start	Cleaning starts at every start.
2	Every stop	Cleaning starts at every stop.
3	Reserved	
4	Overload detection	Cleaning sequence starts when overload situation is detected. To set up the overload curve, see parameters in group 37 User load curve.
5	Underload detection	Cleaning sequence starts when underload situation is detected. To set up the overload curve, see parameters in group 37 User load curve.
6	Fixed time interval	Time interval defined by parameter 83.15 Fixed time interval.
7	Combined timer1	Combined timer 1 of timed functions starts cleaning.
89	Reserved	
10	Supervision 1	Cleaning sequence starts when Supervision 1 is high.
11	Supervision 2	Cleaning sequence starts when Supervision 2 is high.
12	Supervision 3	Cleaning sequence starts when Supervision 3 is high.
13	DI4	Cleaning sequence starts when DI4 is high.
14	DI5	Cleaning sequence starts when DI5 is high.
15	DI6	Cleaning sequence starts when DI6 is high.

83.12	Manually force cleaning	Starts 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
	DI4	Starts pump cleaning when DI6 goes high.	4
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 94).	-
83.15	Fixed time interval	Defines the constant time interval between cleaning cycles. This parameter is used only when cleaning is triggered by time interval.	02:00:00h
	00:00:0045:12:15 h	Time	1 = 1h
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
	165535	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.	80
		Note: If you have disabled the negative rotation direction by speed limits, the pump cleaning does not operate in the negative direction.	
	0100%	Percentage of the cleaning speed/frequency value.	1 = 1%

No.	Name/Value	Description	Def/FbEq16	
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	
	0.00060.000 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	
	0.00060.000 s	Time	1 = 1s	
83.27	Cleaning on time	Defines the cleaning On time when the drive is running at cleaning speed set by parameter 83.20 Cleaning speed step.	10.000	
	0.0001000.000 s	Time	1 = 1s	
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	
	0.0001000.000 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 55).	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 <i>Cleaning count monitoring</i> (page 55).	00:01:00h	
	00:00:0045:12:15 h	Time	1 = 1h	
83.37	Maximum cleaning count	Defines the maximum cleaning counts allowed. See section <i>Cleaning count monitoring</i> (page 55).	5	
	030	Maximum cleaning counts.	1 = 1	
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 (trip and brake chopper activation limits) of the drive. WARNING! An incorrect setting may cause the motor to rush uncontrollably, or the brake chopper or resistor to overload. 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	
	380415 V	380415 V	2	
	440480 V	440480 V	3	

No.	Name/Value	Description	Def/FbEq16
95.02	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.	-
	065535 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
	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.	-

Bit	Name Information			
0	EX motor Not supported for ACQ580.			
1	ABB Sine filter 1 = An ABB sine filter is connected to the output of the drive.			
215	Reserved			

0000b0111b	Hardware options configuration word.	1 = 1

Not selected

English

Deutsch

Italiano

Español

Français

Svenska

Russki

None.

English.

German.

Spanish.

French.

Swedish.

Russian.

Italian.

No.	95.20 HW options word 1		Descr	Description Def/Fb specifies hardware-related options that require differentiated arameter defaults. This parameter is not affected by a parameter restore.	
95.20			param		
	Bit	Name		Value	
	0	Supply freq 60 Hz	uency	If you change the value of this bit, you have to do a complete the drive after the change. After reset you have to reselect the to be used. See section Differences in the default values between 50 Hz 60 Hz supply frequency settings on page 281. 0 = 50 Hz. 1 = 60 Hz.	
	111	Reserved			
	12	du/dt filter activation		When active, an external du/dt filter is connected to the drive/inv 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.	
	1315	Reserved			
	0000hFFFFh		Hardw	are options configuration word.	1 = 1
96 System		param	age selection; access levels; macro selection; eter save and restore; control unit reboot; user eter sets; unit selection.		
96.01	5.01 Language		Notes Notes Notes This	s the language of the parameter interface and other yed information when viewed on the control panel. all languages listed below are necessarily supported. s parameter does not affect the languages visible in the ce composer PC tool. (Those are specified under View ettings – Drive default language.)	-

0

1033

1031

1040

3082

1036

1053

1049

No.	Name/V	alue	Description	Def/FbEq16	
96.02	06.02 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 96.10096.102, 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 96.10096.102. 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 91).	0	
	09999	9999	Pass code.	-	
96.03	Access	level status	Shows which access levels have been activated by pass codes entered into parameter 96.02 Pass code.	0001b	
	Bit	Name			
	0	End user			
	1	Service			
	2	Advanced	Advanced programmer		
	310	Reserved			
	11	OEM acces	s level 1		
	12	OEM acces	s level 2		
	13	OEM acces	ss level 3		
	14	Parameter	lock		
	15	Reserved			
	0000b	.0111b	Active access levels.	-	
96.06	Parame	ter restore	Restores the original settings of the control program, ie. parameter default values. Note: This parameter cannot be changed while the drive is running.	Done	
	Done		Restoring is completed.	0	
Restore defaults		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	

No.	Name/Value	Description	Def/FbEq16
	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 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
	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
	Reset motor data	Restores all motor nominal values and motor ID run results to default values.	2
	All to factory defaults	Restores all drive parameters and settings back to initial factory values, except • parameter 95.20 HW options word 1 and the differentiated defaults implemented by it.	34560
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. 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. Note: A new parameter value is saved automatically when changed from the PC tool or control panel but not when altered through a fieldbus adapter connection.	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 <i>User parameter sets</i> (page 90).	-
	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

No.	Name/Value	Description	Def/FbEq16
	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
	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		819
	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 1416, 47, 5058 and 9293) 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
	Reserved		617
	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

No.	Name/Value	Description			Def/FbEq16	
96.12	User set I/O mode in1	The second secon				
		Status of source defined by par. 96.12	Status of source defined by par. 96.13	User parameter set selected		
		0	0	Set 1		
		1	0	Set 2		
		0	1	Set 3		
		1	1	Set 4		
	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.	Digital input DI4 (10.02 DI delayed status, bit 3).			
	DI5	Digital input DI5 (10.	Digital input DI5 (10.02 DI delayed status, bit 4).			
	DI6	Digital input DI6 (10.	Digital input DI6 (10.02 DI delayed status, bit 5).			
	Reserved					
	Timed function 1	Bit 0 of 34.01 Timed	functions status (see	e page 189).	18	
	Timed function 2	Bit 1 of 34.01 Timed	functions status (see	e page 189).	19	
	Timed function 3	Bit 2 of 34.01 Timed	functions status (see	e page 189).	20	
	Reserved				2123	
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 182).			24	
	Supervision 2	Bit 1 of 32.01 Super	vision status (see pag	ge 182).	25	
	Supervision 3	Bit 2 of 32.01 Super	vision status (see pag	ge 182).	26	
	Other [bit]	Source selection (se	e Terms and abbrevi	ations on page 94).	-	
96.13	User set I/O mode in2	See parameter 96.12	2 User set I/O mode	in1.	Not selected	

No.	Name/Value		ne/Value Description		Def/FbEq16
96.16	Unit selection		selects the unit of parameters indicating poind torque.	ower, temperature	0000b
	Bit	Name	Information		
	0	Power unit	0 = kW		
			1 = hp		
	1	Reserved	T		
	2	Temperatur unit	0 = °C 1 = °F		
	3	Reserved			
	4	Torque unit	0 = Nm (N·m)		
			1 = lbft (lb·ft)		
	515	Reserved			
	0000h	.FFFFh	Init selection word.		1 = 1
96.51	Clear fault and event logger		clears all events from the drive's fault and	event logs.	Done
	Done		= No action		0
	Clear		= Clear the loggers.		1
	01				1 = 1
96.100	Change code	user pass	Visible when user lock is open) to change the current user pass code, entended in the current user pass code, entended in the confirm userning will be active until the new pass code ocancel changing the pass code, close the onfirming. To close the lock, enter an invariant error of the control board boot, or cycle the power. See also section User lock (page 91).	ser pass code. A ode is confirmed. e user lock without lid pass code in	10000000
	100000		lew user pass code.		-
96.101	Confirm	user pass	Visible when user lock is open) Confirms the new user pass code entered in user pass code.	in 96.100 Change	
	100000		Confirmation of new user pass code.		-

6.102	I loor loo			tion	Def/FbEq16
96.102	User lock functionality 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: We recommend you select all the actions and functionalities unless otherwise required by the application. Bit Name Information				0000h
	0	Disable ABB access levels Freeze parameter lock state Disable file download		1 = ABB access levels (service, advanced programmer, etc.; see 96.03) disabled 1 = Changing the parameter lock state prevented, ie. pass code 358 has no effect 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.	
	1				
	2				
	310	Reserved			
	11	Disable OE level 1	M access	1 = OEM access level 1 disabled	
	12	Disable OE level 2	M access	1 = OEM access level 2 disabled	
	13	Disable OEM access level 3		s 1 = OEM access level 3 disabled	
	1415	Reserved			
	0000h			n of actions to be prevented by user lock.	_

No.	Name/Value	Description	Def/FbEq16
97 Mo	tor 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 73. Higher switching frequency results in lower acoustic noise-Note: If you have a multimotor system, contact your local ABB representative.	4 kHz
	4 kHz	4 kHz.	4
	8 kHz	8 kHz.	8
	12 kHz	12 kHz.	12
97.02	Minimum switching frequency	Lowest switching frequency that is allowed. Depends on the frame size.	2 kHz
	1.5 kHz	1.5 kHz. Not for all frame sizes.	2
	2 kHz	2 kHz.	2
	4 kHz	4 kHz.	4
	8 kHz	8 kHz.	8
	12 kHz	12 kHz.	12
97.03	Slip gain	Defines the slip gain which is used to improve the estimated motor slip. 100% means full slip gain; 0% means no slip gain. The default value is 100%. Other values can be used if a static speed error is detected despite having the setting at full slip gain. Example (with nominal load and nominal slip of 40 rpm): A 1000 rpm constant speed reference is given to the drive. Despite having full slip gain (= 100%), a manual tachometer measurement from the motor axis gives a speed value of 998 rpm. The static speed error is 1000 rpm - 998 rpm = 2 rpm. To compensate the error, the slip gain should be increased to 105% (2 rpm / 40 rpm = 5%).	100%
	0200%	Slip gain.	1 = 1%
97.04	Voltage reserve	Defines the minimum allowed voltage reserve. When the voltage reserve has decreased to the set value, the drive enters the field weakening area. Note: This is an expert level parameter and should not be adjusted without appropriate skill. If the intermediate circuit DC voltage $U_{\rm dc}$ = 550 V and the voltage reserve is 5%, the RMS value of the maximum output voltage in steady-state operation is 0.95×550 V / sqrt(2) = 369 V The dynamic performance of the motor control in the field weakening area can be improved by increasing the voltage reserve value, but the drive enters the field weakening area earlier.	-2%
	-450%	Voltage reserve.	1 = 1%
97.05	Flux braking	Defines the level of flux braking power. (Other stopping and braking modes can be configured in parameter group 21 Start/stop mode). Note: This is an expert level parameter and should not be adjusted without appropriate skill.	Disabled
	Disabled	Flux braking is disabled.	0

No.	Name/Value	Description	Def/FbEq16
	Moderate	Flux level is limited during the braking. Deceleration time is longer compared to full braking.	1
	Full	Maximum braking power. Almost all available current is used to convert the mechanical braking energy to thermal energy in the motor. WARNING! Using full flux braking heats up the motor especially in cyclic operation. Make sure that the motor can withstand this if you have a cyclic application.	2
97.09	Switching frequency mode	An optimization setting for balancing between control performance and motor noise level. Note: This is an expert level parameter and should not be adjusted without appropriate skill	Normal
	Normal	Control performance optimized for long motor cables.	0
	Low noise	Minimizes motor noise. Note: This setting requires derating. Refer to the rating data in the <i>Hardware manual</i> .	1
97.10	Signal injection	Enables the anti-cogging function: a high-frequency alternating signal is injected to the motor in the low speed region to improve the stability of torque control. This removes the "cogging" that can sometimes be seen as the rotor passes the motor magnetic poles. Anti-cogging can be enabled with different amplitude levels. Notes: This is an expert level parameter and should not be adjusted without appropriate skill. Use as low a level as possible that gives satisfactory performance. Signal injection cannot be applied to asynchronous motors.	Disabled
	Disabled	Anti-cogging disabled.	0
	Enabled (5%)	Anti-cogging enabled with amplitude level of 5%.	1
	Enabled (10%)	Anti-cogging enabled with amplitude level of 10%.	2
	Enabled (15%)	Anti-cogging enabled with amplitude level of 15%.	3
	Enabled (20%)	Anti-cogging enabled with amplitude level of 20%.	4
97.11	TR tuning	Rotor time constant tuning. This parameter can be used to improve torque accuracy in closed-loop control of an induction motor. Normally, the motor identification run provides sufficient torque accuracy, but manual fine-tuning can be applied in exceptionally demanding applications to achieve optimal performance. Note: This is an expert level parameter and should not be adjusted without appropriate skill.	100%
	25400%	Rotor time constant tuning.	1 = 1%
		1	1

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. U / U _N (%) Relative output voltage. IR compensation set to 15%. 100% Relative output voltage. IR compensation. Field weakening point 50% of nominal frequency See also section IR compensation for scalar motor control on page 66.	3.50%
	0.0050.00%	Voltage boost at zero speed in percent of nominal motor voltage.	1 = 1%
97.15	Motor model temperature adaptation	Enables the motor model temperature adaptation. Estimated motor temperature can be used to adapt temperature dependent parameters (e.g. resistances) of motor model.	Disabled
	Disabled	Temperature adaptation disabled.	0
	Estimated temperature	Temperature adaptation with motor temperature estimate (parameter 35.01 Motor estimated temperature).	1
97.16	Stator temperature factor	Tunes the motor temperature dependence of stator parameters (stator resistance).	50%
	0200%	Tuning factor.	1 = 1%
97.17	Rotor temperature factor	Tunes the motor temperature dependence of rotor parameters (eg. rotor resistance).	100%
	0200%	Tuning factor.	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

No.	Name/Value	Description	Def/FbEq16
98 Use param	er motor eters	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 98.0298.12 and 98.14. Notes: Parameter value is automatically set to zero when ID run is selected by parameter 99.13 ID run requested. The values of parameters 98.0298.12 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 98.0298.12 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 $R_{\rm S}$ of the motor model. With a star-connected motor, $R_{\rm S}$ is the resistance of one winding. With a delta-connected motor, $R_{\rm S}$ is one-third of the resistance of one winding.	0.00000 p.u.
	0.000000.50000 p.u.	Stator resistance in per unit.	-
98.03	Rr user	Defines the rotor resistance $R_{\rm R}$ of the motor model. Note: This parameter is valid only for asynchronous motors.	0.00000 p.u.
	0.000000.50000 p.u.	Rotor resistance in per unit.	-
98.04	Lm user	Defines the main inductance $L_{\rm M}$ of the motor model. Note: This parameter is valid only for asynchronous motors.	0.00000 p.u.
	0.0000010.00000 p.u.	Main inductance in per unit.	-
98.05	SigmaL user	Defines the leakage inductance σL_{S} . Note: This parameter is valid only for asynchronous motors.	0.00000 p.u.
	0.000001.00000 p.u.	Leakage inductance in per unit.	-
98.06	Ld user	Defines the direct axis (synchronous) inductance. Note: This parameter is valid only for permanent magnet motors.	0.00000 p.u.
	0.0000010.00000 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.
	0.0000010.00000 p.u	Quadrature axis inductance in per unit.	-

No.	Name/Value	Description	Def/FbEq16
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
	0.00000100.0000 0 ohm	Stator resistance.	-
98.10	Rr user SI	Defines the rotor resistance $R_{\rm R}$ of the motor model. Note: This parameter is valid only for asynchronous motors.	0.00000 ohm
	0.00000100.0000 0 ohm	Rotor resistance.	-
98.11	Lm user SI	Defines the main inductance $L_{\rm M}$ of the motor model. Note: This parameter is valid only for asynchronous motors.	0.00 mH
	0.00100000.00 mH	Main inductance.	1 = 10000 mH
98.12	SigmaL user SI	Defines the leakage inductance $\sigma L_{\rm S}$. Note: This parameter is valid only for asynchronous motors.	0.00 mH
	0.00100000.00 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
	0.00100000.00 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
	0.00100000.00 mH	Quadrature axis inductance.	1 = 10000 mH

99 Mo	tor data	Motor configuration settings.	
99.03	Motor type	Selects the motor type. Note: This parameter cannot be changed while the drive is running.	Asynchro- nous 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
	SynRM	Synchronous reluctance motor. Three-phase AC synchronous motor with salient pole rotor without permanent magnets.	2

