

ABB GENERAL PURPOSE DRIVES

ACS480 standard control program Firmware manual



List of related manuals

Drive firmware manuals and guides	Code (English)
ACS480 standard control program firmware manual	3AXD50000047399
ACS480-04 (0.75 to 11 kW) hardware manual	3AXD50000047392
ACS480-04 quick installation and start-up guide	3AXD50000047400
ACS-AP-x assistant control panels user's manual	3AUA0000085685
ACS-BP-S basic control panels user's manual	3AXD50000032527
Option manuals and guides	
DPMP-01 mounting platform for ACP-AP control panel	3AUA0000100140
DPMP-02/03 mounting platform for ACP-AP control panel	3AUA0000136205
FCAN-01 CANopen adapter module user's manual	3AFE68615500
FCNA-01 ControlNet adapter module user's manual	3AUA0000141650
FDNA-01 DeviceNet™ adapter module user's manual	3AFE68573360
FECA-01 EtherCAT adapter module user's manual	3AUA0000068940
FENA-01/-11/-21 Ethernet adapter module user's manual	3AUA0000093568
FEPL-02 Ethernet POWERLINK adapter module user's manual	3AUA0000123527
FMBT-21 Modbus/TCP adapter module user's manual	3AXD50000158607
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
Option manuals and guides	
Drive composer PC tool user's manual	3AUA0000094606
Converter modules with electrolytic DC capacitors in the DC link, capacitor reforming instructions	3BFE64059629
NETA-21 remote monitoring tool user's manual	3AUA0000096939
NETA-21 remote monitoring tool installation and start-	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.

The code below opens an online listing of the manuals applicable to the product:



up guide

ACS480 manuals

Firmware manual

ACS480 standard control program

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Further information







Introduction to the manual

Contents of this chapter

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

Applicability

The manual applies to the ACS480 standard control program (ASDKA version 2.09 or later).

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 194) on the control panel.

Compatibility

This manual is compatible with the ACS-AP-x assistant control panel, the hardware version C or later and panel software version 5.02 or later.

The images and instructions are based on the use of the assistant control panel with an ACS480 drive equipped with the Standard control program.

Safety instructions

Follow all safety instructions.

- Read the complete safety instructions in the Hardware manual of the drive before you install, commission, or use the drive.
- Read the firmware function-specific warnings and notes before changing parameter values. These warnings and notes are included in the parameter descriptions presented in chapter Parameters on page 177.

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 13) 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 19) describes how to start up the drive as well as how to start, stop, change the direction of the motor rotation and adjust the motor speed through the I/O interface.
- Control panel (page 39) contains instructions for removing and reinstalling the assistant control panel and briefly describes its display, keys and key shortcuts.
- Settings, I/O and diagnostics on the control panel (page 45) describes the simplified settings and diagnostic functions provided on the assistant control panel.
- Control macros (page 73) contains a short description of each macro together with a connection diagram. Macros are pre-defined applications which will save the user time when configuring the drive.
- Program features (page 105) describes program features with lists of related user settings, actual signals, and fault and warning messages.
- Parameters (page 177) describes the parameters used to program the drive.
- Additional parameter data (page 415) contains further information on the parameters.

- Fieldbus control through the embedded fieldbus interface (EFB) (page 475) describes the communication to and from a fieldbus network using the drive embedded fieldbus interface with the Modbus RTU protocol.
- Fieldbus control through a fieldbus adapter (page 505) describes the communication to and from a fieldbus network using an optional fieldbus adapter module.
- Fault tracing (page 451) lists the warning and fault messages with possible causes and remedies.
- Control chain diagrams (page 523) describes the parameter structure within the drive.
- Further information (inside of the back cover, page 539) 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.

Categorization by frame (size)

The drive 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.

Related documents

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

Terms and abbreviations

Term/abbreviation	Explanation					
ACS-BP-S	Basic control panel, basic operator keypad for communication with the drive.					
ACX-AP-x	Assistant control panel, advanced operator keypad for communication with the drive.					
	The ACS480 supports types ACS-AP-I, ACS-AP-S and ACS-AP-W (with a Bluetooth interface).					
Al	Analog input; interface for analog input signals					
AO	Analog output; interface for analog output signals					
BIO-01	Frontal I/O extension module. Can be used simultaneously with a fieldbus adapter module.					
Brake chopper Conducts the surplus energy from the intermediate circuit of the the brake resistor when necessary. The chopper operates when link voltage exceeds a certain maximum limit. The voltage rise is typically caused by deceleration (braking) of a high inertia motor						
Brake resistor Dissipates the drive surplus braking energy conducted by the br chopper to heat. Essential part of the brake circuit. See chapter chopper in the Hardware manual of the drive.						
BREL-01	Optional side-mounted relay output extension module					
Control board	Circuit board in which the control program runs.					
Control unit	Control board built in a housing					
CDPI-01	Communication adapter module					
CCA-01	Configuration adapter					
CHDI-01	Optional 115/230 V digital input extension module					
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 ACX-AP control panel (flange mounting)					
DPMP-02/03	Mounting platform for ACX-AP control panel (surface mounting)					
Drive	Frequency converter for controlling AC motors					
EFB	Embedded fieldbus					
FBA	Fieldbus adapter					
FECA-01	Optional EtherCAT adapter module					
FENA-21	Optional Ethernet adapter module for EtherNet/IP, Modbus TCP and PROFINET IO protocols					
FEPL-02	Ethernet POWERLINK adapter module					
FMBT-21	Optional Modbus/TCP adapter module					
FPBA-01	Optional PROFIBUS DP adapter module					

Term/abbreviation	Explanation					
Frame (size)	Refers to drive physical size. 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 drive hardware manual.					
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					
LSW	Least significant word					
Macro	Pre-defined default values of parameters in drive control program. Each macro is intended for a specific application. See chapter <i>Control macros</i> on page 73.					
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 (3AUA0000093568 [English]).					
Parameter	User-adjustable operation instruction to the drive, or signal measured or calculated by the drive					
PID 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,					
R1,	Frame (size)					
RIIO-01 Frontal standard I/O extension. Cannot be used simultaneously fieldbus adapter						
RO	Relay output; interface for a digital output signal. Implemented with a relay.					
Rectifier	Converts alternating current and voltage to direct current and voltage.					
STO	Safe torque off. See chapter <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.

See also section *User lock* on page 175.

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.