No.	Name/Value	Description	Def/FbEq16
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 <i>Scalar</i> 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 <i>Operating modes of the drive</i> (page 42).	0
	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 also section DC voltage control (page 73), and section Operating modes of the drive (page 42).	1
99.06	Motor nominal current	Defines the nominal motor current. 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.	0.0 A
	0.06400.0 A	Nominal current of the motor. The allowable range is $1/62 \times I_N$ of the drive $(02 \times I_N)$ with scalar control mode).	1 = 1 A
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.	0.0 V
	0.0800.0	Nominal voltage of the motor.	10 = 1 V

No.	Name/Value Description		Def/FbEq16
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
	0.0500.0 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.	0 rpm
	030000 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.	0.00 kW or hp
	0.00 10000.00 kW or 0.00 13404.83 hp	Nominal power of the motor.	1 = 1 unit
99.11	· ·		0.00
	0.001.00	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 <i>96.16 Unit selection</i> . Note: This parameter cannot be changed while the drive is running.	0.000 N·m or lb·ft
	0.0004000000.000 N·m or 0.0002950248.597 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.	None
		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%. With scalar control mode (99.04 Motor control mode = Scalar), only the Current measurement calibration ID run mode is possible. 	
		 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, 99.0699.12) have been changed. 	
		 Ensure that the Safe Torque Off and emergency stop circuits (if any) are closed during the ID run. Mechanical brake (if present) is not opened by the logic for the ID run. 	
		This parameter cannot be changed while the drive is running.	
	None	No motor ID run is requested. This mode can be selected only if the ID run (<i>NormallReduced/StandstilllAdvanced</i>) has already been performed once.	0
	Nomal	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 50100% of the nominal speed during the ID run. ENSURE THAT IT IS SAFE TO RUN THE MOTOR	1

No.	Name/Value	Description	Def/FbEq16
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 (ie. in case of a motor with an integrated brake supplied from the motor terminals). 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 50100% of the nominal speed during the ID run. ENSURE THAT IT IS SAFE TO RUN THE MOTOR BEFORE PERFORMING THE ID RUN!	2
	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
	Reserved		4
	Current measurement calibration	Current offset and gain measurement calibration is set to calibrate the control loops. The calibration will be performed at next start. Only for frames R6R9.	5
	Advanced	Advanced ID run. Only for frames R6R9. 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
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
	Standstill	Standstill ID run.	3
	Reserved		4

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No.	Name/Value	lame/Value Description	
	Current measurement calibration. measurement calibration		5
	Advanced	Advanced ID run.	6
99.15	Motor polepairs calculated	Calculated number of pole pairs in the motor.	0
	01000	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.	UVW
	UVW	Normal.	0
	UWV	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
15.35	Freq out 1 src max	1500.000	1800.000
12.20	Al1 scaled at Al1 max	1500.000	1800.000
13.18	AO1 source max	1500.0	1800.0
22.26	Constant speed 1	300.00 rpm	360.00 rpm
22.27	Constant speed 2	600.00 rpm	720.00 rpm
22.28	Constant speed 3	900 .00 rpm	1080.00 rpm
22.29	Constant speed 4	1200.00 rpm	1440.00 rpm
22.30	Constant speed 5	1500.00 rpm	1800.00 rpm
22.30	Constant speed 6	2400.00 rpm	2880.00 rpm
22.31	Constant speed 7	3000.00 rpm	3600.00 rpm
28.26	Constant frequency 1	5.00 Hz	6.00 Hz
28.27	Constant frequency 2	10.00 Hz	12.00 Hz
28.28	Constant frequency 3	15.00 Hz	18.00 Hz
28.29	Constant frequency 4	20.00 Hz	24.00 Hz
28.30	Constant frequency 5	25.00 Hz	30.00 Hz
28.31	Constant frequency 6	40.00 Hz	48.00 Hz
28.32	Constant frequency 7	50.00 Hz	60.00 Hz

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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
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
31.26	Stall speed limit	150.00 rpm	180.00 rpm
31.27	Stall frequency limit	15.00 Hz	18.00 Hz
31.30	Overspeed trip margin	500.00 rpm	500.00 rpm
46.01	Speed scaling	1500.00 rpm	1800.00 rpm
46.02	Frequency scaling	50.00 Hz	60.00 Hz



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 93).

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 preselected 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 <i>Parameters</i> (page 93).
List	Selection list.

1	0	
_	a	4

Term	Definition
No.	Parameter number.
РВ	Packed Boolean (bit list).
Real	Real number.
Туре	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	Туре	Range	Unit	FbEq32	
01 Actu	01 Actual values					
01.01	Motor speed used	Real	-30000.0030000.00	rpm	100 = 1 rpm	
01.02	Motor speed estimated	Real	-30000.0030000.00	rpm	100 = 1 rpm	
01.03	Motor speed %	Real	-1000.001000.00	%	100 = 1%	
01.06	Output frequency	Real	-500.00500.00	Hz	100 = 1 Hz	
01.07	Motor current	Real	0.0030000.00	Α	100 = 1 A	
01.08	Motor current % of motor nom	Real	0.01000.0	%	10 = 1%	
01.09	Motor current % of drive nom	Real	0.01000.0	%	10 = 1%	
01.10	Motor torque	Real	-1600.01600.0	%	10 = 1%	
01.11	DC voltage	Real	0.002000.00	V	100 = 1 V	
01.13	Output voltage	Real	02000	V	1 = 1 V	
01.14	Output power	Real	-32768.0032767.00	kW or hp	100 = 1 unit	
01.15	Output power % of motor nom	Real	-300.00300.00	%	100 = 1%	
01.16	Output power % of drive nom	Real	-300.00300.00	%	100 = 1%	
01.17	Motor shaft power	Real	-32768.0032767.00	kW or hp	100 = 1 unit	
01.18	Inverter GWh counter	Real	065535	GWh	1 = 1 GWh	
01.19	Inverter MWh counter	Real	01000	MWh	1 = 1 MWh	
01.20	Inverter kWh counter	Real	01000	kWh	1 = 1 kWh	
01.24	Flux actual %	Real	0200	%	1 = 1%	
01.30	Nominal torque scale	Real	0.0004000000	N·m or lb·ft	1000 = 1 unit	
01.50	Current hour kWh	Real	0.001000000.00	kWh	100 = 1 kWh	
01.51	Previous hour kWh	Real	0.001000000.00	kWh	100 = 1 kWh	
01.52	Current day kWh	Real	0.001000000.00	kWh	100 = 1 kWh	
01.53	Previous day kWh	Real	0.001000000.00	kWh	100 = 1 kWh	
01.61	Abs motor speed used		0.0030000.00	rpm	100 = 1 rpm	
01.62	Abs motor speed %		0.001000.00%	%	100 = 1%	
01.63	Abs output frequency		0.00500.00 Hz	Hz	100 = 1 Hz	
01.64	Abs motor torque		0.01600.0	%	10 = 1%	
01.65	Abs output power		0.0032767.00	kW	100 = 1 kW	
01.66	Abs output power % motor nom		0.00300.00	%	100 = 1%	
01.67	Abs output power % drive nom		0.00300.00	%	100 = 1%	
01.68	Abs motor shaft power		0.0032767.00	kW	100 = 1 kW	
03 Input	references					
03.01	Panel reference	Real	-100000.00100000.00	-	100 = 1	
03.02	Panel reference remote	Real	-100000.00100000.00	-	100 = 1	
03.05	FB A reference 1	Real	-100000.00100000.00	-	100 = 1	
03.06	FB A reference 2	Real	-100000.00100000.00	-	100 = 1	
03.09	EFB reference 1	Real	-30000.0030000.00	-	100 = 1	
03.10	EFB reference 2	Real	-30000.0030000.00	-	100 = 1	

No.	Name	Type	Range	Unit	FbEq32
07.06	Loading package name	List	-	-	1 = 1
07.07	Loading package version	Data	-	-	1 = 1
07.11	Cpu usage	Real	0100	%	1 = 1%
07.25	Customization package name	Data	-	-	1 = 1
07.26	Customization package version	Data	-	-	1 = 1

Parameter groups 10...99

No.	Name	Type	Range	Unit	FbEq32	
10 Standard DI, RO						
10.02	DI delayed status	PB	0000hFFFFh	-	1 = 1	
10.03	DI force selection	PB	0000hFFFFh	-	1 = 1	
10.04	DI forced data	PB	0000hFFFFh	-	1 = 1	
10.21	RO status	PB	0000hFFFFh	-	1 = 1	
10.22	RO force selection	PB	0000hFFFFh	-	1 = 1	
10.23	RO forced data	PB	0000hFFFFh	-	1 = 1	
10.24	RO1 source	Binary src	-	-	1 = 1	
10.25	RO1 ON delay	Real	0.03000.0	s	10 = 1 s	
10.26	RO1 OFF delay	Real	0.03000.0	S	10 = 1 s	
10.27	RO2 source	Binary src	-	-	1 = 1	
10.28	RO2 ON delay	Real	0.03000.0	s	10 = 1 s	
10.29	RO2 OFF delay	Real	0.03000.0	s	10 = 1 s	
10.30	RO3 source	Binary src	-	-	1 = 1	
10.31	RO3 ON delay	Real	0.03000.0	S	10 = 1 s	
10.32	RO3 OFF delay	Real	0.03000.0	S	10 = 1 s	
10.99	RO/DIO control word	PB	0000hFFFFh	-	1 = 1	
10.101	RO1 toggle counter	Real	04294967000	-	1 = 1	
10.102	RO2 toggle counter	Real	04294967000	-	1 = 1	
10.103	RO3 toggle counter	Real	04294967000	-	1 = 1	
11 Stand	dard DIO, FI, FO					
11.21	DI5 configuration	List	01	-	1 = 1	
11.38	Freq in 1 actual value	Real	016000	Hz	1 = 1 Hz	
11.39	Freq in 1 scaled value	Real	-32768.00032767.000	-	1000 = 1	
11.42	Freq in 1 min	Real	016000	Hz	1 = 1 Hz	
11.43	Freq in 1 max	Real	016000	Hz	1 = 1 Hz	
11.44	Freq in 1 at scaled min	Real	-32768.00032767.000	-	1000 = 1	
11.45	Freq in 1 at scaled max	Real	-32768.00032767.000	-	1000 = 1	
12 Stand	dard Al					
12.02	Al force selection	PB	0000hFFFFh	-	1 = 1	
12.03	Al supervision function	List	04	-	1 = 1	
12.04	Al supervision selection	PB	0000hFFFFh	-	1 = 1	
12.11	Al1 actual value	Real	0.00020.000 mA or 0.00010.000 V	mA or V	1000 = 1 unit	
12.12	Al1 scaled value	Real	-32768.00032767.000	-	1000 = 1	
12.13	Al1 forced value	Real	0.00020.000 mA or 0.00010.000 V	mA or V	1000 = 1 unit	
12.15	Al1 unit selection	List	2, 10	-	1 = 1	

No.	Name	Туре	Range	Unit	FbEq32
12.16	Al1 filter time	Real	0.00030.000	s	1000 = 1 s
12.17	Al1 min	Real	0.00020.000 mA or 0.00010.000 V	mA or V	1000 = 1 unit
12.18	Al1 max	Real	0.00020.000 mA or 0.00010.000 V	mA or V	1000 = 1 unit
12.19	Al1 scaled at Al1 min	Real	-32768.00032767.000	-	1000 = 1
12.20	Al1 scaled at Al1 max	Real	-32768.00032767.000	-	1000 = 1
12.21	Al2 actual value	Real	0.00020.000 mA or 0.00010.000 V	mA or V	1000 = 1 unit
12.22	Al2 scaled value	Real	-32768.00032767.000	-	1000 = 1
12.23	Al2 forced value	Real	0.00020.000 mA or 0.00010.000 V	mA or V	1000 = 1 unit
12.25	Al2 unit selection	List	2, 10	-	1 = 1
12.26	Al2 filter time	Real	0.00030.000	s	1000 = 1 s
12.27	Al2 min	Real	0.00020.000 mA or 0.00010.000 V	mA or V	1000 = 1 unit
12.28	Al2 max	Real	0.00020.000 mA or 0.00010.000 V	mA or V	1000 = 1 unit
12.29	Al2 scaled at Al2 min	Real	-32768.00032767.000	-	1000 = 1
12.30	Al2 scaled at Al2 max	Real	-32768.00032767.000	-	1000 = 1
12.101	Al1 percent value	Real	0.00100.00	%	100 = 1%
12.102	Al2 percent value	Real	0.00100.00	%	100 = 1%
13 Stan	dard AO				
13.02	AO force selection	PB	0000hFFFFh	-	1 = 1
13.11	AO1 actual value	Real	0.00022.000 or 0.00011000 V	mA	1000 = 1 mA
13.12	AO1 source	Analog src	-	-	1 = 1
13.13	AO1 forced value	Real	0.00022.000 or 0.00011000 V	mA	1000 = 1 mA
13.15	AO1 unit selection	List	2, 10	-	1 = 1
13.16	AO1 filter time	Real	0.00030.000	s	1000 = 1 s
13.17	AO1 source min	Real	-32768.032767.0	-	10 = 1
13.18	AO1 source max	Real	-32768.032767.0	-	10 = 1
13.19	AO1 out at AO1 src min	Real	0.00022.000 or 0.00011000 V	mA	1000 = 1 mA
13.20	AO1 out at AO1 src max	Real	0.00022.000 or 0.00011000 V	mA	1000 = 1 mA
13.21	AO2 actual value	Real	0.00022.000	mA	1000 = 1 mA
13.22	AO2 source	Analog src	-	-	1 = 1
13.23	AO2 forced value	Real	0.00022.000	mA	1000 = 1 mA
13.26	AO2 filter time	Real	0.00030.000	S	1000 = 1 s
13.27	AO2 source min	Real	-32768.032767.0	-	10 = 1
13.28	AO2 source max	Real	-32768.032767.0	-	10 = 1

No.	Name	Type	Range	Unit	FbEq32
13.29	AO2 out at AO2 src min	Real	0.00022.000	mA	1000 = 1 mA
13.30	AO2 out at AO2 src max	Real	0.00022.000	mA	1000 = 1 mA
13.91	AO1 data storage	Real	-327.68327.67	-	100 = 1
13.92	AO2 data storage	Real	-327.68327.67	-	100 = 1
15 I/O e	xtension module				
15.01	Extension module type	List	03	-	1 = 1
15.02	Detected extension module	List	03	-	1 = 1
15.03	DI status	PB	0000hFFFFh	-	1 = 1
15.04	RO/DO status	PB	0000hFFFFh	-	1 = 1
15.05	RO/DO force selection	PB	0000hFFFFh	-	1 = 1
15.06	RO/DO forced data	PB	0000hFFFFh	-	1 = 1
15.07	RO4 source	Binary src	-	-	1 = 1
15.08	RO4 ON delay	Real	0.03000.0	s	10 = 1 s
15.09	RO4 OFF delay	Real	0.03000.0	s	10 = 1 s
15.10	RO5 source	Binary src	-	-	1 = 1
15.11	RO5 ON delay	Real	0.03000.0	s	10 = 1 s
15.12	RO5 OFF delay	Real	0.03000.0	s	10 = 1 s
15.22	DO1 configuration	List	0, 2	-	1 = 1
15.23	DO1 source	Binary src	-	-	1 = 1
15.24	DO1 ON delay	Real	0.03000.0	S	10 = 1 s
15.25	DO1 OFF delay	Real	0.03000.0	s	10 = 1 s
15.32	Freq out 1 actual value	Real	016000	Hz	1 = 1 Hz
15.33	Freq out 1 source	Analog src	-	-	1 = 1
15.34	Freq out 1 src min	Real	-32768.032767.0	-	1000 = 1
15.35	Freq out 1 src max	Real	-32768.032767.0	-	1000 = 1
15.36	Freq out 1 at src min	Real	016000	Hz	1 = 1 Hz
15.37	Freq out 1 at src max	Real	016000	Hz	1 = 1 Hz
19 Oper	ation mode				
19.01	Actual operation mode	List	12, 10, 20	-	1 = 1
19.11	Ext1/Ext2 selection	Binary src	-	-	1 = 1
20 Start	/stop/direction				
20.01	Ext1 commands	List	01, 4, 1112, 14	-	1 = 1
20.02	Ext1 start trigger type	List	01	-	1 = 1
20.03	Ext1 in1 source	Binary src	-	-	1 = 1
20.04	Ext1 in2 source	Binary src	-	-	1 = 1

No.	Name	Type	Range	Unit	FbEq32
20.05	Ext1 in3 source	Binary	-	-	1 = 1
		src			
20.06	Ext2 commands	List	06, 1112, 14	-	1 = 1
20.07	Ext2 start trigger type	List	01	-	1 = 1
20.08	Ext2 in1 source	Binary src	-	-	1 = 1
20.09	Ext2 in2 source	Binary src	-	-	1 = 1
20.10	Ext2 in3 source	Binary src	-	-	1 = 1
20.40	Run permissive	Binary src	-	-	1 = 1
20.41	Start interlock 1	Binary src	-	-	1 = 1
20.42	Start interlock 2	Binary src	-	-	1 = 1
20.43	Start interlock 3	Binary src	-	-	1 = 1
20.44	Start interlock 4	Binary src	-	-	1 = 1
20.45	Start interlock stop mode	Binary src	-	-	1 = 1
20.46	Run permissive text	Binary src	-	-	1 = 1
20.47	Start interlock 1 text	Binary src	-	-	1 = 1
20.48	Start interlock 2 text	Binary src	-	-	1 = 1
20.49	Start interlock 3 text	Binary src	-	-	1 = 1
20.50	Start interlock 4 text	Binary src	-	-	1 = 1
21 Start	stop mode				
21.01	Vector start mode	List	02	-	1 = 1
21.02	Magnetization time	Real	010000	ms	1 = 1 ms
21.03	Stop mode	List	02	-	1 = 1
21.04	Emergency stop mode	List	02	-	1 = 1
21.05	Emergency stop source	Binary src	-	-	1 = 1
21.06	Zero speed limit	Real	0.0030000.00	rpm	100 = 1 rpm
21.07	Zero speed delay	Real	030000	ms	1 = 1 ms
21.08	DC current control	PB	0000b0011b	-	1 = 1
21.09	DC hold speed	Real	0.001000.00	rpm	100 = 1 rpm
21.10	DC current reference	Real	0.0100.0	%	10 = 1%
21.11	Post magnetization time	Real	03000	s	1 = 1 s
21.14	Pre-heating input source	Binary src	-	-	1 = 1

No.	Name	Туре	Range	Unit	FbEq32
21.16	Pre-heating current	Real	0.030.0	%	10 = 1%
21.18	Auto restart time	Real	0.0, 0.110.0	s	10 = 1 s
21.19	Scalar start mode	List	04	-	1 = 1
21.21	DC hold frequency	Real	0.001000.00	Hz	100 = 1 Hz
21.22	Start delay	Real	0.0060.00	s	100 = 1 s
21.23	Smooth start	Real	02	-	1 = 1
21.24	Smooth start current	Real	10.0100.0	%	100 = 1%
21.25	Smooth start speed	Real	2.0100.0	%	100 = 1%
21.26	Torque boost current	Real	15.0300.0	%	100 = 1%
21.30	Speed compensated stop mode	Real	03	-	1 = 1
21.31	Speed comp stop delay	Real	0.001000.00	s	100 = 1 s
21.32	Speed comp stop threshold	Real	0100	%	1 = 1%
22 Spee	d reference selection				
22.01	Speed ref unlimited	Real	-30000.0030000.00	rpm	100 = 1 rpm
22.11	Ext1 speed ref1	Analog src	-	-	1 = 1
22.18	Ext2 speed ref1	Analog src	-	-	1 = 1
22.21	Constant speed function	PB	00b11b	-	1 = 1
22.22	Constant speed sel1	Binary src	-	-	1 = 1
22.23	Constant speed sel2	Binary src	-	-	1 = 1
22.24	Constant speed sel3	Binary src	-	-	1 = 1
22.26	Constant speed 1	Real	-30000.0030000.00	rpm	100 = 1 rpm
22.27	Constant speed 2	Real	-30000.0030000.00	rpm	100 = 1 rpm
22.28	Constant speed 3	Real	-30000.0030000.00	rpm	100 = 1 rpm
22.29	Constant speed 4	Real	-30000.0030000.00	rpm	100 = 1 rpm
22.30	Constant speed 5	Real	-30000.0030000.00	rpm	100 = 1 rpm
22.31	Constant speed 6	Real	-30000.0030000.00	rpm	100 = 1 rpm
22.32	Constant speed 7	Real	-30000.0030000.00	rpm	100 = 1 rpm
22.41	Speed ref safe	Real	-30000.0030000.00	rpm	100 = 1 rpm
22.51	Critical speed function	PB	00b11b	-	1 = 1
22.52	Critical speed 1 low	Real	-30000.0030000.00	rpm	100 = 1 rpm
22.53	Critical speed 1 high	Real	-30000.0030000.00	rpm	100 = 1 rpm
22.54	Critical speed 2 low	Real	-30000.0030000.00	rpm	100 = 1 rpm
22.55	Critical speed 2 high	Real	-30000.0030000.00	rpm	100 = 1 rpm
22.56	Critical speed 3 low	Real	-30000.0030000.00	rpm	100 = 1 rpm
22.57	Critical speed 3 high	Real	-30000.0030000.00	rpm	100 = 1 rpm
22.71	Motor potentiometer function	List	03	-	1 = 1

No.	Name	Туре	Range	Unit	FbEq32				
22.72	Motor potentiometer initial value	Real	-32768.0032767.00	=	100 = 1				
22.73	Motor potentiometer up source	Binary src	-	-	1 = 1				
22.74	Motor potentiometer down source	Binary src	-	-	1 = 1				
22.75	Motor potentiometer ramp time	Real	0.03600.0	s	10 = 1 s				
22.76	Motor potentiometer min value	Real	-32768.0032767.00	-	100 = 1				
22.77	Motor potentiometer max value	Real	-32768.0032767.00	-	100 = 1				
22.80	Motor potentiometer ref act	Real	-32768.0032767.00	-	100 = 1				
22.86	Speed reference act 6	Real	-30000.0030000.00	rpm	100 = 1 rpm				
22.87	Speed reference act 7	Real	-30000.0030000.00	rpm	100 = 1 rpm				
23 Spee	d reference ramp								
23.01	Speed ref ramp input	Real	-30000.0030000.00	rpm	100 = 1 rpm				
23.02	Speed ref ramp output	Real	-30000.0030000.00	rpm	100 = 1 rpm				
23.12	Acceleration time 1	Real	0.0001800.000	s	1000 = 1 s				
23.13	Deceleration time 1	Real	0.0001800.000	s	1000 = 1 s				
23.23	Emergency stop time	Real	0.0001800.000	s	1000 = 1 s				
23.32	Shape time 1	Real	0.0001800.000	S	1000 = 1 s				
24 Spee	24 Speed reference conditioning								
24.01	Used speed reference	Real	-30000.0030000.00	rpm	100 = 1 rpm				
24.02	Used speed feedback	Real	-30000.0030000.00	rpm	100 = 1 rpm				
24.03	Speed error filtered	Real	-30000.030000.0	rpm	100 = 1 rpm				
24.04	Speed error inverted	Real	-30000.030000.0	rpm	100 = 1 rpm				
24.11	Speed correction	Real	-10000.0010000.00	rpm	100 = 1 rpm				
24.12	Speed error filter time	Real	010000	ms	1 = 1 ms				
25 Spee	d control								
25.01	Torque reference speed control	Real	-1600.01600.0	%	10 = 1%				
25.02	Speed proportional gain	Real	0.00250.00	-	100 = 1				
25.03	Speed integration time	Real	0.001000.00	s	100 = 1 s				
25.04	Speed derivation time	Real	0.00010.000	s	1000 = 1 s				
25.05	Derivation filter time	Real	010000	ms	1 = 1 ms				
25.06	Acc comp derivation time	Real	0.001000.00	S	100 = 1 s				
25.07	Acc comp filter time	Real	0.01000.0	ms	10 = 1 ms				
25.15	Proportional gain em stop	Real	1.00250.00	-	100 = 1				
25.53	Torque prop reference	Real	-30000.030000.0	%	10 = 1%				
25.54	Torque integral reference	Real	-30000.030000.0	%	10 = 1%				
25.55	Torque deriv reference	Real	-30000.030000.0	%	10 = 1%				
25.56	Torque acc compensation	Real	-30000.030000.0	%	10 = 1%				

No.	Name	Туре	Range	Unit	FbEq32
28 Freq	uency reference chain				
28.01	Frequency ref ramp input	Real	-500.00500.00	Hz	100 = 1 Hz
28.02	Frequency ref ramp output	Real	-500.00500.00	Hz	100 = 1 Hz
28.11	Ext1 frequency ref1	Analog	-	-	1 = 1
		src			
28.15	Ext2 frequency ref1	Analog src	-	-	1 = 1
28.21	Constant frequency function	PB	00b11b	-	1 = 1
28.22	Constant frequency sel1	Binary src	-	-	1 = 1
28.23	Constant frequency sel2	Binary src	-	-	1 = 1
28.24	Constant frequency sel3	Binary src	-	-	1 = 1
28.26	Constant frequency 1	Real	-500.00500.00	Hz	100 = 1 Hz
28.27	Constant frequency 2	Real	-500.00500.00	Hz	100 = 1 Hz
28.28	Constant frequency 3	Real	-500.00500.00	Hz	100 = 1 Hz
28.29	Constant frequency 4	Real	-500.00500.00	Hz	100 = 1 Hz
28.30	Constant frequency 5	Real	-500.00500.00	Hz	100 = 1 Hz
28.31	Constant frequency 6	Real	-500.00500.00	Hz	100 = 1 Hz
28.32	Constant frequency 7	Real	-500.00500.00	Hz	100 = 1 Hz
28.41	Frequency ref safe	Real	-500.00500.00	Hz	100 = 1 Hz
28.51	Critical frequency function	PB	00b11b	-	1 = 1
28.52	Critical frequency 1 low	Real	-500.00500.00	Hz	100 = 1 Hz
28.53	Critical frequency 1 high	Real	-500.00500.00	Hz	100 = 1 Hz
28.54	Critical frequency 2 low	Real	-500.00500.00	Hz	100 = 1 Hz
28.55	Critical frequency 2 high	Real	-500.00500.00	Hz	100 = 1 Hz
28.56	Critical frequency 3 low	Real	-500.00500.00	Hz	100 = 1 Hz
28.57	Critical frequency 3 high	Real	-500.00500.00	Hz	100 = 1 Hz
28.72	Freq acceleration time 1	Real	0.0001800.000	s	1000 = 1 s
28.73	Freq deceleration time 1	Real	0.0001800.000	S	1000 = 1 s
28.76	Freq ramp in zero source	Binary src	-	-	1 = 1
28.82	Shape time 1	Real	0.0001800.000	S	1000 = 1 s
28.92	Frequency ref act 3	Real	-500.00500.00	Hz	100 = 1 Hz
28.96	Frequency ref act 7	Real	-500.00500.00	Hz	100 = 1 Hz
28.97	Frequency ref unlimited	Real	-500.00500.00	Hz	100 = 1 Hz
30 Limit	ts				
30.01	Limit word 1	PB	0000hFFFFh	-	1 = 1
30.02	Torque limit status	PB	0000hFFFFh	-	1 = 1
30.11	Minimum speed	Real	-30000.0030000.00	rpm	100 = 1 rpm
30.12	Maximum speed	Real	-30000.0030000.00	rpm	100 = 1 rpm
30.13	Minimum frequency	Real	-500.00500.00	Hz	100 = 1 Hz

No.	Name	Туре	Range	Unit	FbEq32
30.14	Maximum frequency	Real	-500.00500.00	Hz	100 = 1 Hz
30.17	Maximum current	Real	0.0030000.00	Α	100 = 1 A
30.18	Torq lim sel	Binary src	-	-	1 = 1
30.19	Minimum torque 1	Real	-1600.00.0	%	10 = 1%
30.20	Maximum torque 1	Real	0.01600.0	%	10 = 1%
30.21	Min torque 2 source	Analog src	-	-	1 = 1
30.22	Max torque 2 source	Analog src	-	-	1 = 1
30.23	Minimum torque 2	Real	-1600.00.0	%	10 = 1%
30.24	Maximum torque 2	Real	0.01600.0	%	10 = 1%
30.26	Power motoring limit	Real	0.00600.00	%	100 = 1%
30.27	Power generating limit	Real	-600.000.00	%	100 = 1%
30.30	Overvoltage control	List	01	-	1 = 1
30.31	Undervoltage control	List	01	-	1 = 1
31 Fault	functions				
31.01	External event 1 source	Binary src	-	-	1 = 1
31.02	External event 1 type	List	01	-	1 = 1
31.03	External event 2 source	Binary src	-	-	1 = 1
31.04	External event 2 type	List	01	-	1 = 1
31.05	External event 3 source	Binary src	-	-	1 = 1
31.06	External event 3 type	List	01	-	1 = 1
31.07	External event 4 source	Binary src	-	-	1 = 1
31.08	External event 4 type	List	01	-	1 = 1
31.09	External event 5 source	Binary src	-	-	1 = 1
31.10	External event 5 type	List	01	-	1 = 1
31.11	Fault reset selection	Binary src	-	-	1 = 1
31.12	Autoreset selection	PB	0000hFFFFh	-	1 = 1
31.13	Selectable fault	Real	0000hFFFFh	-	1 = 1
31.14	Number of trials	Real	05	-	1 = 1
31.15	Total trials time	Real	1.0600.0	s	10 = 1 s
31.16	Delay time	Real	0.0120.0	s	10 = 1 s
31.19	Motor phase loss	List	01	-	1 = 1
31.20	Earth fault	List	02	-	1 = 1
31.21	Supply phase loss	List	01	-	1 = 1
31.22	STO indication run/stop	List	03	-	1 = 1
31.23	Wiring or earth fault	List	01	-	1 = 1

No.	Name	Туре	Range	Unit	FbEq32
31.24	Stall function	List	02	-	1 = 1
31.25	Stall current limit	Real	0.01600.0	%	10 = 1%
31.26	Stall speed limit	Real	0.0010000.00	rpm	100 = 1 rpm
31.27	Stall frequency limit	Real	0.001000.00	Hz	100 = 1 Hz
31.28	Stall time	Real	03600	s	1 = 1 s
31.30	Overspeed trip margin	Real	0.0010000.00	rpm	100 = 1 rpm
31.32	Emergency ramp supervision	Real	0300	%	1 = 1%
31.33	Emergency ramp supervision delay	Real	0100	S	1 = 1 s
31.36	Aux fan fault bybass	List	01	-	1 = 1
32 Supe	ervision				
32.01	Supervision status	PB	00000111b	-	1 = 1
32.05	Supervision 1 function	List	06	-	1 = 1
32.06	Supervision 1 action	List	03	-	1 = 1
32.07	Supervision 1 signal	Analog src	-	-	1 = 1
32.08	Supervision 1 filter time	Real	0.00030.000	S	1000 = 1 s
32.09	Supervision 1 low	Real	-21474836.00 21474836.00	-	100 = 1
32.10	Supervision 1 high	Real	-21474836.00 21474836.00	-	100 = 1
32.11	Supervision 1 hysteresis	Real	0.00100000.00	-	100 = 1
32.15	Supervision 2 function	List	06	-	1 = 1
32.16	Supervision 2 action	List	03	-	1 = 1
32.17	Supervision 2 signal	Analog src	-	-	1 = 1
32.18	Supervision 2 filter time	Real	0.00030.000	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	0.00100000.00	-	100 = 1
32.25	Supervision 3 function	List	06	-	1 = 1
32.26	Supervision 3 action	List	03	-	1 = 1
32.27	Supervision 3 signal	Analog src	-	-	1 = 1
32.28	Supervision 3 filter time	Real	0.00030.000	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	0.00100000.00	-	100 = 1
32.35	Supervision 4 function	List	06	-	1 = 1
32.36	Supervision 4 action	List	03	-	1 = 1

No.	Name	Туре	Range	Unit	FbEq32
32.37	Supervision 4 signal	Analog	-	-	1 = 1
		src			
32.38	Supervision 4 filter time	Real	0.00030.000	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	0.00100000.00	-	100 = 1
32.45	Supervision 5 function	List	06	-	1 = 1
32.46	Supervision 5 action	List	03	-	1 = 1
32.47	Supervision 5 signal	Analog src	-	-	1 = 1
32.48	Supervision 5 filter time	Real	0.00030.000	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	0.00100000.00	-	100 = 1
32.55	Supervision 6 function	List	06	-	1 = 1
32.56	Supervision 6 action	List	03	-	1 = 1
32.57	Supervision 6 signal	Analog src	-	-	1 = 1
32.58	Supervision 6 filter time	Real	0.00030.000	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	0.00100000.00	-	100 = 1
34 Time	d functions				
34.01	Timed functions status	PB	0000hFFFFh	-	1 = 1
34.02	Timer status	PB	0000hFFFFh	-	1 = 1
34.04	Season/exception day status	PB	0000hFFFFh	-	1 = 1
34.10	Timed functions enable	Binary src	-	-	1 = 1
34.11	Timer 1 configuration	PB	0000hFFFFh	-	1 = 1
34.12	Timer 1 start time	Time	00:00:0023:59:59	s	1 = 1 s
34.13	Timer 1 duration	Duration	00 00:0007 00:00	min	1 = 1 min
34.14	Timer 2 configuration	PB	0000hFFFFh	-	1 = 1
34.15	Timer 2 start time	Time	00:00:0023:59:59	S	1 = 1 s
34.16	Timer 2 duration	Duration	00 00:0007 00:00	min	1 = 1 min
34.17	Timer 3 configuration	PB	0000hFFFFh	-	1 = 1
34.18	Timer 3 start time	Time	00:00:0023:59:59	S	1 = 1 s
34.19	Timer 3 duration	Duration	00 00:0007 00:00	min	1 = 1 min
34.20	Timer 4 configuration	PB	0000hFFFFh	-	1 = 1