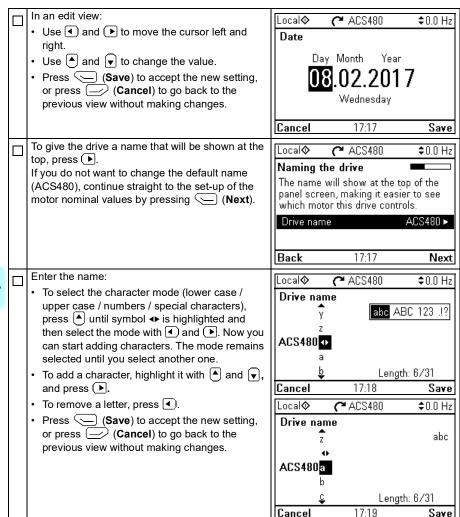
How to start up the drive using the First start assistant on the assistant control panel

Safety
Do not start-up the drive unless you are a qualified electrician. Read and obey the instructions in chapter <i>Safety instructions</i> at the beginning of the dware <i>manual</i> of the drive. Ignoring the instructions can cause physical injury or death, or lage to the equipment
Check the installation. See chapter <i>Installation checklist</i> in the <i>Hardware manual</i> of the drive.
Make sure there is no active start on (DI1 in factory settings, that is, ABB standard macro). The drive will start up automatically at power-up if the external run command is on and the drive is in the remote control mode. Check that the starting of the motor does not cause any danger. 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
Included below the display. The commands assigned to the softkeys vary depending on the context. Use keys ♠, ♠, ♠ and ♠ to move the cursor and/or change values depending on the active view. Key ♠ shows a context-sensitive help page. For more information, see ACS-AP-x assistant control panels user's manual (3AUA0000085685 [English]).
assigned to the softkeys vary depending on the context. Use keys ♠, ♠, ♠ and ♠ to move the cursor and/or change values depending on the active view. Key ♠ shows a context-sensitive help page. For more information, see ACS-AP-x assistant control panels user's manual (3AUA0000085685





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 Nederlands Svenska OK ►
Select Start set-up and press (Next).	Local
Select the localization you want to use and press (Next).	Local
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).	Local ◆ C* ACS480
Set the date and time as well as date and time display formats. • Go to the edit view of a selected row by pressing ▶. • Scroll the view with ▶ and ▼. Go to the next view by pressing (Next).	Local ◆





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

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

◆ ABB Motors (€ ◆							
3 ~ motor M2AA 200 MLA 4							
IEC 200 M/L 55							
			1	No			
				Ins.cl.	F	IP 5	5
V	Hz	kW	r/min	Α	cos φ	IA/IN	t _{E/s}
690 Y	50	30	1475	32.5	0.83		
400 D	50	30	1475	56	0.83		
660 Y	50	30	1470	34	0.83		
380 D	50	30	1470	59	0.83		
415 D	50	30	1475	54	0.83		
440 D	60	35	1770	59	0.83		
Cat. no	3G.	AA 202	001 -	ADA			
6312/C3 6 210/C3 180 kg							
						ф.	

Select the motor type.

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

Start with the motor nominal current.

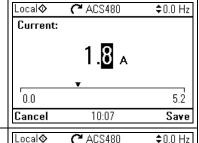
If you have to change the value, go to the edit view of the selected row by pressing (when this symbol is shown at the end of the row).

Local**⊘** C ACS480 \$0.0 Hz Motor nominal values Find the values on the motor's nameplate, and enter them here: Asynchronous motor ► Type: 1.8 A ► Current: Voltage: 400 0 V ▶ Back 08:31 Next

Set the correct value:

- 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.

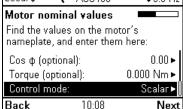


Continue to check/edit the nominal values and select scalar or vector control mode.

Motor nominal $\cos \Phi$ and nominal torque are optional.

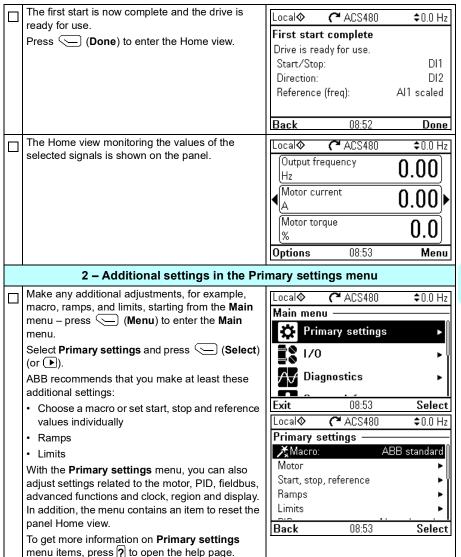
Roll down with (▼) to see the last row in the view. After editing the last row, the panel goes to the

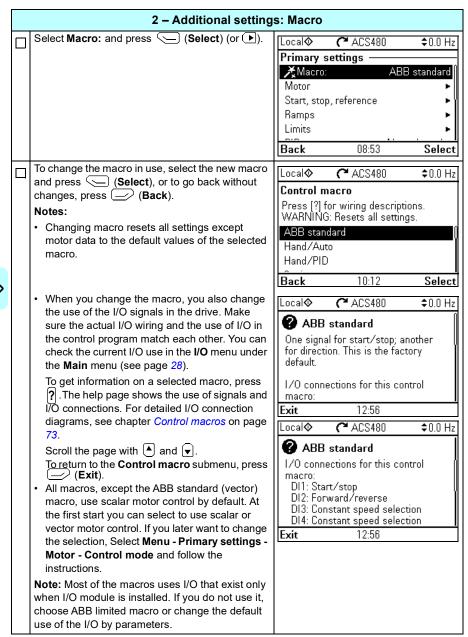
To go directly to the next view, press (Next).