No.	Name	Туре	Range	Unit	FbEq32
34.21	Timer 4 start time	Time	00:00:0023:59:59	s	1 = 1 s
34.22	Timer 4 duration	Duration	00 00:0007 00:00	min	1 = 1 min
34.23	Timer 5 configuration	PB	0000hFFFFh	-	1 = 1
34.24	Timer 5 start time	Time	00:00:0023:59:59	S	1 = 1 s
34.25	Timer 5 duration	Duration	00 00:0007 00:00	min	1 = 1 min
34.26	Timer 6 configuration	PB	0000hFFFFh	-	1 = 1
34.27	Timer 6 start time	Time	00:00:0023:59:59	s	1 = 1 s
34.28	Timer 6 duration	Duration	00 00:0007 00:00	min	1 = 1 min
34.29	Timer 7 configuration	PB	0000hFFFFh	-	1 = 1
34.30	Timer 7 start time	Time	00:00:0023:59:59	s	1 = 1 s
34.31	Timer 7 duration	Duration	00 00:0007 00:00	min	1 = 1 min
34.32	Timer 8 configuration	PB	0000hFFFFh	-	1 = 1
34.33	Timer 8 start time	Time	00:00:0023:59:59	s	1 = 1 s
34.34	Timer 8 duration	Duration	00 00:0007 00:00	min	1 = 1 min
34.35	Timer 9 configuration	PB	0000hFFFFh	-	1 = 1
34.36	Timer 9 start time	Time	00:00:0023:59:59	S	1 = 1 s
34.37	Timer 9 duration	Duration	00 00:0007 00:00	min	1 = 1 min
34.38	Timer 10 configuration	PB	0000hFFFFh	-	1 = 1
34.39	Timer 10 start time	Time	00:00:0023:59:59	S	1 = 1 s
34.40	Timer 10 duration	Duration	00 00:0007 00:00	min	1 = 1 min
34.41	Timer 11 configuration	PB	0000hFFFFh	-	1 = 1
34.42	Timer 11 start time	Time	00:00:0023:59:59	S	1 = 1 s
34.43	Timer 11 duration	Duration	00 00:0007 00:00	min	1 = 1 min
34.44	Timer 12 configuration	PB	0000hFFFFh	-	1 = 1
34.45	Timer 12 start time	Time	00:00:0023:59:59	S	1 = 1 s
34.46	Timer 12 duration	Duration	00 00:0007 00:00	min	1 = 1 min
34.60	Season 1 start date	Date	01.0131.12	d	1 = 1 d
34.61	Season 2 start date	Date	01.0131.12	d	1 = 1 d
34.62	Season 3 start date	Date	01.0131.12	d	1 = 1 d
34.63	Season 4 start date	Date	01.0131.12	d	1 = 1 d
34.70	Number of active exceptions	Real	016	-	1 = 1
34.71	Exception types	PB	0000hFFFFh	-	1 = 1
34.72	Exception 1 start	Date	01.0131.12	d	1 = 1 d
34.73	Exception 1 length	Real	060	d	1 = 1 d
34.74	Exception 2 start	Date	01.0131.12	d	1 = 1 d
34.75	Exception 2 length	Real	060	d	1 = 1 d
34.76	Exception 3 start	Date	01.0131.12	d	1 = 1 d
34.77	Exception 3 length	Real	060	d	1 = 1 d
34.78	Exception day 4	Date	01.0131.12	d	1 = 1 d
34.79	Exception day 5	Date	01.0131.12	d	1 = 1 d
34.80	Exception day 6	Date	01.0131.12	d	1 = 1 d

No.	Name	Туре	Range	Unit	FbEq32
34.81	Exception day 7	Date	01.0131.12	d	1 = 1 d
34.82	Exception day 8	Date	01.0131.12	d	1 = 1 d
34.83	Exception day 9	Date	01.0131.12	d	1 = 1 d
34.84	Exception day 10	Date	01.0131.12	d	1 = 1 d
34.85	Exception day 11	Date	01.0131.12	d	1 = 1 d
34.86	Exception day 12	Date	01.0131.12	d	1 = 1 d
34.87	Exception day 13	Date	01.0131.12	d	1 = 1 d
34.88	Exception day 14	Date	01.0131.12	d	1 = 1 d
34.89	Exception day 15	Date	01.0131.12	d	1 = 1 d
34.90	Exception day 16	Date	01.0131.12	d	1 = 1 d
34.100	Timed function 1	PB	0000hFFFFh	-	1 = 1
34.101	Timed function 2	PB	0000hFFFFh	-	1 = 1
34.102	Timed function 3	PB	0000hFFFFh	-	1 = 1
34.110	Boost time function	PB	0000hFFFFh	-	1 = 1
34.111	Boost time activation source	Binary src	-	-	1 = 1
34.112	Boost time duration	Duration	00 00:0007 00:00	min	1 = 1 min
35 Moto	r thermal protection				
35.01	Motor estimated temperature	Real	-601000 °C or -761832 °F	°C or °F	1 = 1 °
35.02	Measured temperature 1	Real	-605000 °C or -769032 °F, 0 ohm or [<i>35.12</i>] ohm	°C, °F or ohm	1 = 1 unit
35.03	Measured temperature 2	Real	-605000 °C or -769032 °F, 0 ohm or [35.12] ohm	°C, °F or ohm	1 = 1 unit
35.11	Temperature 1 source	List	02, 58, 1116, 19, 21, 22	-	1 = 1
35.12	Temperature 1 fault limit	Real	-605000 °C or -769032 °F	°C, °F or ohm	1 = 1 unit
35.13	Temperature 1 warning limit	Real	-605000 °C or -769032 °F	°C, °F or ohm	1 = 1 unit
35.14	Temperature 1 Al source	Analog src	-	1	1 = 1
35.21	Temperature 2 source	List	02, 58, 1116, 19	-	1 = 1
35.22	Temperature 2 fault limit	Real	-605000 °C or -769032 °F	°C, °F or ohm	1 = 1 unit
35.23	Temperature 2 warning limit	Real	-605000 °C or -769032 °F	°C, °F or ohm	1 = 1 unit
35.24	Temperature 2 Al source	Analog src	-	-	1 = 1
35.31	Safe motor temperature enable	List	01	-	1 = 1
35.50	Motor ambient temperature	Real	-60100 °C or -76 212 °F	°C	1 = 1 °

No.	Name	Type	Range	Unit	FbEq32
35.51	Motor load curve	Real	50150	%	1 = 1%
35.52	Zero speed load	Real	50150	%	1 = 1%
35.53	Break point	Real	1.00 500.00	Hz	100 = 1 Hz
35.54	Motor nominal temperature rise	Real	0300 °C or 32572 °F	°C or °F	1 = 1 °
35.55	Motor thermal time const	Real	10010000	s	1 = 1 s
36 Load	analyzer				
36.01	PVL signal source	Analog src	-	-	1 = 1
36.02	PVL filter time	Real	0.00120.00	s	100 = 1 s
36.06	AL2 signal source	Analog src	-	-	1 = 1
36.07	AL2 signal scaling	Real	0.0032767.00	-	100 = 1
36.09	Reset loggers	List	03	-	1 = 1
36.10	PVL peak value	Real	-32768.0032767.00	-	100 = 1
36.11	PVL peak date	Data	-	-	1 = 1
36.12	PVL peak time	Data	-	-	1 = 1
36.13	PVL current at peak	Real	-32768.0032767.00	Α	100 = 1 A
36.14	PVL DC voltage at peak	Real	0.002000.00	V	100 = 1 V
36.15	PVL speed at peak	Real	-30000.00 30000.00	rpm	100 = 1 rpm
36.16	PVL reset date	Data	-	-	1 = 1
36.17	PVL reset time	Data	-	-	1 = 1
36.20	AL1 0 to 10%	Real	0.00100.00	%	100 = 1%
36.21	AL1 10 to 20%	Real	0.00100.00	%	100 = 1%
36.22	AL1 20 to 30%	Real	0.00100.00	%	100 = 1%
36.23	AL1 30 to 40%	Real	0.00100.00	%	100 = 1%
36.24	AL1 40 to 50%	Real	0.00100.00	%	100 = 1%
36.25	AL1 50 to 60%	Real	0.00100.00	%	100 = 1%
36.26	AL1 60 to 70%	Real	0.00100.00	%	100 = 1%
36.27	AL1 70 to 80%	Real	0.00100.00	%	100 = 1%
36.28	AL1 80 to 90%	Real	0.00100.00	%	100 = 1%
36.29	AL1 over 90%	Real	0.00100.00	%	100 = 1%
36.40	AL2 0 to 10%	Real	0.00100.00	%	100 = 1%
36.41	AL2 10 to 20%	Real	0.00100.00	%	100 = 1%
36.42	AL2 20 to 30%	Real	0.00100.00	%	100 = 1%
36.43	AL2 30 to 40%	Real	0.00100.00	%	100 = 1%
36.44	AL2 40 to 50%	Real	0.00100.00	%	100 = 1%
36.45	AL2 50 to 60%	Real	0.00100.00	%	100 = 1%
36.46	AL2 60 to 70%	Real	0.00100.00	%	100 = 1%
36.47	AL2 70 to 80%	Real	0.00100.00	%	100 = 1%
36.48	AL2 80 to 90%	Real	0.00100.00	%	100 = 1%
36.49	AL2 over 90%	Real	0.00100.00	%	100 = 1%

No.	Name	Туре	Range	Unit	FbEq32					
36.50	AL2 reset date	Data	-	-	1 = 1					
36.51	AL2 reset time	Data	-	-	1 = 1					
37 User	37 User load curve									
37.01	ULC output status word	PB	0000hFFFFh	-	1 = 1					
37.02	ULC supervision signal	Analog src	-	-	1 = 1					
37.03	ULC overload actions	List	03	-	1 = 1					
37.04	ULC underload actions	List	03	-	1 = 1					
37.11	ULC speed table point 1	Real	-30000.030000.0	rpm	10 = 1 rpm					
37.12	ULC speed table point 2	Real	-30000.030000.0	rpm	10 = 1 rpm					
37.13	ULC speed table point 3	Real	-30000.030000.0	rpm	10 = 1 rpm					
37.14	ULC speed table point 4	Real	-30000.030000.0	rpm	10 = 1 rpm					
37.15	ULC speed table point 5	Real	-30000.030000.0	rpm	10 = 1 rpm					
37.16	ULC frequency table point 1	Real	-500.0500.0	Hz	10 = 1 Hz					
37.17	ULC frequency table point 2	Real	-500.0500.0	Hz	10 = 1 Hz					
37.18	ULC frequency table point 3	Real	-500.0500.0	Hz	10 = 1 Hz					
37.19	ULC frequency table point 4	Real	-500.0500.0	Hz	10 = 1 Hz					
37.20	ULC frequency table point 5	Real	-500.0500.0	Hz	10 = 1 Hz					
37.21	ULC underload point 1	Real	-1600.01600.0	%	10 = 1%					
37.22	ULC underload point 2	Real	-1600.01600.0	%	10 = 1%					
37.23	ULC underload point 3	Real	-1600.01600.0	%	10 = 1%					
37.24	ULC underload point 4	Real	-1600.01600.0	%	10 = 1%					
37.25	ULC underload point 5	Real	-1600.01600.0	%	10 = 1%					
37.31	ULC overload point 1	Real	-1600.01600.0	%	10 = 1%					
37.32	ULC overload point 2	Real	-1600.01600.0	%	10 = 1%					
37.33	ULC overload point 3	Real	-1600.01600.0	%	10 = 1%					
37.34	ULC overload point 4	Real	-1600.01600.0	%	10 = 1%					
37.35	ULC overload point 5	Real	-1600.01600.0	%	10 = 1%					
37.41	ULC overload timer	Real	0.010000.0	S	10 = 1 s					
37.42	ULC underload timer	Real	0.010000.0	S	10 = 1 s					
40 Proc	ess PID set 1			1						
40.01	Process PID output actual	Real	-32768.0032767.00	%	100 = 1 PID customer unit					
40.02	Process PID feedback actual	Real	-32768.0032767.00	PID customer units	100 = 1 PID customer unit					
40.03	Process PID setpoint actual	Real	-32768.0032767.00	PID customer units	100 = 1 PID customer unit					
40.04	Process PID deviation actual	Real	-32768.0032767.00	PID customer units	100 = 1 PID customer unit					
40.06	Process PID status word	PB	0000hFFFFh	-	1 = 1					
40.07	Process PID operation mode	List	02	-	1 = 1					

No.	Name	Туре	Range	Unit	FbEq32
40.08	Set 1 feedback 1 source	Analog src	-	-	1 = 1
40.09	Set 1 feedback 2 source	Analog src	-	-	1 = 1
40.10	Set 1 feedback function	List	013	-	1 = 1
40.11	Set 1 feedback filter time	Real	0.00030.000	S	1000 = 1 s
40.16	Set 1 setpoint 1 source	Analog src	-	-	1 = 1
40.17	Set 1 setpoint 2 source	Analog src	-	-	1 = 1
40.18	Set 1 setpoint function	List	011	-	1 = 1
40.19	Set 1 internal setpoint sel1	Binary src	-	-	1 = 1
40.20	Set 1 internal setpoint sel2	Binary src	-	-	1 = 1
40.21	Set 1 internal setpoint 1	Real	-32768.0032767.00	PID customer units	100 = 1 PID customer unit
40.22	Set 1 internal setpoint 2	Real	-32768.0032767.00	PID customer units	100 = 1 PID customer unit
40.23	Set 1 internal setpoint 3	Real	-32768.0032767.00	PID customer units	100 = 1 PID customer unit
40.26	Set 1 setpoint min	Real	-32768.0032767.00	-	100 = 1
40.27	Set 1 setpoint max	Real	-32768.0032767.00	-	100 = 1
40.28	Set 1 setpoint increase time	Real	0.01800.0	s	10 = 1 s
40.29	Set 1 setpoint decrease time	Real	0.01800.0	s	10 = 1 s
40.30	Set 1 setpoint freeze enable	Binary src	-	-	1 = 1
40.31	Set 1 deviation inversion	Binary src	-	-	1 = 1
40.32	Set 1 gain	Real	0.10100.00	-	100 = 1
40.33	Set 1 integration time	Real	0.09999.0	s	10 = 1 s
40.34	Set 1 derivation time	Real	0.00010.000	s	1000 = 1 s
40.35	Set 1 derivation filter time	Real	0.010.0	s	10 = 1 s
40.36	Set 1 output min	Real	-32768.032767.0	-	10 = 1
40.37	Set 1 output max	Real	-32768.032767.0	-	10 = 1
40.38	Set 1 output freeze	Binary src	-	-	1 = 1
40.43	Set 1 sleep level	Real	0.032767.0	-	10 = 1
40.44	Set 1 sleep delay	Real	0.03600.0	s	10 = 1 s
40.45	Set 1 sleep boost time	Real	0.03600.0	s	10 = 1 s
40.46	Set 1 sleep boost step	Real	0.032767.0	PID customer units	10 = 1 PID customer unit

No.	Name	Туре	Range	Unit	FbEq32
40.47	Set 1 wake-up deviation	Real	-32768.0032767.00	PID customer units	100 = 1 PID customer unit
40.48	Set 1 wake-up delay	Real	0.0060.00	S	100 = 1 s
40.49	Set 1 tracking mode	Binary src	-	1	1 = 1
40.50	Set 1 tracking ref selection	Analog src	-	-	1 = 1
40.57	PID set1/set2 selection	Binary src	-	-	1 = 1
40.58	Set 1 increase prevention	Binary src	-	-	1 = 1
40.59	Set 1 decrease prevention	Binary src	-	-	1 = 1
40.62	PID internal setpoint actual	Real	-32768.0032767.00	PID customer units	100 = 1 PID customer unit
40.90	Set 1 feedback multiplier k	Real	-100000.00100000.00	-	100 = 1
40.91	Feedback data storage	Real	-327.68327.67	-	100 = 1
40.92	Setpoint data storage	Real	-327.68327.67	-	100 = 1
41 Proc	ess PID set 2				
41.08	Set 2 feedback 1 source	Analog src	-	-	1 = 1
41.09	Set 2 feedback 2 source	Analog src	-	-	1 = 1
41.10	Set 2 feedback function	List	013	-	1 = 1
41.11	Set 2 feedback filter time	Real	0.00030.000	S	1000 = 1 s
41.16	Set 2 setpoint 1 source	Analog src	-	-	1 = 1
41.17	Set 2 setpoint 2 source	Analog src	-	-	1 = 1
41.18	Set 2 setpoint function	List	011	-	1 = 1
41.19	Set 2 internal setpoint sel1	Binary src	-	-	1 = 1
41.20	Set 2 internal setpoint sel2	Binary src	-	-	1 = 1
41.21	Set 2 internal setpoint 1	Real	-32768.0032767.00	PID customer unit	100 = 1 PID customer unit
41.22	Set 2 internal setpoint 2	Real	-32768.0032767.00	PID customer units	100 = 1 PID customer unit
41.23	Set 2 internal setpoint 3	Real	-32768.0032767.00	PID customer units	100 = 1 PID customer unit
41.26	Set 2 setpoint min	Real	-32768.0032767.00	-	100 = 1
41.27	Set 2 setpoint max	Real	-32768.0032767.00		100 = 1
41.28	Set 2 setpoint increase time	Real	0.01800.0	S	10 = 1 s

No.	Name	Type	Range	Unit	FbEq32
41.29	Set 2 setpoint decrease time	Real	0.01800.0	s	10 = 1 s
41.30	Set 2 setpoint freeze enable	Binary src	-	-	1 = 1
41.31	Set 2 deviation inversion	Binary src	-	-	1 = 1
41.32	Set 2 gain	Real	0.10100.00	-	100 = 1
41.33	Set 2 integration time	Real	0.09999.0	s	10 = 1 s
41.34	Set 2 derivation time	Real	0.00010.000	s	1000 = 1 s
41.35	Set 2 derivation filter time	Real	0.010.0	s	10 = 1 s
41.36	Set 2 output min	Real	-32768.032767.0	-	10 = 1
41.37	Set 2 output max	Real	-32768.032767.0	-	10 = 1
41.38	Set 2 output freeze	Binary src	-	-	1 = 1
41.43	Set 2 sleep level	Real	0.032767.0	-	10 = 1
41.44	Set 2 sleep delay	Real	0.03600.0	S	10 = 1 s
41.45	Set 2 sleep boost time	Real	0.03600.0	S	10 = 1 s
41.46	Set 2 sleep boost step	Real	0.032767.0	PID customer units	10 = 1 PID customer unit
41.47	Set 2 wake-up deviation	Real	-32768.032767.0	PID customer units	100 = 1 PID customer unit
41.48	Set 2 wake-up delay	Real	0.0060.00	s	100 = 1 s
41.49	Set 2 tracking mode	Binary src	-	-	1 = 1
41.50	Set 2 tracking ref selection	Analog src	-	-	1 = 1
41.58	Set 2 increase prevention	Binary src	-	-	1 = 1
41.59	Set 2 decrease prevention	Binary src	-	-	1 = 1
41.90	Set 2 feedback multiplier k	Real	-100000.00100000.00	-	100 = 1
45 Ener	gy efficiency				
45.01	Saved GW hours	Real	065535	GWh	1 = 1 GWh
45.02	Saved MW hours	Real	0999	MWh	1 = 1 MWh
45.03	Saved kW hours	Real	0.0999.9	kWh	10 = 1 kWh
45.04	Saved energy	Real	0.0214748364.0	kWh	10 = 1 kWh
45.05	Saved money x1000	Real	04294967295 thousands	(defina- ble)	1 = 1 currency unit
45.06	Saved money	Real	0.00999.99	(defina- ble)	100 = 1 currency unit
45.07	Saved amount	Real	0.0021474830.08	(defina- ble)	100 = 1 currency unit
45.08	CO2 reduction in kilotons	Real	065535	metric kiloton	1 = 1 metric kiloton

No.	Name	Туре	Range	Unit	FbEq32
45.09	CO2 reduction in tons	Real	0.0999.9	metric ton	10 = 1 metric ton
45.10	Total saved CO2	Real	0.0214748300.8	metric ton	10 = 1 metric ton
45.11	Energy optimizer	List	01	-	1 = 1
45.12	Energy tariff 1	Real	0.0004294966.296	(defina- ble)	1000 = 1 currency unit
45.13	Energy tariff 2	Real	0.0004294966.296	(defina- ble)	1000 = 1 currency unit
45.14	Tariff selection	Binary src	-	-	1 = 1
45.18	CO2 conversion factor	Real	0.00065.535	tn/ MWh	1000 = 1 tn/MWh
45.19	Comparison power	Real	0.0010000000.00	kW	10 = 1 kW
45.21	Energy calculations reset	List	01	-	1 = 1
46 Moni	toring/scaling settings				
46.01	Speed scaling	Real	0.0030000.00	rpm	100 = 1 rpm
46.02	Frequency scaling	Real	0.101000.00	Hz	100 = 1 Hz
46.03	Torque scaling	Real	0.11000.0	%	10 = 1%
46.04	Power scaling	Real	0.1030000.00 kW or 0.1040200.00 hp	kW or hp	10 = 1 unit
46.05	Current scaling	Real	030000	А	1 = 1 A
46.06	Speed ref zero scaling	Real	0.00 30000.00	rpm	100 = 1 rpm
46.11	Filter time motor speed	Real	220000	ms	1 = 1 ms
46.12	Filter time output frequency	Real	220000	ms	1 = 1 ms
46.13	Filter time motor torque	Real	220000	ms	1 = 1 ms
46.14	Filter time power	Real	220000	ms	1 = 1 ms
46.21	At speed hysteresis	Real	0.0030000.00	rpm	100 = 1 rpm
46.22	At frequency hysteresis	Real	0.001000.00	Hz	100 = 1 Hz
46.31	Above speed limit	Real	0.0030000.00	rpm	100 = 1 rpm
46.32	Above frequency limit	Real	0.001000.00	Hz	100 = 1 Hz
46.33	Above torque limit	Real	0.01600.0	%	10 = 1%
46.41	kWh pulse scaling	Real	0.0011000.000	kWh	1000 = 1 kWh
47 Data	storage				
47.01	Data storage 1 real32	Real	-2147483.000 2147483.000		1000 = 1
47.02	Data storage 2 real32	Real	-2147483.000 2147483.000	-	1000 = 1
47.03	Data storage 3 real32	Real	-2147483.000 2147483.000	-	1000 = 1
47.04	Data storage 4 real32	Real	-2147483.000 2147483.000	-	1000 = 1
47.11	Data storage 1 int32	Real	-2147483648 2147483647	-	1 = 1

No.	Name	Туре	Range	Unit	FbEq32
47.12	Data storage 2 int32	Real	-2147483648 2147483647	=	1 = 1
47.13	Data storage 3 int32	Real	-2147483648 2147483647	-	1 = 1
47.14	Data storage 4 int32	Real	-2147483648 2147483647	=	1 = 1
47.21	Data storage 1 int16	Real	-3276832767	-	1 = 1
47.22	Data storage 2 int16	Real	-3276832767	-	1 = 1
47.23	Data storage 3 int16	Real	-3276832767	-	1 = 1
47.24	Data storage 4 int16	Real	-3276832767	-	1 = 1
49 Pane	el port communication				
49.01	Node ID number	Real	132	-	1 = 1
49.03	Baud rate	List	15	-	1 = 1
49.04	Communication loss time	Real	0.33000.0	s	10 = 1 s
49.05	Communication loss action	List	03	-	1 = 1
49.06	Refresh settings	List	01	-	1 = 1
50 Field	lbus adapter (FBA)				
50.01	FBA A enable	List	01	-	1 = 1
50.02	FBA A comm loss func	List	05	-	1 = 1
50.03	FBA A comm loss t out	Real	0.36553.5	S	10 = 1 s
50.04	FBA A ref1 type	List	05	-	1 = 1
50.05	FBA A ref2 type	List	05	-	1 = 1
50.06	FBA A SW sel	List	01	-	1 = 1
50.07	FBA A actual 1 type	List	05	-	1 = 1
50.08	FBA A actual 2 type	List	05	-	1 = 1
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	-	-	1 = 1
50.12	FBA A debug mode	List	01	-	1 = 1
50.13	FBA A control word	Data	00000000hFFFFFFFh	-	1 = 1
50.14	FBA A reference 1	Real	-2147483648 2147483647	-	1 = 1
50.15	FBA A reference 2	Real	-2147483648 2147483647	-	1 = 1
50.16	FBA A status word	Data	00000000hFFFFFFFh	-	1 = 1
50.17	FBA A actual value 1	Real	-2147483648 2147483647	-	1 = 1
50.18	FBA A actual value 2	Real	-2147483648 2147483647	-	1 = 1
51 FBA	A settings				
51.01	FBA A type	List	-	-	1 = 1

No.	Name	Туре	Range	Unit	FbEq32
51.02	FBA A Par2	Real	065535	-	1 = 1
51.26	FBA A Par26	Real	065535	-	1 = 1
51.27	FBA A par refresh	List	01	-	1 = 1
51.28	FBA A par table ver	Data	-	-	1 = 1
51.29	FBA A drive type code	Real	065535	-	1 = 1
51.30	FBA A mapping file ver	Real	065535	-	1 = 1
51.31	D2FBA A comm status	List	06	-	1 = 1
51.32	FBA A comm SW ver	Data	-	-	1 = 1
51.33	FBA A appl SW ver	Data	-	-	1 = 1
52 FBA	A data in	<u> </u>			
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 Emb	edded fieldbus	<u> </u>			L
58.01	Protocol	List	01	-	1 = 1
58.02	Protocol ID	Real	0000hFFFFh	-	1 = 1
58.03	Node address	Real	0255	-	1 = 1
58.04	Baud rate	List	07	-	1 = 1
58.05	Parity	List	03	-	1 = 1
58.06	Communication control	List	02	-	1 = 1
58.07	Communication diagnostics	PB	0000hFFFFh	-	1 = 1
58.08	Received packets	Real	04294967295	-	1 = 1
58.09	Transmitted packets	Real	04294967295	-	1 = 1
58.10	All packets	Real	04294967295	-	1 = 1
58.11	UART errors	Real	04294967295	-	1 = 1
58.12	CRC errors	Real	04294967295	-	1 = 1
58.14	Communication loss action	List	05	-	1 = 1
58.15	Communication loss mode	List	12	-	1 = 1
58.16	Communication loss time	Real	0.06000.0	S	10 = 1 s
58.17	Transmit delay	Real	065535	ms	1 = 1 ms
58.18	EFB control word	PB	0000hFFFFh	-	1 = 1
58.19	EFB status word	PB	0000hFFFFh	-	1 = 1
58.25	Control profile	List	0, 5	-	1 = 1
58.26	EFB ref1 type	List	02, 45	-	1 = 1
58.27	EFB ref2 type	List	02, 45	-	1 = 1
58.28	EFB act1 type	List	02, 45	-	1 = 1

No.	Name	Туре	Range	Unit	FbEq32
58.29	EFB act2 type	List	02, 45	-	1 = 1
58.31	EFB act1 transparent source	Analog src	-	-	1 = 1
58.32	EFB act2 transparent source	Analog src	-	-	1 = 1
58.33	Addressing mode	List	02	-	1 = 1
58.34	Word order	List	01	-	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
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
71 Exte	rnal PID1				
71.01	External PID act value	Real	-32768.0032767.00	%	100 = 1 PID customer unit
71.02	Feedback act value	Real	-32768.0032767.00	PID customer units	100 = 1 PID customer unit
71.03	Setpoint act value	Real	-32768.0032767.00	PID customer units	100 = 1 PID customer unit
71.04	Deviation act value	Real	-32768.0032767.00	PID customer units	100 = 1 PID customer unit
71.06	PID status word	PB	0000hFFFFh	-	1 = 1
71.07	PID operation mode	List	02	-	1 = 1
71.08	Feedback 1 source	Analog src	-	-	1 = 1
71.11	Feedback filter time	Real	0.00030.000	s	1000 = 1 s
71.14	Setpoint scaling	Real	-32768.0032767.00	-	100 = 1
71.15	Output scaling	Real	-32768.0032767.00	-	100 = 1
71.16	Setpoint 1 source	Analog src		-	1 = 1
71.19	Internal setpoint sel1	Binary src	-	-	1 = 1

No.	Name	Туре	Range	Unit	FbEq32
71.20	Internal setpoint sel2	Binary	-	-	1 = 1
		src			
71.21	Internal setpoint 1	Real	-32768.0032767.00	PID customer	100 = 1 PID customer unit
				units	odotornor driit
71.22	Internal setpoint 2	Real	-32768.0032767.00	PID	100 = 1 PID
				customer units	customer unit
71.23	Internal setpoint 3	Real	-32768.0032767.00	PID	100 = 1 PID
				customer	customer unit
74.00	0.1	51	00700 00 00707 00	units	100 1
71.26	Setpoint min	Real	-32768.0032767.00	-	100 = 1
71.27	Setpoint max	Real	-32768.0032767.00	-	100 = 1
71.31	Deviation inversion	Binary src	-	-	1 = 1
71.32	Gain	Real	0.10100.00	-	100 = 1
71.33	Integration time	Real	0.09999.0	S	10 = 1 s
71.34	Derivation time	Real	0.00010.000	S	1000 = 1 s
71.35	Derivation filter time	Real	0.010.0	S	10 = 1 s
71.36	Output min	Real	-32768.032767.0	-	10 = 1
71.37	Output max	Real	-32768.032767.0	-	10 = 1
71.38	Output freeze enable	Binary src	-	-	1 = 1
71.39	Deadband range	Real	0.032767.0	-	10 = 1
71.40	Deadband delay	Real	0.03600.0	s	10 = 1 s
71.58	Increase prevention	Binary	-	-	1 = 1
		src			
71.59	Decrease prevention	Binary src	-	-	1 = 1
71.62	Internal setpoint actual	Real	-32768.0032767.00	PID	100 = 1 PID
				customer units	customer unit
76 Multi	pump configuration				
76.01	PFC status	PB	0000hFFFFh	-	1 = 1
76.02	Multipump system status	PB	0000hFFFFh	-	1 = 1
76.11	Pump status 1	PB	0000hFFFFh	-	1 = 1
76.12	Pump status 2	PB	0000hFFFFh	-	1 = 1
76.13	Pump status 3	PB	0000hFFFFh	-	1 = 1
76.14	Pump status 4	PB	0000hFFFFh	-	1 = 1
76.15	Pump status 5	PB	0000hFFFFh	-	1 = 1
76.16	Pump status 6	PB	0000hFFFFh	-	1 = 1
76.17	Pump status 7	PB	0000hFFFFh	-	1 = 1
76.18	Pump status 8	PB	0000hFFFFh	-	1 = 1
76.21	Multipump configuration	List	=	-	1 = 1
76.22	Multipump node number	Real	18	-	1 = 1

No.	Name	Type	Range	Unit	FbEq32
76.23	Master enable	List	-	-	1 = 1
76.25	Number of motors	Real	18	-	1 = 1
76.26	Min number of motors allowed	Real	08	-	1 = 1
76.27	Max number of motors allowed	Real	18	-	1 = 1
76.30	Start speed 1	Real	032767	rpm/Hz	1 = 1 unit
76.31	Start speed 2	Real	032767	rpm/Hz	1 = 1 unit
76.32	Start speed 3	Real	032767	rpm/Hz	1 = 1 unit
76.33	Start speed 4	Real	032767	rpm/Hz	1 = 1 unit
76.34	Start speed 5	Real	032767	rpm/Hz	1 = 1 unit
76.35	Start speed 6	Real	032767	rpm/Hz	1 = 1 unit
76.36	Start speed 7	Real	032767	rpm/Hz	1 = 1 unit
76.41	Stop speed 1	Real	032767	rpm/Hz	1 = 1 unit
76.42	Stop speed 2	Real	032767	rpm/Hz	1 = 1 unit
76.43	Stop speed 3	Real	032767	rpm/Hz	1 = 1 unit
76.44	Stop speed 4	Real	032767	rpm/Hz	1 = 1 unit
76.45	Stop speed 5	Real	032767	rpm/Hz	1 = 1 unit
76.46	Stop speed 6	Real	032767	rpm/Hz	1 = 1 unit
76.47	Stop speed 7	Real	032767	rpm/Hz	1 = 1 unit
76.55	Start delay	Real	0.0012600.00	s	100 = 1 s
76.56	Stop delay	Real	0.0012600.00	s	100 = 1 s
76.57	PFC speed hold on	Real	0.001000.00	s	100 = 1 s
76.58	PFC speed hold off	Real	0.001000.00	s	100 = 1 s
76.59	PFC contactor delay	Real	0.20600.00	s	100 = 1 s
76.60	PFC ramp acceleration time	Real	0.001800.00	s	100 = 1 s
76.61	PFC ramp deceleration time	Real	0.001800.00	s	100 = 1 s
76.62	IPC smooth acceleration time	Real	3.001800.00	s	100 = 1 s
76.63	IPC smooth deceleration time	Real	3.001800.00	s	100 = 1 s
76.70	PFC Autochange	List	-	-	1 = 1
76.71	PFC Autochange interval	Real	0.0042949672.95	h	100 = 1 h
76.72	Maximum wear imbalance	Real	0.001000000.00	h	100 = 1 h
76.73	Autochange level	Real	0.0300.0	%	10 = 1%
76.74	Autochange auxiliary PFC	List	-	-	1
76.76	Max stationary time	Real	0.0214748368.0	h	10 = 1 h
76.77	Pump priority	Binary src	-	-	-
76.81	PFC 1 interlock	List	-	-	1 = 1
76.82	PFC 2 interlock	List	-	-	1 = 1
76.83	PFC 3 interlock	List	-	-	1 = 1
76.84	PFC 4 interlock	List	-	-	1 = 1
76.85	PFC 5 interlock	List	-	-	1 = 1
76.86	PFC 6 interlock	List	-	-	1 = 1