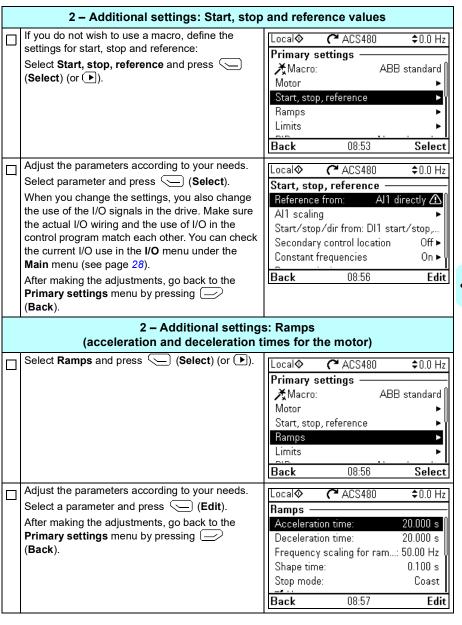




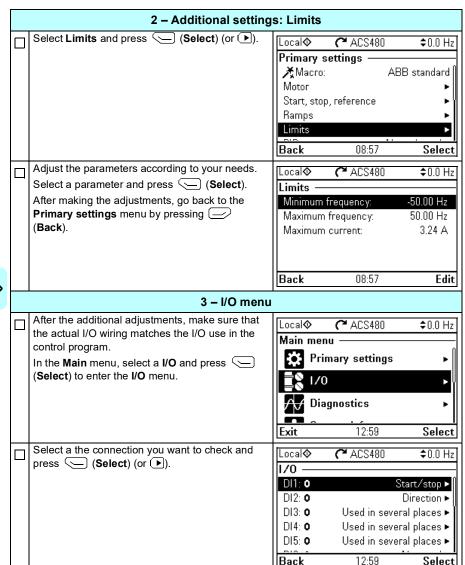






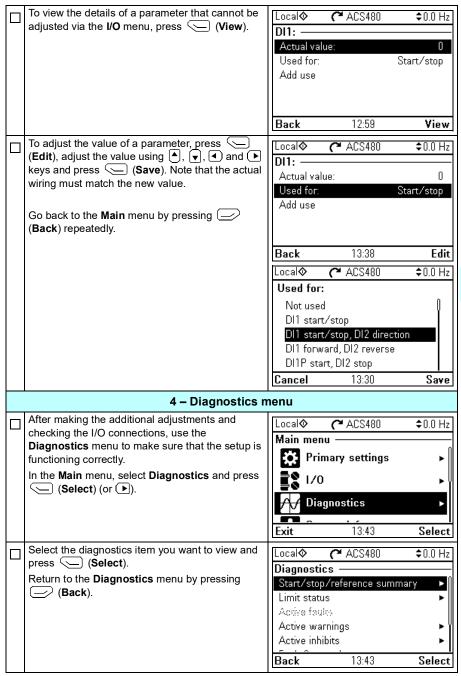


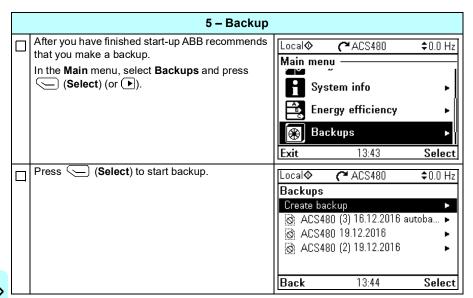














How to control the drive through the I/O interface

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 ABB standard macro are in use.

Preliminary settings

If you need to change the direction of rotation, check that limits allow reverse direction: Go to Menu -Primary settings - Limits and make sure that the minimum limit has a negative value and the maximum limit has a positive value.

Make sure that the control connections are wired according to the connection diagram given for the ABB standard macro.

Note: Most of the macros uses I/O that exist only when I/O module is installed. If you do not use it, choose ABB limited macro or change the default use of the I/O by parameters.

Make sure that the drive is in remote control. Press key Loc/Rem to switch between remote and local control

See section ABB standard macro on page 75.

In remote control, the panel display shows text Remote at the top left.

Starting and controlling the speed of the motor

Start by switching digital input DI1 on.

The arrow starts rotating. It is dotted until the setpoint is reached.

Regulate the drive output frequency (motor speed) by adjusting voltage of analog input AI1.

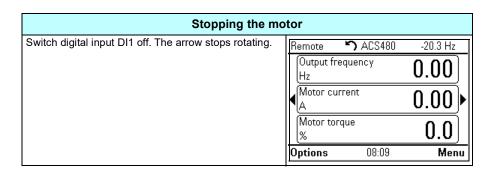
Remote 3	. ACS480	20.2 Hz
Output frequency Hz		14.20
√Motor current A		0.39
Motor torque %	9	1.4
Options	08:09	Menu

Changing the direction of the motor rotation

Reverse direction: Switch digital input DI2 on. Forward direction: Switch digital input DI2 off.

Re	mote	. ACS480	-20.3 Hz
	Dutput fre Hz	quency -	14.90
▼	Motor curi 4	rent	0.39
	Motor tord %	lue	-0.9
Οp	tions	08:09	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 34) or with parameter 99.13 ID run requested (see page 36).

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*.

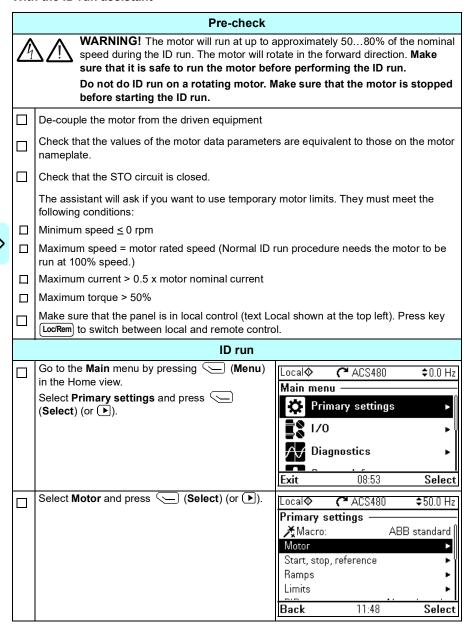
change the control mode to vector with the Control mode assistant (go to Menu -Primary settings - Motor - Control mode) and follow the instructions. The ID run assistant then guides you through the ID run.

or

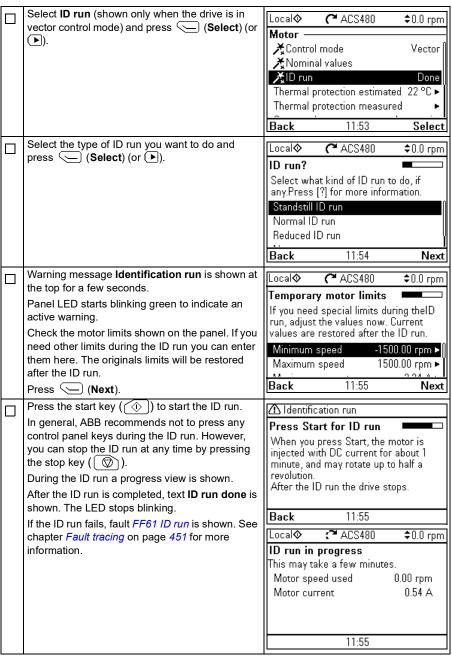
- set parameter 99.04 Motor control mode to Vector, and
 - for I/O controlled drive, check parameters in groups 22 Speed reference selection, 23 Speed reference ramp, 12 Standard AI, 30 Limits and 46 Monitoring/scaling settings.
- for torque controlled drive, check also parameters in group 26 Torque reference chain.

ID run procedure

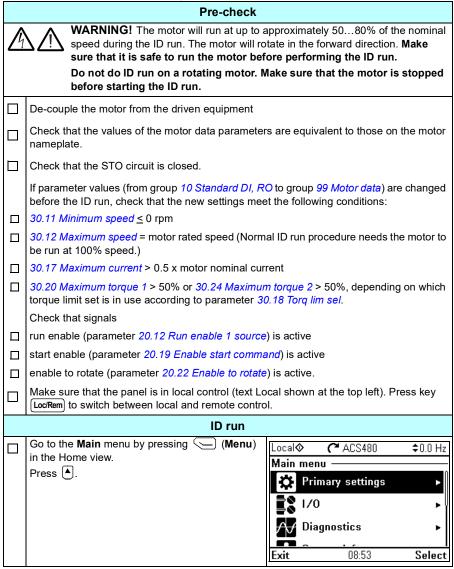
With the ID run assistant





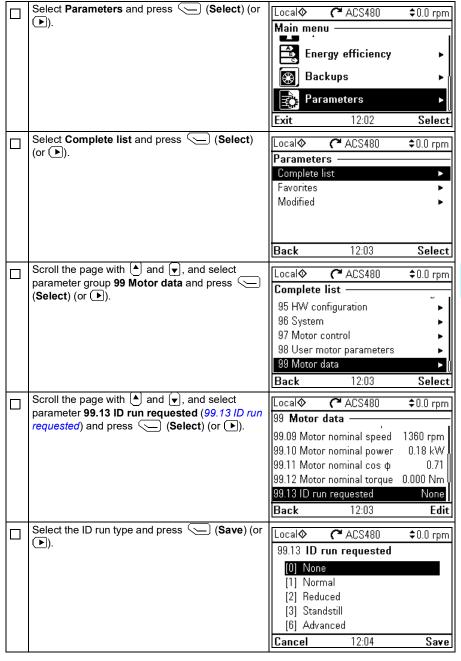


With parameter 99.13 ID run requested









The panel returns to the previous view and warning message Identification run is shown at the top for a few seconds. Panel LED starts blinking green to indicate an active warning (AFF6). The AFF6 warning view is shown when no key has been pressed for one minute. Pressing (How to fix) shows text informing that the ID run will be done at the next start. You can hide the warning view by pressing (Hide). Press the start key () to start the ID run. In general, ABB recommends not to press any control panel keys during the ID run. However, you can stop the ID run at any time by pressing the stop key ().	99.10 Moto 99.11 Moto 99.12 Moto 99.13 ID ru Back Local W Au Identific	r nominal speed or nominal power or nominal cos φ or nominal torque in requested 12:05 ACS480 arning AFF6 x code: 0000 000 ation run ntification run abort	0.71 0.000 Nm Normal Edit \$0.0 rpm 0 12:04:56
	Hide	12:06	How to fix
During the ID run the arrow is rotating at the top. After the ID run is completed, text ID run done is shown. The LED stops blinking. If the ID run fails, fault <i>FF61 ID run</i> is shown. See chapter <i>Fault tracing</i> on page <i>451</i> for more information.	99.10 Moto 99.11 Moto 99.12 Moto	ACS480 data or nominal speed or nominal power or nominal cos ф or nominal torque in requested 12:03	0.71





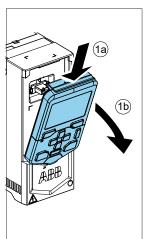
Control panel

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 ACX-AP-x assistant control panels user's manual (3AUA0000085685 [English]).

Removing and reinstalling the control panel

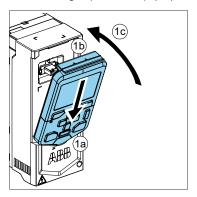
To remove the control panel, press the retaining clip at the top (1a) and pull it forward from the top edge (1b).



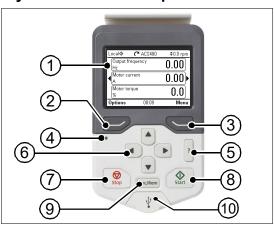




To reinstall the control panel, put the bottom of the container in position (1a), press the retaining clip at the top (1b) and push the control panel in at the top edge (1c).



Layout of the control panel

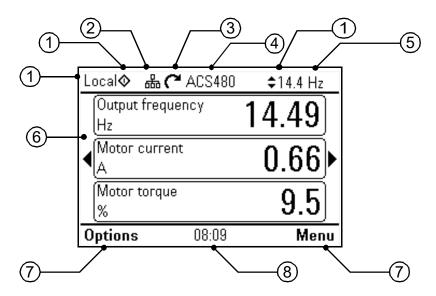


1	Layout of the control panel display
2	Left softkey
3	Right softkey
4	Status LED, see chapter Maintenance and hardware diagnostics, section LEDs in the Hardware manual of the drive.
5	Help

6	The arrow keys
7	Stop (see Start and Stop)
8	Start (see Start and Stop)
9	Local/Remote (see Loc/Rem)
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:

			Giving reference from this panel
	Not allowed	Not allowed	Not allowed

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

Text/Icons		Starting from this control panel		Giving reference from this panel
Local	\lambda	\$ Allowed	Allowed	Allowed

Remote: The drive is in remote 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
Remote		Not allowed	Not allowed	Not allowed
Remote 💠		Allowed	Allowed	Not allowed
Remote	‡	Not allowed	Allowed	Allowed
Remote 💠	↑	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
~	Blinking	Faulted
(24↔	Blinking	Running, at reference, but the reference value is 0
(3+J	Rotating	Running, not at reference
G⇔J	Rotating	Running, at reference
\mathbb{M}	-	Pre-heating (motor heating) active
Z ₂	-	PID sleep mode active

- Drive name: If a name has been given, it is displayed in the top pane. By default, it is "ACS480". You can change the name on the control panel by selecting Menu Primary settings Clock, region, display (see page 62).
- 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 46).
- 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 41 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 62).

You can adjust the display contrast and back light functionality on the control panel by selecting Menu - Primary settings - Clock, region, display (see page 62).

Kevs

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 (\blacktriangle and $\boxed{\bullet}$) 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, • and function the same way as and not 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.

Start and Stop

In local control, the start key (\bigcirc) and the stop key (\bigcirc) start and stop the drive, respectively.

Loc/Rem

The location key (Loc/Rem) is used for switching the control between the control panel (Local) and remote connections (Remote). When switching from Remote to Local while the drive is running, the drive keeps running at the same speed. When switching from Local to Remote, the status of the remote location is adopted.

Key shortcuts

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

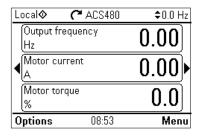
Shortcut	Available in	Effect
+ •	any view	Save a screenshot. Up to fifteen images may be stored in the control panel memory. To transfer images to PC, connect the assistant control panel to PC with a USB cable and the panel will mount itself as an MTP (media transfer protocol) device. Pictures are stored in the screen shots folder.
		For more instructions, see ACX-AP-x assistant control panels user's manual (3AUA0000085685 [English]).
→ + ♠, → + ▼	any view	Adjust backlight brightness.
+ A , + V	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.

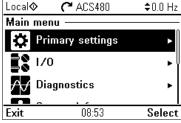
Settings, I/O and diagnostics on the control panel

Contents of this chapter

This chapter provides detailed information about the Primary settings, I/O and Diagnostics menus on the control panel.

To get to the Primary settings, I/O or Diagnostic menu from the Home view, first select Menu to go the Main menu, and in the Main menu, select Primary settings, I/O or Diagnostics.





Primary settings menu



To go the Primary settings menu from the Home view, select Menu - Primary settings.

The **Primary settings** menu enables you to adjust and define additional settings used in the drive.