	Name	Type	Range	Unit	FbEq32
76.95	Regulator bypass control	Binary src	-	=	-
	IPC parameter synchronization	Binary src	-	-	-
76.102	IPC synchronization settings	PB	0000hFFFFh	-	1 = 1
76.105	IPC synchronization checksum	PB	-	-	1 = 1
77 Multip	pump maintenance and monit	oring			
77.10	PFC runtime change	List	=	-	-
77.11	Pump 1 running time	Real	0.0042949672.95	h	100 = 1 h
77.12	Pump 2 running time	Real	0.0042949672.95	h	100 = 1 h
77.13	Pump 3 running time	Real	0.0042949672.95	h	100 = 1 h
77.14	Pump 4 running time	Real	0.0042949672.95	h	100 = 1 h
77.15	Pump 5 running time	Real	0.0042949672.95	h	100 = 1 h
77.16	Pump 6 running time	Real	0.0042949672.95	h	100 = 1 h
77.17	Pump 7 running time	Real	0.0042949672.95	h	100 = 1 h
77.18	Pump 8 running time	Real	0.0042949672.95	h	100 = 1 h
77.20	IPC online pumps	PB	0b00000b1111 1111 1111 1111	-	-
77.21	IPC comm loss status	PB	0b00000b1111 1111 1111 1111	1	1
80 Flow	calculation				
80.01	Actual flow	Real	-200000.00200000.00	-	100 = 1
80.02	Actual flow percentage	Binary src	-100.00100.00	%	100 = 1
80.11	Flow feedback 1 source	List	-	-	-
80.12	Flow feedback 2 source	List	-	ı	1
80.13	Flow feedback function	List	-	i	1
80.14	Flow feedback multiplier	Real	-200000.00200000.00	ı	100 = 1
80.15	Maximum flow	Real	-200000.00200000.00	-	100 = 1
82 Pump	protections				
82.01	Quick ramp mode	List	02	-	1 = 1
82.05	Quick ramp 1 accel. time	Real	0.105.00	S	1 = 1
82.06	Quick ramp 1 decel. time	Real	0.105.00	S	1 = 1
82.07	Quick ramp 1 upper limit	Real	15100	Hz	1 = 1
82.10	Quick ramp 2 accel. time	Real	0.1020.00	s	1 = 1
82.11	Quick ramp 2 decel. time	Real	0.1020.00	s	1 = 1
82.12	Quick ramp 2 upper limit	Real	15100	Hz	1 = 1
83 Pump	cleaning				
83.01	Pump cleaning status	Binary src	-	-	-
83.02	Pump cleaning progress	Real	0.0100.0	%	1 = 1
83.03	Total cleaning count	Real	01000000	ı	1 = 1

No.	Name	Туре	Range	Unit	FbEq32
83.10	Pump cleaning action	Binary src	-	-	-
83.11	Pump cleaning triggers	PB	0000hFFFFh	-	1 = 1
83.12	Manually force cleaning	Binary src	-	-	-
83.15	Fixed time interval	Time	00:00:0045:12:15	s	1 = 1
83.16	Cycles in cleaning program	Real	165535	-	1 = 1
83.20	Cleaning speed step	Real	0100	%	1 = 1
83.25	Time to cleaning speed	Real	0.00060.000	S	1 = 1
83.26	Time to zero-speed	Real	0.00060.000	s	1 = 1
83.27	Cleaning on time	Real	0.0001000.000	s	1 = 1
83.28	Cleaning off time	Real	0.0001000.000	S	1 = 1
83.35	Cleaning count fault	Binary src	-	-	1 = 1
83.36	Cleaning count time	Time	00:00:0045:12:15	S	1 = 1
83.37	Maximum cleaning count	Real	030	-	1 = 1
95 HW d	configuration				
95.01	Supply voltage	List	0, 23	-	1 = 1
95.02	Adaptive voltage limits	List	01	-	1 = 1
95.03	Estimated AC supply voltage	Real	065535	V	1 = 1 V
95.04	Control board supply	List	01	-	1 = 1
95.15	Special HW settings	PB	0000hFFFFh	-	1 = 1
95.20	HW options word 1	PB	0000hFFFFh	-	1 = 1
96 Syste	em				
96.01	Language	List	-	-	1 = 1
96.02	Pass code	Data	099999999	-	1 = 1
96.03	Access level status	PB	000b111b	-	1 = 1
96.06	Parameter restore	List	0, 2, 8, 32, 62, 512, 1024, 34560	-	1 = 1
96.07	Parameter save manually	List	01	-	1 = 1
96.08	Control board boot	List	01	-	1 = 1
96.10	User set status	List	07, 2023	-	1 = 1
96.11	User set save/load	List	05, 1821	-	1 = 1
96.12	User set I/O mode in1	Binary src	-	-	-
96.13	User set I/O mode in2	Binary src	-	-	-
96.16	Unit selection	PB	000hFFFFh		1 = 1
96.51	Clear fault and event logger	Real	01	-	1 = 1
	(Parameters 96.10096	.102 only v	risible when enabled by param	eter <mark>96.02</mark>))
96.100	Change user pass code	Data	1000000099999999	-	1 = 1
96.101	Confirm user pass code	Data	1000000099999999	-	1 = 1
96.102	User lock functionality	PB	0000hFFFFh	-	1 = 1

No.	Name	Type	Range	Unit	FbEq32
97 Moto	or control				•
97.01	Switching frequency reference	List	4, 8, 12	kHz	1 = 1 kHz
97.02	Minimum switching frequency	List	2, 4, 8, 12	kHz	1 = 1 kHz
97.03	Slip gain	Real	0200	%	1 = 1%
97.04	Voltage reserve	Real	-450	%	1 = 1%
97.05	Flux braking	List	02	-	1 = 1
97.09	Switching frequency mode	List	01	-	1 = 1
97.10	Signal injection	List	04	-	1 = 1
97.11	TR tuning	Real	25400	%	1 = 1%
97.13	IR compensation	Real	0.0050.00	%	100 = 1%
97.15	Motor model temperature adaptation	List	01	-	1 = 1
97.16	Stator temperature factor	Real	0200	%	1 = 1%
97.17	Rotor temperature factor	Real	0200	%	1 = 1%
97.20	U/F ratio	List	01	-	1 = 1
98 User	motor parameters			•	
98.01	User motor model mode	List	01	-	1 = 1
98.02	Rs user	Real	0.00000.50000	p.u.	100000 = 1 p.u.
98.03	Rr user	Real	0.00000.50000	p.u.	100000 = 1 p.u.
98.04	Lm user	Real	0.0000010.00000	p.u.	100000 = 1 p.u.
98.05	SigmaL user	Real	0.000001.00000	p.u.	100000 = 1 p.u.
98.06	Ld user	Real	0.0000010.00000	p.u.	100000 = 1 p.u.
98.07	Lq user	Real	0.0000010.00000	p.u.	100000 = 1 p.u.
98.08	PM flux user	Real	0.000002.00000	p.u.	100000 = 1 p.u.
98.09	Rs user SI	Real	0.00000100.00000	ohm	100000 = 1 p.u.
98.10	Rr user SI	Real	0.00000100.00000	ohm	100000 = 1 p.u.
98.11	Lm user SI	Real	0.00100000.00	mH	100 = 1 mH
98.12	SigmaL user SI	Real	0.00100000.00	mH	100 = 1 mH
98.13	Ld user SI	Real	0.00100000.00	mH	100 = 1 mH
98.14	Lq user SI	Real	0.00100000.00	mH	100 = 1 mH
99 Moto	or data				
99.03	Motor type	List	02	-	1 = 1
99.04	Motor control mode	List	01	-	1 = 1
99.06	Motor nominal current	Real	0.06400.0	Α	10 = 1 A
99.07	Motor nominal voltage	Real	0.0800.0	V	10 = 1 V

314 Additional parameter data

No.	Name	Type	Range	Unit	FbEq32
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	0.0010000.00 kW or 0.00 13404.83 hp	kW or hp	100 = 1 unit
99.11	Motor nominal cos Φ	Real	0.00 1.00	-	100 = 1
99.12	Motor nominal torque	Real	0.0004000000.000 N·m or 0.0002950248.597 lb·ft	N·m or lb·ft	1000 = 1 unit
99.13	ID run requested	List	03, 6	-	1 = 1
99.14	Last ID run performed	List	03, 6	-	1 = 1
99.15	Motor polepairs calculated	Real	01000	-	1 = 1
99.16	Motor phase order	List	01	-	1 = 1

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 and names of active warnings and faults are displayed on the control panel of the drive as well as in the Drive composer PC tool. 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 the panel or from a selectable source (parameter 31.11 Fault reset selection) such as the digital inputs of the drive. 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 (318).

Editable messages

For external events, the action (fault or warning), name and the message text can be edited. To specify external events, select **Menu - Primary settings - Advanced** functions - External events.

Contact information can also be included and the text edited. To specify contact information, select Menu - Primary settings - Clock, region, display - Contact info view.

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 316.

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
- Menu Diagnostics Active warnings
- parameters in group 04 Warnings and faults (page 100).

For previously occurred faults and warnings, see

- Menu Diagnostics Fault & event log
- parameters in group 04 Warnings and faults (page 100).

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]).

QR code generation for mobile service application

A QR code (or a series of QR codes) can be generated by the drive for display on the control panel. The QR code contains drive identification data, information on the latest events, and values of status and counter parameters. The code can be read with a mobile device containing the ABB service application, which then sends the data to ABB for analysis. For more information on the application, contact your local ABB service representative.

To generate the QR code, select Menu - System info - QR code.

Note: If a control panel which does not support QR code generation (version older than v.6.4x) is used, the **QR code** menu entry will disappear totally and will not be available any longer either with control panels supporting the QR code generation.

Warning messages

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

Code (hex)	Warning / Aux. code	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) or 28 Frequency reference chain (frequency control). Also check parameters 46.01 Speed scaling, 46.02 Frequency scaling and 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 start-up 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.
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 <i>Electrical installation</i> , section <i>Checking the insulation of the assembly</i> in the <i>Hardware manual</i> 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.

Code (hex)	Warning / Aux. code	Cause	What to do
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.
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
A3A2	DC link undervoltage	Intermediate circuit DC voltage too low (when the drive is stopped).	may cause the motor to rush uncontrollably, or may overload the resistor. Check the supply voltage.
АЗАА	DC not charged	The voltage of the intermediate DC circuit has not yet risen to operating level.	If the problem persists, contact your local ABB representative.
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.
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.

Code (hex)	Warning / Aux. code	Cause	What to do
A4A9	Cooling	Drive module temperature is excessive.	Check ambient temperature. If it exceeds 40 °C/104 °F (IP21 frames R4R9) or if it exceeds 50 °C /122 °F (IP21 frames R0R9), ensure that load current does not exceed derated load capacity of drive. For all P55 frames, check the derating temperatures. 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.
A580	PU communication	Communication errors detected between the drive control unit and the power unit.	Check the connections between the drive control unit and the power unit. Check the value of parameter 95.04 Control board supply.
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 328).
	0001	Auxiliary fan 1 missing.	
	0002	Auxiliary fan 2 missing.	
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 <i>The Safe torque off function</i> in the <i>Hardware manual</i> of the drive and description of parameter 31.22 STO indication run/stop (page 179). Check the value of parameter 95.04 Control board supply.
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.

Code (hex)	Warning / Aux. code	Cause	What to do
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.
A6A4	Motor nominal value	The motor parameters are set incorrectly.	Check the auxiliary code. See actions for each code below.
		The drive is not dimensioned correctly.	
	1	Slip frequency is too small.	Check the settings of the motor
	2	Synchronous and nominal speeds differ too much.	configuration parameters in groups 98 and 99. Check that the drive is sized correctly for
	3	Nominal speed is higher than synchronous speed with 1 pole pair.	the motor.
	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 start-up 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.
A6B0	User lock is open	The user lock is open, ie. user lock configuration parameters 96.10096.102 are visible.	Close the user lock by entering an invalid pass code in parameter 96.02 Pass code. See section User lock (page 91).
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 <i>User lock</i> (page 91).
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).

Code (hex)	Warning / Aux. code	Cause	What to do
A6E5	Al 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 because of e.g. excessive load or insufficient motor power.	Check motor load and drive ratings. Check fault function parameters.
A7AB	Extension I/O configuration failure	Installed CMOD module is not the same as configured.	Check that the installed module (shown by parameter 15.02 Detected extension module) is the same as selected by parameter 15.01 Extension module type.
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.
A8A0	Al supervision Programmable warning: 12.03 Al supervision function	An analog signal is outside the limits specified for the analog input.	Check signal level at the analog input. Check the wiring connected to the input. Check the minimum and maximum limits of the input in parameter group 12 Standard Al.
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.

Code (hex)	Warning / Aux. code	Cause	What to do
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).
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).
A8C0	ULC invalid speed table	User load curve: X-axis points (speed) are not valid.	Check that points fulfill conditions. See parameter 37.11 ULC speed table point 1.
A8C1	ULC overload warning	User load curve: Signal has been too long over the overload curve.	See parameter 37.03 ULC overload actions.
A8C4	ULC underload warning	User load curve: Signal has been too long under the underload curve.	See parameter 37.04 ULC underload actions.
A8C5	ULC invalid underload table	User load curve: Underload curve points are not valid.	Check that points fulfill conditions. See parameter 37.21 ULC underload point 1.
A8C6	ULC invalid overload table	User load curve: Overload curve points are not valid.	Check that points fulfill conditions. See parameter 37.31 ULC overload point 1.

Code (hex)	Warning / Aux. code	Cause	What to do
A8C8	ULC invalid frequency table	User load curve: X-axis points (frequency) are not valid.	Check that points fulfill conditions $500.0 \text{ Hz} \le 37.16 < 37.17 < 37.18 < 37.19 < 37.20 \le 500.0 \text{ Hz}. See parameter 37.16 \text{ ULC frequency table} point 1.$
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.
AF88	Season configuration warning	You have configured a season which starts before the previous season.	Configure the seasons with increasing start dates, see parameters 34.60 Season 1 start date34.63 Season 4 start date.
AF8C	Process PID sleep mode	The drive is entering sleep mode.	Informative warning. See section Sleep and boost functions for process PID control (page 56), and parameters 40.4340.48.
AFAA	Autoreset	A fault is about to be autoreset.	Informative warning. See the settings in parameter group 31 Fault functions.
AFE1	Emergency stop (off2)	Drive has received an emergency stop (mode selection off2) command.	Check that it is safe to continue operation. Then return emergency stop push button to normal position. Restart
AFE2	Emergency stop (off1 or off3)	Drive has received an emergency stop (mode selection off1 or off3) command.	drive. If the emergency stop was unintentional, check the source selected by parameter 21.05 Emergency stop source.

Code (hex)	Warning / Aux. code	Cause	What to do
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.
AFF6	Identification run	Motor ID run will occur at next start.	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 <i>The Safe torque off function</i> in the <i>Hardware manual</i> of the drive and description of parameter 31.22 STO indication run/stop (page 179).

Fault messages

Code (hex)	Fault / Aux. code	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 has not been 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 (select <i>Current measurement calibration</i> at parameter 99.13). If the fault persists, contact your local ABB representative.
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 parameters 46.01 Speed scaling, 46.02 Frequency scaling and 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 start-up 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	Cause	What to do
2340	Short circuit	Short-circuit in motor cable(s) or motor	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.
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.
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 (ie. input power cable is connected to drive motor connection).	Check input power connections.
3210	DC link overvoltage	Excessive intermediate circuit DC voltage.	Check that overvoltage control is on (parameter 30.30 Overvoltage control). Check that the supply voltage matches the nominal input voltage of the drive. Check the supply line for static or transient overvoltage. Check resistor (if present). Check deceleration time. Use coast-to-stop function (if applicable). Retrofit drive with 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.
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.
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.