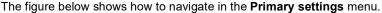
After making the guided settings using the first start assistant, ABB recommends that you make at least these additional settings:

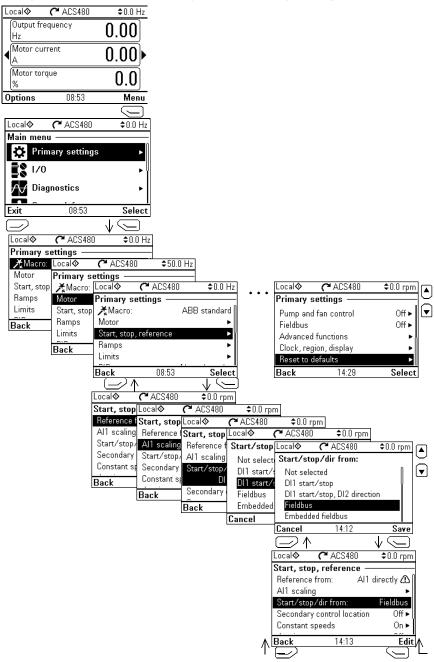
- Select a Macro or set Start, stop, reference values
- Ramps
- Limits

With the **Primary settings** menu, you can also adjust settings related to the motor, PID, fieldbus, advanced functions and clock, region and display. In addition, you can reset the fault and event logs, panel Home view, parameters not related to hardware, fieldbus settings, motor data and ID run results, all parameters, end user texts as well as reset everything to factory defaults. Note that the Primary settings menu only enables you to modify some of the settings: more advanced configuration is done via the parameters: Select Menu - Parameters. For more information on the different parameters, see chapter *Parameters* on page 177.

In the **Setting** menu, the **\(\lambda \)** symbol indicates multiple connected signals/parameters. The X symbol indicates that the setting provides an assistant when modifying the parameters.

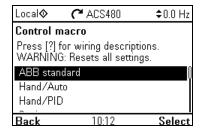
To get more information on **Primary settings** menu items, press the [?] key to open the help page.





The sections below provide detailed information about the contents of the different submenus available in the **Primary settings** menu.

Macro

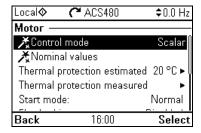


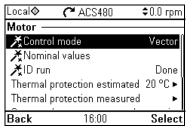
Use the **Macro** submenu to quickly set up drive control and reference source by selecting from a set of predefined wiring configurations.

Note: For detailed information about the available macros, see *Control macros* on page 73.

If you do not wish to use a macro, manually define the settings for **Start**, **stop**, **reference**. Note that even if you select to use a macro, you can also modify the other settings to suit your needs.

Motor





Use the **Motor** submenu to adjust motor-related settings, such as nominal values, control mode or thermal protection.

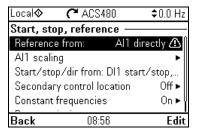
Note that settings that are visible depend on other selections, for example vector or scalar control mode, used motor type or selected start mode.

Three assistants are available: Control mode, Nominal value and ID run (for vector control mode only).

The table below provides detailed information about the available setting items in the Motor menu.

Menu item	Description	Corresponding parameter
Control mode	Selects whether to use scalar or vector control mode.	99.04 Motor control mode
	For information on scalar control mode, see <i>Speed compensated stop</i> on page <i>153</i> .	
	For information on vector control mode, see <i>Rush</i> control on page 150.	
Nominal values	Enter the motor's nominal values from the motor's nameplate.	99.06 Motor nominal current 99.12 Motor nominal torque
Thermal protection estimated	The settings in this submenu are meant to protect the motor from overheating by automatically triggering a fault or warning above a certain temperature.	35 Motor thermal protection
	By default, motor thermal estimate protection is on. ABB recommends checking the values for the protection to function properly. For more information, see <i>Motor thermal protection</i>	
	on page 160.	
Thermal protection measured	The settings in this submenu are meant to protect the motor with a thermal measurement from overheating by automatically triggering a fault or warning above a certain temperature.	35 Motor thermal protection
	For more information, see <i>Motor thermal protection</i> on page <i>160</i> .	
Start mode:	Sets how the drive starts the motor (e.g. premagnetize or not).	21 Start/stop mode
Flux braking:	Sets how much current to use for braking, ie. how the motor is magnetized before starting. For more information, see <i>Flux braking</i> on page 145.	97.05 Flux braking
U/f ratio:	The form of voltage to frequency ratio below field weakening point.	97.20 U/F ratio
IR compensation:	Sets how much to boost voltage at zero speed. Increase this for higher break-away torque. For more information, see <i>IR compensation for scalar motor control</i> on page 142.	97.13 IR compensation
Pre-heating	Turns pre-heating on or off. The drive can prevent condensation in a stopped motor by feeding it a fixed current (% of motor nominal current). Use in humid or cold conditions to prevent condensation.	21.14 Pre-heating input source 21.16 Pre-heating current
Phase order:	If the motor turns in the wrong direction, change this setting to fix the direction instead of changing the phase order on the motor cable.	99.16 Motor phase order

Start, stop, reference



Use the Start, stop, reference submenu to set up start/stop commands, reference, and related features, such as constant speeds or run permissions.

The table below provides detailed information about the available setting items in the Start, stop, reference menu.

Menu item	Description	Corresponding parameter
Reference from	Sets where the drive gets its reference when remote control (EXT1) is active.	28.11 Ext1 frequency ref1 or 22.11 Ext1 speed ref1 12.19 Al1 scaled at Al1 min
Reference-related settings (e.g. Al scaling, Al2 scaling, Motor potentiometer settings) depending on the selected reference	The voltage or current fed to the input is converted into a value the drive can use (e.g. reference).	12.20 Al1 scaled at Al1 max
Start/stop/dir from:	Sets where the drive gets start, stop, and (optionally) direction commands when remote control (EXT1) is active.	20.01 Ext1 commands
Secondary control location	Settings for the secondary remote control location, EXT2. These settings include reference source, start, stop, direction and command sources for EXT2. By default, EXT2 is set to Off .	19.11 Ext1/Ext2 selection 28.15 Ext2 frequency ref1 or 22.18 Ext2 speed ref1 12.17 Al1 min 12.18 Al1 max 12.27 Al2 min 12.28 Al2 max 20.06 Ext2 commands 20.08 Ext2 in1 source 20.10 Ext2 in3 source 20.10 Ext2 in3 source

Menu item	Description	Corresponding parameter
Constant speeds / Constant frequencies	These settings are for using a constant value as the reference. By default, this is set to On . For more information, see <i>Constant speeds/frequencies</i> on page 122.	28.21 Constant frequency function or 22.21 Constant speed function 28.26 Constant frequency 1 28.27 Constant frequency 2 28.28 Constant frequency 3 22.26 Constant speed 1 22.27 Constant speed 2 22.28 Constant speed 3
Jogging	These settings allow you to use a digital input to briefly run the motor using predefined speed and acceleration/deceleration ramps. By default, jogging is disabled and it can only be used in the Vector control mode. For more information, see <i>Jogging</i> on page 150.	20.25 Jogging enable 22.42 Jogging 1 ref 22.43 Jogging 2 ref 23.20 Acc time jogging 23.21 Dec time jogging
Run permissions	Settings to prevent the drive from running or starting when a specific digital input is low.	20.12 Run enable 1 source 20.11 Run enable stop mode 20.19 Enable start command 20.22 Enable to rotate 21.05 Emergency stop source 21.04 Emergency stop mode 23.23 Emergency stop time

Ramps

Local♦	(~ ACS480	\$0.0 Hz
Ramps		
Acceler	ation time:	20.000 s
Deceler	ation time:	20.000 s
Frequen	icy scaling for ram	: 50.00 Hz 🏻
Shape ti	ime:	0.100 s
Stop mo	ode:	Coast
Back	08:57	Edit

Use the Ramps submenu to set up acceleration and deceleration settings.

Note: To set ramps, you also have to specify parameter 46.01 Speed scaling (in speed control mode) or 46.02 Frequency scaling (in frequency control mode).

The table below provides detailed information about the available setting items in the Ramps menu.

Menu item	Description	Corresponding parameter
Acceleration time:	This is the time between standstill and "scaling speed" when using the default ramps (set 1).	23.12 Acceleration time 1 28.72 Freq acceleration time 1
Deceleration time:	This is the time between standstill and "scaling speed" when using the default ramps (set 1).	23.13 Deceleration time 1 28.73 Freq deceleration time 1
Frequency scaling for ramps:	This is the he maximum speed/frequency value for acceleration ramp rate and the initial value for deceleration ramp rate. Applies to both ramp sets.	46.02 Frequency scaling
Shape time:	Sets the shape of the default ramps (set 1).	23.32 Shape time 1 28.82 Shape time 1
Stop mode:	Sets how the drive stops the motor.	21.03 Stop mode
Use two ramp sets	Sets the use of a second acceleration/deceleration ramp set. If unselected, only one ramp set is used. Note that if this selection is not enabled, the selection below are not available.	
Activate ramp set 2:	To switch ramp sets, you can either: use a digital input (low = set 1; high = set 2), or automatically switch to set 2 above a certain frequency/speed.	23.11 Ramp set selection 28.71 Freq ramp set selection
Acceleration time 2:	Sets the time between standstill and "scaling speed" when using ramp set 2.	23.14 Acceleration time 2 28.74 Freq acceleration time 2
Deceleration time 2:	Sets the time between standstill and "scaling speed" when using ramp set 2.	23.15 Deceleration time 2 28.75 Freq deceleration time 2

Menu item	Description	Corresponding parameter
Shape time 2:	Sets the shape of ramps in set 2.	23.33 Shape time 2
	, , ,	28.83 Shape time 2

Limits

Local ♦ (~ ACS480	\$0.0 Hz
Limits —	
Minimum frequency:	-50.00 Hz
Maximum frequency:	50.00 Hz
Maximum current:	3.24 A
Back 08:57	L 1,7
Back 08:57	Edit

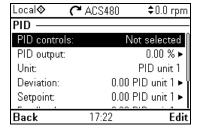
Use the Limits submenu to set the allowed operating range. This function is intended to protect the motor, connected hardware and mechanics. The drive stays within these limits, no matter what reference value it gets.

Note: To set ramps, you also have to specify parameter 46.01 Speed scaling (in speed control mode) or 46.02 Frequency scaling (in frequency control mode); these limit parameters have no effect on ramps.

The table below provides detailed information about the available setting items in the Limits menu.

Menu item	Description	Corresponding parameter
Minimum frequency	Sets the minimum operating frequency. Affects scalar control only.	30.13 Minimum frequency
Maximum frequency	Sets the maximum operating frequency. Affects scalar control only.	30.14 Maximum frequency
Minimum speed	Sets the minimum operating speed. Affects vector control only.	30.11 Minimum speed
Maximum speed	Sets the maximum operating speed. Affects vector control only.	30.12 Maximum speed
Minimum torque	Sets the minimum operating torque. Affects vector control only.	30.19 Minimum torque 1
Maximum torque	Sets the maximum operating torque. Affects vector control only.	30.20 Maximum torque 1
Maximum current	Sets the maximum output current.	30.17 Maximum current

PID



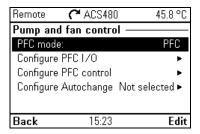
The PID submenu contains settings and actual values for the process PID controller for controlling multiple pumps or fans through the drive's relay outputs.

The table below provides detailed information about the available setting items in the PID menu.

Menu item	Description	Corresponding parameter
PID controls:	Sets what to use PID output for:	40.07 Process PID
	 Not selected: PID not used. 	operation mode
	 Frequency reference (or Speed reference, depending on the motor control mode): Uses PID output as a frequency (speed) reference when remote control (EXT1) is active. 	
PID output:	View the process PID output or set its range.	40.01 Process PID output actual 40.36 Set 1 output min 40.37 Set 1 output max
Unit:	PID customer unit. Sets the text shown as the unit	
	for setpoint, feedback and deviation.	
Deviation:	View or invert process PID deviation.	40.04 Process PID deviation actual 40.31 Set 1 deviation inversion
Setpoint:	View or configure the process PID setpoint, ie. the target process value. You can also use a constant setpoint value instead of (or in addition to) an external setpoint source. When a constant setpoint is active, it overrides the	40.03 Process PID setpoint actual 40.16 Set 1 setpoint 1 source
	normal setpoint.	
Feedback:	View or configure process PID feedback, ie. the measured value.	40.02 Process PID feedback actual 40.08 Set 1 feedback 1 source 40.11 Set 1 feedback filter time

Menu item	Description	Corresponding parameter
Tuning	The Tuning submenu contains settings for gain, integration time and derivation time. 1. Make sure it is safe to start the motor and run the actual process. 2. Start the motor in remote control. 3. Change setpoint by a small amount. 4. Watch how feedback reacts. 5. Adjust gain/integration/derivation.	40.32 Set 1 gain 40.33 Set 1 integration time 40.34 Set 1 derivation time 40.35 Set 1 derivation filter time
Sleep function	6. Repeat steps 3-5 until feedback reacts as desired. The sleep function can be used to save energy by stopping the motor during low demand. By default, sleep function is disabled. If d, the motor automatically stops when demand is low, and starts again when deviation grows too large. This saves energy when rotating the motor at low speeds would be useless. See section Sleep and boost functions for process PID control on page 130.	40.43 Set 1 sleep level 40.44 Set 1 sleep delay 40.45 Set 1 sleep boost time 40.46 Set 1 sleep boost step 40.47 Set 1 wake-up deviation 40.48 Set 1 wake-up delay

Pump and fan control

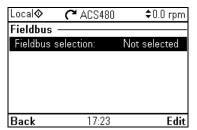


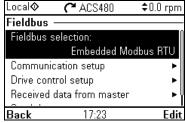
The Pump and fan control submenu contains settings for the Pump and fan control logic. The Pump and fan control is supported in external control location EXT2 only.