Code (hex)	Fault / Aux. code	Cause	What to do
4290	Cooling	Drive module temperature is excessive.	Check ambient temperature. If it exceeds 40 °C/104 °F (IP21 frames R4R9) or if it exceeds 50 °C /122 °F (IP21 frames R0R9), ensure that load current does not exceed derated load capacity of drive. For all P55 frames, check the derating temperatures. See chapter <i>Technical data</i> , section <i>Derating</i> in the <i>Hardware manual</i> 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).
4981	External temperature 1 (Editable message text)	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 (Editable message text)	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).
5081	Auxiliary fan broken	An auxiliary cooling fan (connected to the fan connectors on the control unit) is stuck or disconnected.	Check the auxiliary code. Check auxiliary fan(s) and connection(s). Replace fan if faulty. Make sure the front cover of the drive is in place and tightened. If the commissioning of the drive requires th the cover is off, activate parameter 31.36 Aux fan fault bybass within 2 min from control unit reboot to temporarily suppress the fault. Reboot the control unit (using parameter 96.08 Control board boot) or by cycling power.
	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	Cause	What to do
5091	Safe torque off Programmable fault: 31.22 STO indication run/stop	Safe torque off function is active, ie. safety circuit signal(s) connected to connector STO is broken during start or run.	Check safety circuit connections. For more information, see chapter <i>The Safe torque off function</i> in the <i>Hardware manual</i> of the drive and description of parameter 31.22 STO indication run/stop (page 179). 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.
50A0	Fan	Cooling fan stuck or disconnected.	Check fan operation and connection. Replace fan if faulty.
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.
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.
5696	PU state feedback	State feedback from output phases does not match control signals.	Contact your local ABB representative.
5697	Charging feedback	Charging feedback signal missing.	Check the feedback signal coming from the charging system
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

Code (hex)	Fault / Aux. code	Cause	What to do
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
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.
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
6581	Parameter system	Parameter load or save failed.	Try forcing a save using parameter 96.07 Parameter save manually. Retry.
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.	Contact your local ABB representative.
		Version mismatch between EFB protocol firmware and drive firmware.	
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.
6885	Text file overflow	Internal fault.	Reset the fault. Contact your local ABB representative if the fault persists.

Code (hex)	Fault / Aux. code	Cause	What to do
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.
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.
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.
73B0	Emergency ramp failed	Emergency stop did not finish within expected time.	Check the settings of parameters 31.32 Emergency ramp supervision and 31.33 Emergency ramp supervision delay. Check the predefined ramp times (23.1223.13 for mode Off1, 23.23 for mode Off3).
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.
8001	ULC underload fault	User load curve: Signal has been too long under the underload curve.	See parameter 37.04 ULC underload actions.
8002	ULC overload fault	User load curve: Signal has been too long over the overload curve.	See parameter 37.03 ULC overload actions.
80A0	Al supervision Programmable fault: 12.03 Al 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.
	0001	AI1LessMIN	
	0002	AI1GreaterMAX	
	0003	AI2LessMIN.	
	0004	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).

Code (hex)	Fault / Aux. code	Cause	What to do	
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).	
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.	
FA81	Safe torque off 1	Safe torque off function is active, ie. STO circuit 1 is broken.	Check safety circuit connections. For more information, see chapter <i>The Safe torque off function</i> in the <i>Hardware</i>	
FA82	Safe torque off 2	Safe torque off function is active, ie. STO circuit 2 is broken.	manual of the drive and description of parameter 31.22 STO indication run/sto (page 179). Check the value of parameter 95.04 Control board supply.	

Code (hex)	Fault / Aux. code	Cause	What to do
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. Check the auxiliary code. The second number of the code indicates the problem (see actions for each code below).
	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 > 99.06. Check that the drive is dimensioned correctly according to the motor.
	0002	Maximum speed limit or calculated field weakening point too low.	Check settings of parameters 30.11 Minimum 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.
	00050008	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	Cause	What to do
	000D	(Permanent magnet motors only) Second acceleration did not finish within reasonable time.	Contact your local ABB representative.
	000E0010	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.
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.

Fieldbus control through the embedded fieldbus interface (EFB)

What this chapter contains

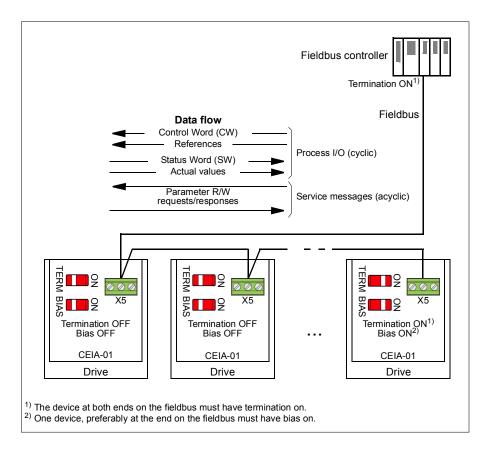
The chapter describes how the drive can be controlled by external devices over a communication network (fieldbus) using the embedded fieldbus interface.

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 the fieldbus to the drive

Connect the fieldbus to terminal X5 on the CEIA-01, which is attached on the control unit of the drive. The connection diagram is shown below.

To be added

Setting up the embedded fieldbus interface

Setting for

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.

Parame	eter	fieldbus control	Function/Information		
COMM	COMMUNICATION INITIALIZATION				
58.01	Protocol	Modbus RTU	Initializes embedded fieldbus communication.		
EMBED	DED MODBUS CO	ONFIGURATION			
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)	Defines the communication speed of the link. Use the same setting as in the master station.		
58.05	Parity	8 EVEN 1 (default)	Selects the parity and stop bit setting. Use the same setting as in the master station.		
58.14	Communication loss action	Fault (default)	Defines the action taken when a communication loss is detected.		
58.15	Communication loss mode	Cw / Ref1 / Ref2 (default)	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 (default)	Selects the control profile used by the drive. See section <i>Basics of the embedded fieldbus interface</i> (page 340).		
58.26 58.27	EFB ref1 type EFB ref2 type	Speed or frequency (default for 58.26), Transparent, General, Transparent (default for 58.27), Speed, Frequency	Defines the types of fieldbus references 1 and 2. The scaling for each reference type is defined by parameters 46.0146.03. With the Speed or frequency setting, the type is selected automatically according to the currently active drive control mode.		
58.28 58.29	EFB act1 type EFB act2 type	Speed or frequency (default for 58.28), Transparent (default for 58.29), General, Speed, Frequency	Defines the types of actual values 1 and 2. The scaling for each actual value type is defined by parameters 46.0146.03. With the Speed or frequency setting, the type is selected automatically according to the currently active drive control mode.		

Parame	eter	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)	Defines the mapping between parameters and holding registers in the 400001465536 (10065535) Modbus register range.
58.34	Word order	LO-HI (default)	Defines the order of the data words in the Modbus message frame.
	Data I/O 1 Data I/O 14	For example, the default settings (I/Os 16 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, AO1 data storage, AO2 data storage, Feedback data storage, Setpoint data storage	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	
20.01 Ext1 commands	Embedded fieldbus	Selects fieldbus as the source for the start and stop commands when EXT1 is selected as the active control location.

Parameter	Setting for fieldbus control	Function/Information
20.06 Ext2 commands	Embedded fieldbus	Selects fieldbus as the source for the start and stop commands when EXT2 is selected as the active control location.
SPEED REFERENCE	SELECTION	
22.11 Ext1 speed ref1	EFB ref1	Selects a reference received through the embedded fieldbus interface as speed reference 1.
22.18 Ext2 speed ref1	EFB ref1	Selects a reference received through the embedded fieldbus interface as speed reference 2.
FREQUENCY REFER	ENCE SELECTION	•
28.11 Ext1 frequency ref1	EFB ref1	Selects a reference received through the embedded fieldbus interface as frequency reference 1.
28.15 Ext2 frequency ref1	EFB ref1	Selects a reference received through the embedded fieldbus interface as frequency reference 2.

OTHER SELECTIONS

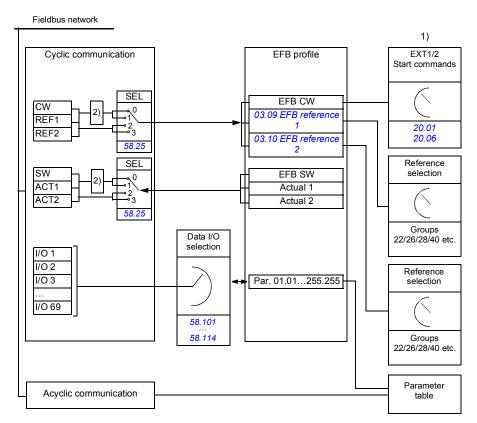
EFB references can be selected as the source at virtually any signal selector parameter by selecting *Other*, then either *03.09 EFB reference 1* or *03.10 EFB reference 2*.

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.
- Data conversion if parameter 58.25 Control profile is set to ABB Drives. See section About the control profiles (page 343).

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 343).

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 343).

References

EFB references 1 and 2 are 16-bit or 32-bit signed integers. The contents of each reference word can be used as the source of virtually any signal, such as the speed, frequency or process reference. In embedded fieldbus communication, references 1 and 2 are displayed by 03.09 EFB reference 1 and 03.10 EFB reference 2 respectively. Whether the references are scaled or not depends on the settings of 58.26 EFB ref1 type and 58.27 EFB ref2 type. See section About the control profiles (page 343).

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 343).

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

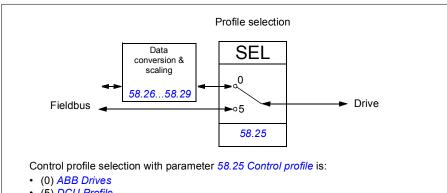
A control profile defines the rules for data transfer between the drive and the fieldbus master, for example:

- 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.



• (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 351.

Bit	Name	Value	STATE/Description
0	OFF1_	1	Proceed to READY TO OPERATE.
	CONTROL	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_	1	Continue operation (OFF2 inactive).
	CONTROL	0	Emergency OFF, coast to stop. Proceed to OFF2 ACTIVE, proceed to SWITCH-ON INHIBITED.
2	OFF3_	1	Continue operation (OFF3 inactive).
	CONTROL	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_	1	Proceed to OPERATION D.
	OPERATION		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.
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.

Bit	Name	Value	STATE/Description
8	Reserved		
8	Reserved		
10	REMOTE_	1	Fieldbus control d.
	CMD	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	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
13	USER_1		for application-specific functionality.
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	0 STOP		Stop according to the mode request bits (b)		neter or the stop
		0	(no op)		
1	START	1	Start the drive.		
	0	(no op)			
2	REVERSE	1	Reverse direction of below how this bit a direction of the motor	ence effect the	
				Sign of the	e reference
				Positive (+)	Negative (-)
			Bit REVERSE = 0	Forward	Reverse
			Bit REVERSE = 1	Reverse	Forward
		0	(no op)		
3	Reserved				
4	RESET	0=>1	Fault reset if an activ	ve fault exists.	
		0	(no op)		

Bit	Name	Value	State/Description
5	EXT2	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.
6	RUN_DISABLE	1	Run disable. If the drive is set to receive the run enable signal from the fieldbus, this bit deactivates the signal.
		0	Run enable. If the drive is set to receive the run enable signal from the fieldbus, this bit activates the signal.
7	STOPMODE_RA	1	Normal ramp stop mode
	MP	0	(no op) Default to parameter stop mode if bits 79 are all 0.
8	STOPMODE_EM	1	Emergency ramp stop mode.
	ERGENCY_RAM P	0	(no op) Default to parameter stop mode if bits 79 are all 0.
9	STOPMODE_CO	1	Coast stop mode.
	AST	0	(no op) Default to parameter stop mode if bits 79 are all 0.
10	RAMP_PAIR _2	1	(no op)
		0	Select ramp set 1 (Acceleration time 1 / Deceleration time 1).
11	RAMP_OUT_ZER O	1	Force Ramp Function Generator output to zero. Drive ramps to stop (current and DC voltage limits in force).
		0	Normal operation.
12	RAMP_HOLD	1	Halt ramping (Ramp Function Generator output held).
		0	Normal operation.
13	RAMP_IN_ZERO	1	Force Ramp Function Generator input to zero.
		0	Normal operation.
14	REQ_LOCAL_LO	1	Drive does not switch to local control mode.
	CK	0	Drive can switch between local and external control modes.
15	TORQ_LIM_PAIR	1	Select torque limit set 2 (Minimum torque 2 / Maximum torque 2) when parameter 30.18 Torq lim sel is set to EFB.
		0	Select torque limit set 1 (Minimum torque 1 / Maximum torque 1) when parameter 30.18 Torq lim sel is set to EFB.
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)

Bit	Name	Value	State/Description
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
23	USER_1		for application-specific functionality.
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 351.

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_	1	SWITCH-ON INHIBITED.
	INHIB	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
12	USER_1		application-specific functionality.
13	USER_2		1
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.

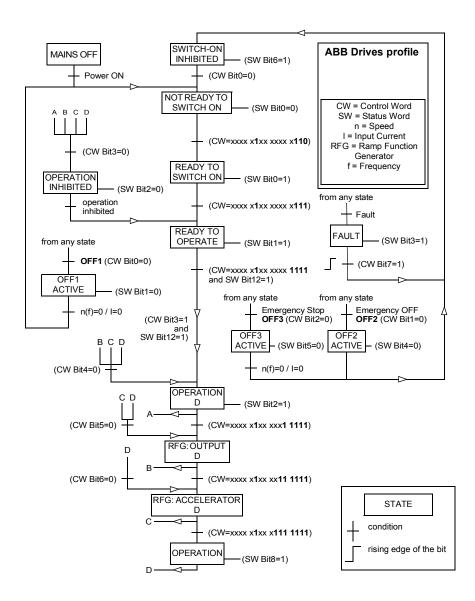
Bit	Name	Value	State/Description
0	READY	1	Drive is ready to receive the start command.
		0	Drive is not ready.
1	D	1	External run enable signal is active.
		0	External run enable signal is not active.
2	Reserved for D_TO_ROTATE		Not yet implemented.
3	RUNNING	1	Drive is modulating.
		0	Drive is not 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	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 46.3146.33
		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_LOC	1	Fieldbus is in local control mode.
	AL	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.
15	FAULT	1	Drive is faulted.
		0	Drive is not faulted.

Bit	Name	Value	State/Description
16	ALARM	1	Warning/Alarm is active.
		0	No warning/alarm.
17	Reserved		
18	Reserved for DIRECTION_LO CK		Not yet implemented.
19	Reserved		
20	Reserved		
21	Reserved		
22	USER_0		Status bits that can be combined with drive logic for
23	USER_1		application-specific functionality.
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 344 and Status Word for the ABB Drives profile on page 348.

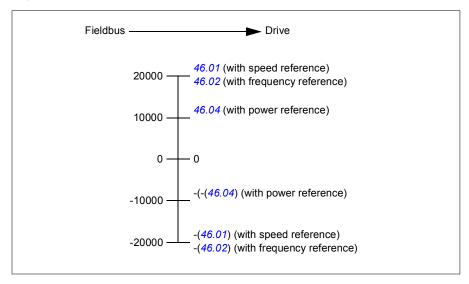


References

References for the ABB Drives profile and DCU Profile

The ABB Drives profile supports the use of two references, EFB reference 1 and EFB reference 2. The references are 16-bit words each containing a sign bit and a 15-bit integer. A negative reference is formed by calculating the two's complement from the corresponding positive reference.

The references are scaled as defined by parameters 46.01...46.04; which scaling is in use depends on the setting of 58.26 EFB ref1 type and 58.27 EFB ref2 type (see page 242).



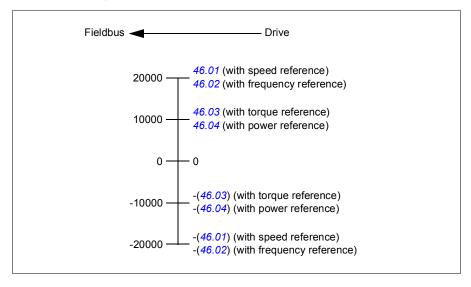
The scaled references are shown by parameters 03.09 EFB reference 1 and 03.10 EFB reference 2.

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 46.01...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 243).



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 344) and Control Word for the DCU Profile (page 345).
	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 58.102 Data I/O 2.
400003	Default: Reference 2 (Ref2 16bit).
	The selection can be changed using parameter 58.102 Data I/O 2.
400004	Default: Status Word (SW 16bit). See sections Status Word for the ABB Drives profile (page 348) and Status Word for the DCU Profile (page 349).
	The selection can be changed using parameter 58.102 Data I/O 2.
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.
400007400014	Data in/out 714.
	Selected by parameters 58.107 Data I/O 758.114 Data I/O 14.
400015400089	Unused
400090400100	Error code access. See section <i>Error code registers (holding registers 400090400100)</i> (page 362).
400101465536	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 0Fh Return Slave Message Count 10Fh 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.	
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.	

Code	Function name	Description
2Bh / 0Eh	Encapsulated Interface	Supported subcodes:
	Transport	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, "AQAKx")
		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: ("ACQ580").

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 <i>Error code registers (holding registers 400090400100)</i> on page 362.

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
800000	RESET	STOPMODE_RAMP
000009	JOGGING_1	STOPMODE_EMERGENCY_RAMP
000010	JOGGING_2	STOPMODE_COAST
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 (9195). 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.		



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.