The table below provides detailed information about the available setting items in the Pump and fan control menu.

Menu item	Description	Corresponding parameter
PFC mode:	See section <i>Pump and fan control (PFC)</i> on page 132.	76.21 Multipump configuration
	Selects the PFC or SPFC control.	
Configure PFC I/O	Configures PFC/SPFC I/O. ROs Interlocks Check I/O configuration (See I/O menu on page 65.)	76.25 Number of motors 76.27 Max number of motors allowed 76.59 PFC contactor delay 10.24 RO1 source 10.27 RO2 source 10.30 RO3 source 76.81 PFC 1 interlock 76.82 PFC 2 interlock 76.83 PFC 3 interlock 76.84 PFC 4 interlock 76.85 PFC 5 interlock
Configure PFC control	Configures PFC/SPFC control	76.86 PFC 6 interlock 76.30 Start point 1 76.31 Start point 2 76.32 Start point 3 76.33 Start point 4 76.34 Start point 4 76.34 Start point 1 76.42 Stop point 1 76.42 Stop point 2 76.43 Stop point 3 76.44 Stop point 4 76.45 Stop point 4 76.45 Stop point 5 76.55 Start delay 76.56 Stop delay
Configure Autochange	Configures Autochange	76.70 PFC autochange 76.71 PFC autochange interval 76.72 Maximum wear imbalance 76.73 Autochange level

Fieldbus





Use the settings in the Fieldbus submenu to use the drive with a fieldbus.

- CANopen
- ControlNet
- DeviceNetTM
- Ethernet POWERLINK
- EtherCAT
- Ethernet/IPTM
- Modbus RTU
- Modbus (TCP)
- PROFIBUS DP
- PROFINET IO

You can also configure all the fieldbus related settings via the parameters (parameter groups 50 Fieldbus adapter (FBA), 51 FBA A settings, 52 FBA A data in, 53 FBA A data out, 58 Embedded fieldbus), but the purpose of the Fieldbus menu is to make the protocol configurations easier.

Note that only Modbus RTU is embedded into I/O module and the other fieldbus modules are optional adapters. For the optional modules, the following adapters are required to the needed protocols:

CANopen: FCAN-01 ControlNet: FCNA-01

DeviceNetTM: FDNA-01

Ethernet POWERLINK: FEPL-02

EtherCAT: FECA-01

Ethernet/IPTM: FENA-21

Modbus/TCP: FMBT-21, FENA-21

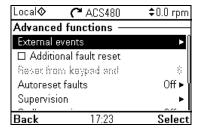
 PROFIBUS DP: FPBA-01 PROFINET IO: FENA-21

The table below provides detailed information about the available setting items in the **Fieldbus** menu. Note that some of the items only become active once you have enabled fieldbus.

Menu item	Description	Corresponding parameter
Fieldbus selection	Select this if you want to use the drive with a	51.01 FBA A type
	fieldbus.	58.01 Protocol enable
Communication	To set up communication between the drive and	51 FBA A settings
setup	the fieldbus master, define these settings and then	51.01 FBA A type
'	select Apply settings to fieldbus module.	51.02 FBA A Par2
		51.27 FBA A par refresh
		51.31 D2FBA A comm
		status 50.13 FBA A control
		word
		50.16 FBA A status
		word
		58 Embedded fieldbus
		58.01 Protocol enable
		58.03 Node address
		58.04 Baud rate 58.05 Parity
		58.25 Control profile
Drive control setup	Sets how a fieldbus master can control this drive,	20.01 Ext1 commands
Brive control setup	and how the drive reacts if the fieldbus	19.11 Ext1/Ext2
	communication fails.	selection
	communication falls.	22.11 Ext1 speed ref1
		28.11 Ext1 frequency
		ref1
		22.41 Speed ref safe 28.41 Frequency ref
		safe
		50.03 FBA A comm loss
		t out
		46.01 Speed scaling
		46.02 Frequency scaling
		23.12 Acceleration time
		23.13 Deceleration time
		28.72 Freq acceleration
		time 1
		28.73 Freq deceleration
		time 1 51.27 FBA A par refresh
		58.14 Communication
		loss action
		58.15 Communication
		loss mode
		58.16 Communication loss time
Received data from	Sets what the drive's fieldbus module expects to	50.13 FBA A control
master	receive from the fieldbus master (PLC). After	word 53 FBA A data out
	changing these settings, select Apply settings to	51.27 FBA A par refresh
	fieldbus module.	58.18 EFB control word
		03.09 EFB reference 1
L	!	

Menu item		Corresponding parameter
Send data to master	fieldbus master (PLC). After changing these settings, select Apply settings to fieldbus	50.16 FBA A status word 52 FBA A data in 51.27 FBA A par refresh 58.19 EFB status word
Apply settings to fieldbus module		51.27 FBA A par refresh 58.06 Communication control

Advanced functions



The Advanced functions submenu contains settings for advanced functions, such as triggering or resetting faults via I/O, signal supervision, using the drive with timed functions, or switching between several entire sets of settings.

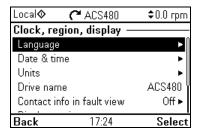
The table below provides detailed information about the available setting items in the Advanced functions menu.

Menu item	Description	Corresponding parameter
External events	Enables you to define custom faults or warnings you can trigger via digital input. The texts of these messages are customizable.	31.01 External event 1 source 31.02 External event 1 type 31.03 External event 2 source 31.04 External event 2 type 31.05 External event 3 source 31.06 External event 3 type
Additional fault reset	You can reset an active fault via I/O: a rising pulse in the selected input means reset.	31.11 Fault reset selection
	A fault can be reset from the fieldbus even if Reset faults manually is unselected.	
Reset from keypad and	Define from where you want to reset faults manually. Note that this submenu is active only if you have selected to reset faults manually.	31.11 Fault reset selection

Menu item	Description	Corresponding parameter
Autoreset faults	Reset faults automatically. For more information, see <i>Automatic fault resets</i> on page <i>168</i> .	31.12 Autoreset selection 31.14 Number of trials 31.15 Total trials time 31.16 Delay time
Supervision	You can select three signals to be supervised. If a signal is outside predefined limits a fault or warning is generated. For complete settings, see group 32 Supervision on page 299.	32.01 Supervision status 32.05 Supervision 1 function 32.06 Supervision 1 action 32.07 Supervision 1 signal 32.09 Supervision 1 low 32.10 Supervision 1 low 32.10 Supervision 1 high 32.11 Supervision 1 hysteresis 32.25 Supervision 3 function 32.26 Supervision 3 action 32.27 Supervision 3 signal 32.29 Supervision 3 low 32.30 Supervision 3 high 32.31 Supervision 3 hysteresis
Stall protection	The drive can detect a motor stall and automatically fault or show a warning message. Stall condition is detected when: current is high (above certain % of motor nominal current), and output frequency (scalar control) or motor speed (vector control) is below a certain limit, and the conditions above have been true for a certain minimum duration.	31.24 Stall function 31.25 Stall current limit 31.26 Stall speed limit 31.27 Stall frequency limit 31.28 Stall time

Menu item	Description	Corresponding parameter
Timed functions	Enables using the drive with timed functions. For complete settings, see group 34 Timed functions on page 307.	34.100 Timed function 1 34.101 Timed function 2 34.102 Timed function 3 34.11 Timer 1 configuration 34.12 Timer 1 start time 34.13 Timer 1 duration 34.44 Timer 12 configuration 34.45 Timer 12 start time 34.46 Timer 12 duration 34.111 Boost time activation source 34.112 Boost time duration
User sets	This submenu enables you to save multiple sets of settings for easy switching. For more information about user sets, see <i>User parameter sets</i> on page 173.	save/load

Clock, region, display



The Clock, region, display submenu contains settings for language, date and time, display (such as brightness) and settings for changing how information is displayed on screen.