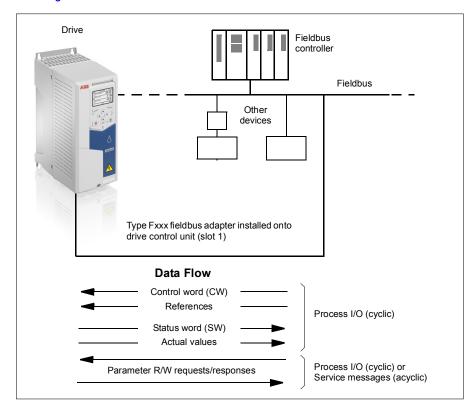
System overview

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 DP (FPBA-01 adapter)
- CANopen (FCAN-01 adapter)
- DeviceNetTM (FDNA-01 adapter)
- EtherNet/IPTM (FENA-11 adapter)

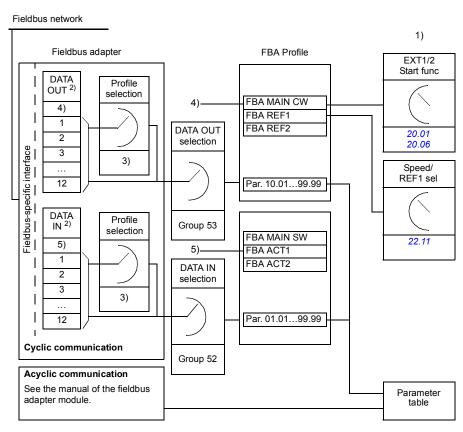
Note: The text and examples in this chapter describe the configuration of one fieldbus adapter (FBA A) by parameters 50.01...50.18 and parameter groups 51 FBA A settings...53 FBA A data out



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.
- 4) With DeviceNet, the control part is transmitted directly.
- 5) With DeviceNet, the actual value part is transmitted directly.

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 369 and 370 respectively. The drive states are presented in the state diagram (page 371).

Debugging the network words

If parameter 50.12 FBA A debug mode is set to Fast, 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

References are 16-bit words containing a sign bit and a 15-bit integer. A negative reference (indicating reversed direction of rotation) is formed by calculating the two's complement from the corresponding positive reference.

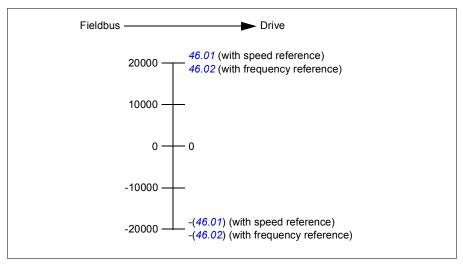
ABB drives can receive control information from multiple sources including analog and digital inputs, the drive control panel and a fieldbus adapter module. In order to have the drive controlled through the fieldbus, the module must be defined as the source for control information such as reference. This is done using the source selection parameters in groups 22 Speed reference selection and 28 Frequency reference chain.

Debugging the network words

If parameter 50.12 FBA A debug mode is set to Fast, the references received from the fieldbus are displayed by 50.14 FBA A reference 1 and 50.15 FBA A reference 2.

Scaling of references

The references are scaled as defined by parameters 46.01...46.04; which scaling is in use depends on the setting of 50.04 FBA A ref1 type and 50.05 FBA A ref2 type.



The scaled references are shown by parameters 03.05 FB A reference 1 and 03.06 FB A reference 2.

Actual values

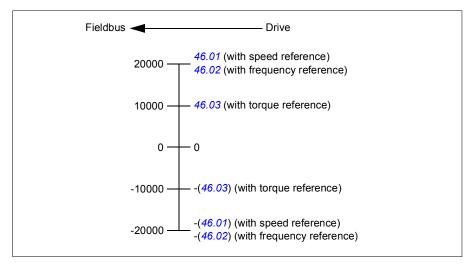
Actual values are 16-bit words containing information on the operation of the drive. The types of the monitored signals are selected by parameters 50.07 FBA A actual 1 type and 50.08 FBA A actual 2 type.

Debugging the network words

If parameter 50.12 FBA A debug mode is set to Fast, 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 46.01...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.



Contents of the fieldbus Control word

The upper case boldface text refers to the states shown in the state diagram (page 371).

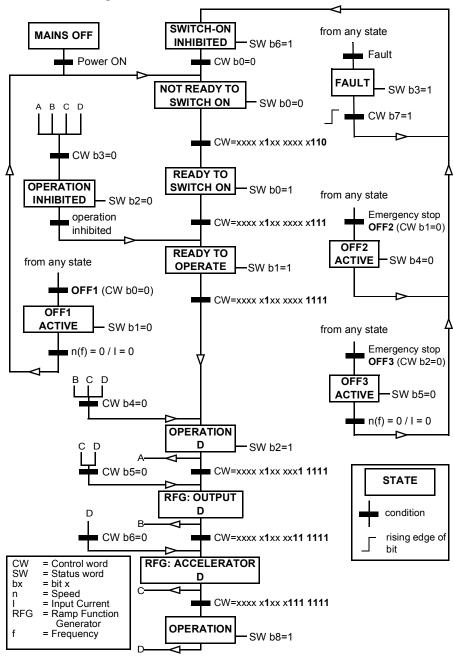
Bit	Name	Value	STATE/Description		
0	Off1 control	1	Proceed to READY TO OPERATE.		
		0	Stop along currently active deceleration ramp. Proceed to OFF1 ACTIVE ; proceed to READY TO SWITCH ON unless other interloc (OFF2, OFF3) are active.		
1	Off2 control 1		Continue operation (OFF2 inactive).		
		0	Emergency 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).		
5	5 Ramp hold		ramp function. Proceed to RAMP FUNCTION GENERATOR: ACCELERATOR D.		
		0	Halt ramping (Ramp Function Generator output held).		
Note: This bit is effe		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. Continue normal operation.		
8	Reserved		Continue normal operation.		
9	Reserved				
10	Remote cmd	1	Fieldbus control d.		
		0	Control word and reference not getting through to the drive, except for bits 02.		
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		
13	User bit 1	1	1		
		0	1		
14	User bit 2	1]		
		0			
15	User bit 3	0			

Contents of the fieldbus Status word

The upper case boldface text refers to the states shown in the state diagram (page 371).

Bit	Name	Value	STATE/Description	
0	Ready to switch	1	READY TO SWITCH ON.	
	ON	0	NOT READY TO SWITCH ON.	
1	1 Ready run		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	7 Warning		Warning active.	
		0	No warning active.	
8	8 At setpoint		OPERATING. Actual value equals reference = is within tolerance limits (see parameters 46.2146.22).	
		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. 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 DP)

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 and reference are according to the PROFIdrive profile, speed control mode.

The reference values sent over the fieldbus have to be scaled within the drive so they have the desired effect. The reference value ±16384 (4000h) corresponds to the range of speed set in parameter 46.01 Speed scaling (both forward and reverse directions). For example, if 46.01 is set to 480 rpm, then 4000h sent over fieldbus will request 480 rpm.

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

The table below gives the recommended drive parameter settings.

Drive parameter	Setting for ACX580 drives	Description
50.01 FBA A enable	1 = [slot number]	s 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⁾	Displays the 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⁾	Displays the current baud rate on the PROFIBUS network in kbit/s.
51.04 MSG type	1 = PPO2 ¹⁾	Displays the 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

Drive parameter	Setting for ACX580 drives	Description
53.05 FBA data out5	23.13 ²⁾	Deceleration time 1
51.27 FBA A par refresh	1 = Configure	Validates the configuration parameter settings.
20.01 Ext1 commands	12 = Fieldbus A	Selects fieldbus adapter A as the source of the start and stop commands for external control location EXT1.
20.02 Ext1 start trigger type	1 = Level	Selects a level-triggered start signal for external control location EXT1.
22.11 Ext1 speed ref1	4 = FB A ref1	Selects fieldbus A reference 1 as the source for speed reference 1.

¹⁾ Read-only or automatically detected/set

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)

²⁾ Example

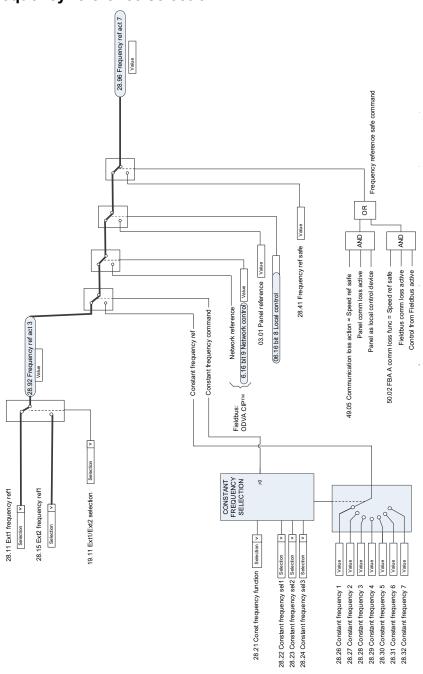
Control chain diagrams

Contents of this chapter

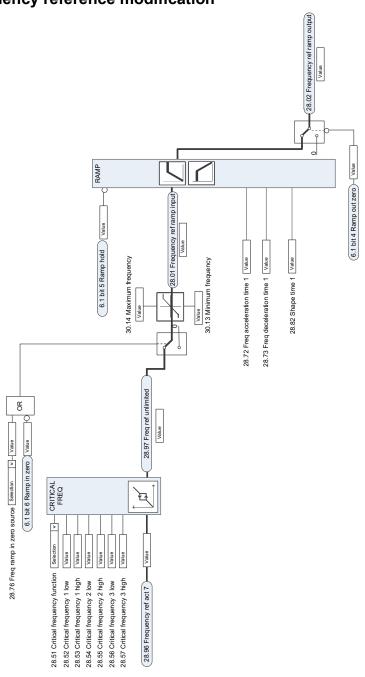
The chapter presents the reference chains of the drive. The control chain diagrams can be used to trace how parameters interact and where parameters have an effect within the drive parameter system.

For a more general diagram, see section Operating modes of the drive (page 42).

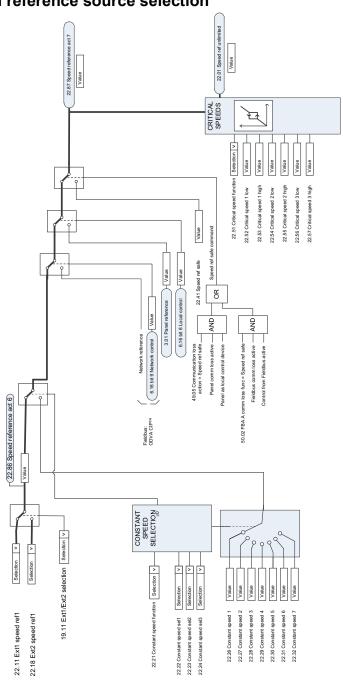
Frequency reference selection



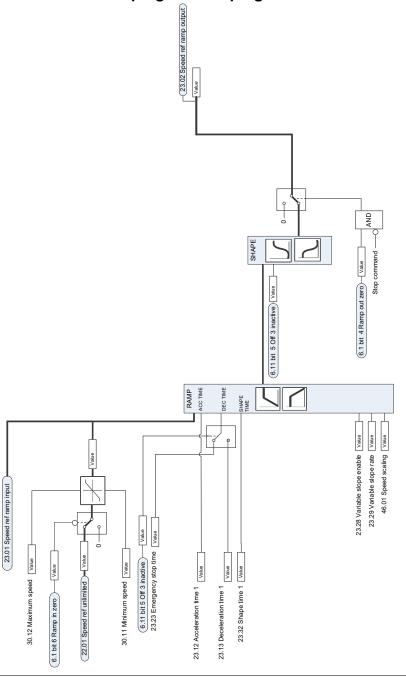
Frequency reference modification



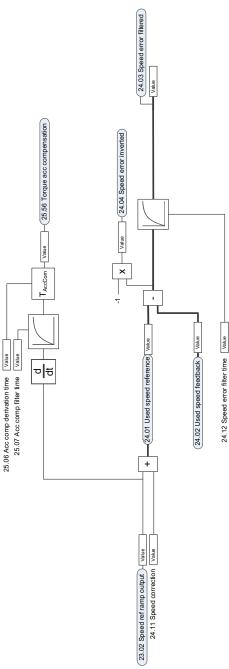
Speed reference source selection



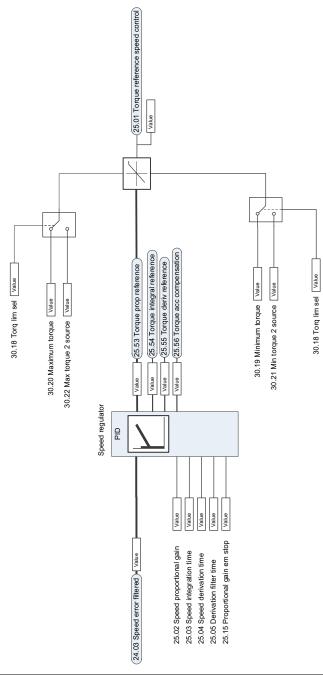
Speed reference ramping and shaping



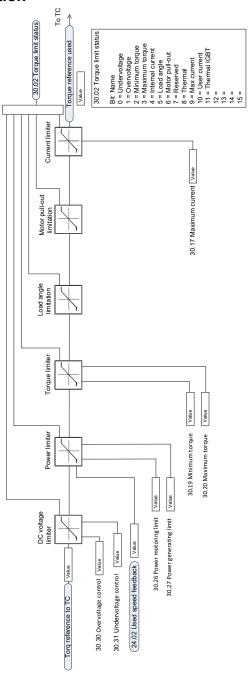
Speed error calculation



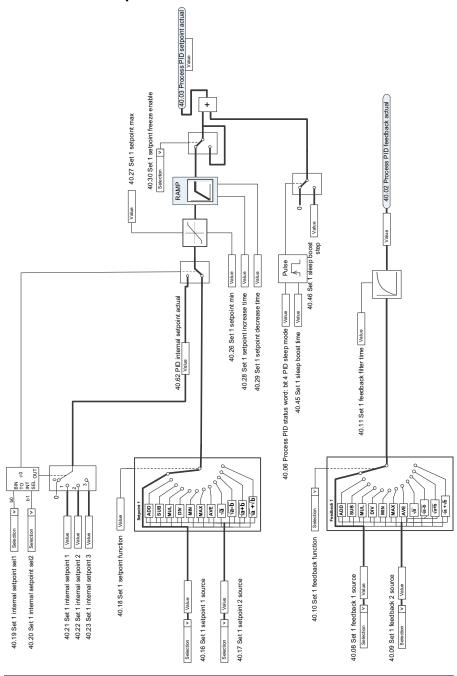
Speed controller



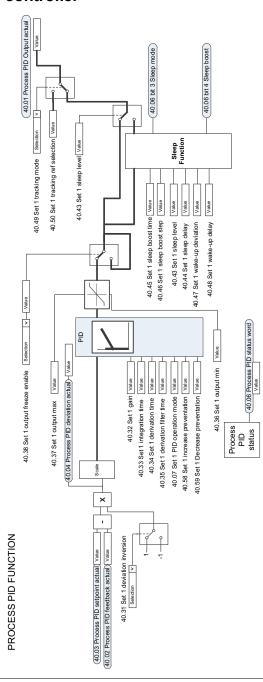
Torque limitation



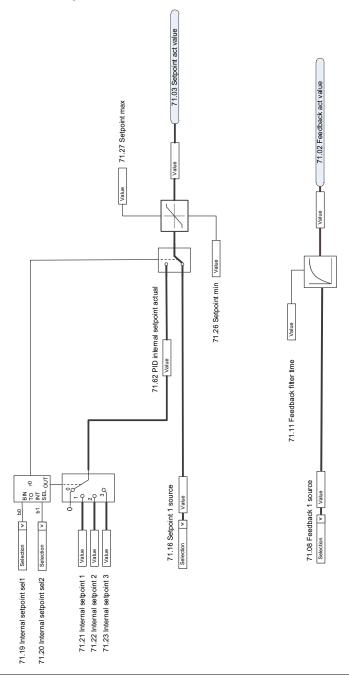
Process PID setpoint and feedback source selection



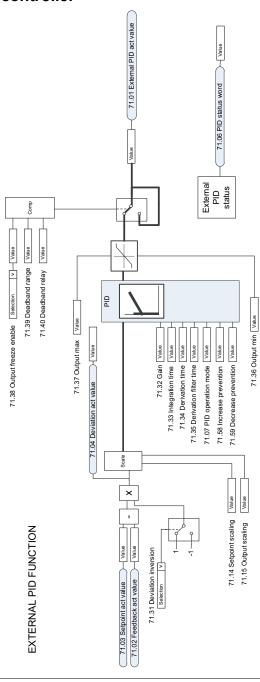
Process PID controller



External PID setpoint and feedback source selection



External PID controller



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 www.abb.com/searchchannels.

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