The table below provides detailed information about the available setting items in the Clock, region, display menu.

Menu item	Description	Corresponding parameter
Language	Change the language used on the control panel screen. Note that the language is loaded from the drive so this takes some time.	96.01 Language
Date & time	Set the time and date, and their formats.	
Units	Select the units used for power, temperature and torque.	
Drive name:	The drive name defined in this setting is shown in the status bar at the top of the screen while using the drive. If more than one drives are connected to the control panel, the drive names make it easy to identify each drive. It also identifies any backups you create for this drive.	
Contact info in fault view	Define a fixed text that is shown during any fault (for example, who to contact in case of a fault). If a fault occurs, this information appears on the panel screen (in addition to the fault-specific information).	
Display settings	Adjust the brightness, contrast and display power save delay of the panel screen or to invert white and black.	
Show in lists	Show or hide the numeric IDs of: • parameters and groups • option list items • bits • devices in Options > Select drive	
Show inhibit pop-up	Enables or disables pop-up views showing information on inhibits, for example when you try to start the drive but it is prevented.	

Reset to defaults

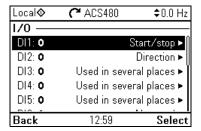


The **Reset to defaults** submenu enables you to reset parameters and other settings.

Menu item	Description	Corresponding parameter
Reset fault and event logs	Clears all events from the drive's fault and event logs.	96.51 Clear fault and event logger
Reset home view layout	Restores the Home view layout back to show the values of the default parameters defined by the control macro in use.	96.06 Parameter restore, selection Reset home view
Reset non-HW parameters	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 parameter 95.01 Supply voltage differentiated defaults implemented by parameters 95.20 HW options word 1 and 95.21 HW options word 2 user lock configuration parameters 96.10096.102.	96.06 Parameter restore, selection Restore defaults
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.	96.06 Parameter restore, selection Reset all fieldbus settings
Reset motor data and IR run results	Restores all motor nominal values and motor ID run results to default values.	96.06 Parameter restore, selection Reset motor data

Menu item	Description	Corresponding parameter
Reset all parameters	Restores all editable parameter values to default values, except	96.06 Parameter restore, selection Clear all
	 end user texts, such as customized warnings and faults, and the drive name 	
	 control panel/PC communication settings control macro selection and the parameter defaults 	
	 parameter 95.01 Supply voltage differentiated defaults implemented by parameters 95.20 HW options word 1 and 95.21 HW options word 2 user lock configuration parameters 96.10096.102 	
	• group 49 Panel port communication parameters.	
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.	96.06 Parameter restore, selection Reset end user texts
Reset all to factory defaults	Restores all drive parameters and settings back to initial factory values, except	96.06 Parameter restore, selection All to factory defaults
	 differentiated defaults implemented by parameters 95.20 HW options word 1 and 95.21 HW options word 2. 	

I/O menu



To go the I/O menu from the Home view, select Menu - I/O.

Use the I/O menu to make sure that the actual I/O wiring matches the I/O use in the control program. It answers the questions:

- · What is each input being used for?
- What is the meaning of each output?

In the **I/O** menu, each row provides the following information:

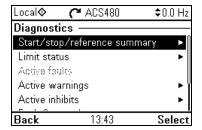
- Terminal name and number
- Flectrical status
- Logical meaning of the drive

Each row also provides a submenu that provides further information on the menu item and lets you make changes to the I/O connections.

The table below provides detailed information about the contents of the different submenus available in the I/O menu.

Menu item	Description
DI1	This submenu lists the functions that use DI1 as input.
DI2	This submenu lists the functions that use DI2 as input.
DI3	This submenu lists the functions that use DI3 as input.
DI4	This submenu lists the functions that use DI4 as input.
DI5	This submenu lists the functions that use DI5 as input. The connector can
	be used as either digital input or frequency input.
DI6	This submenu lists the functions that use DI6 as input.
Al1	This submenu lists the functions that use Al1 as input.
AI2	This submenu lists the functions that use Al2 as input.
RO1	This submenu lists what information goes into relay output 1.
RO2	This submenu lists what information goes into relay output 2.
RO3	This submenu lists what information goes into relay output 3.
AO1	This submenu lists what information goes into AO1.
AO2	This submenu lists what information goes into AO2.

Diagnostics menu



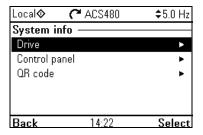
To go the Diagnostics menu from the Home view, select Menu - Diagnostics.

The Diagnostics menu provides you with diagnostic information, such as faults and warnings, and helps you to resolve potential problems. Use the menu to make sure that the drive setup is functioning correctly.

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

Menu item	Description
Start, stop, reference summary	This view shows where the drive is currently taking its start and stop commands and reference. The view is updated in real time.
	If the drive is not starting or stopping as expected, or runs at an undesired speed, use this view to find out where the control comes from.
Limit status This view describes any limits currently affecting operation.	
	If the drive is running at undesired speed, use this view to find out if any limitations are active.
Active faults	This view shows the currently active faults and provides instructions on how to fix and reset them.
Active warnings	This view shows the currently active warnings and provides instructions on how to fix them.
Active inhibits	This view shows the active start inhibits and how to fix them.
Fault & event log	This view lists the faults, warnings and other events that have occurred in the drive.
	Press Details to see, for each stored fault, the fault code, time and values of parameters (actual signals and status words) 05.8005.88 stored at the time of the fault.
Fieldbus	This view provides status information and sent and received data from fieldbus for troubleshooting.
Load profile	This view provides status information regarding load distribution (that is, how much of the drive's running time was spent on each load level) and peak load levels.

System info menu



To go the **System info** menu from the Home view, select **Menu - System info**.

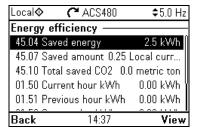
The **System info** menu shows information about the drive and the control panel. In problem situations you can also request the drive to generate a QR code for ABB service, so they can better assist you.

The table below shows the different views in the **System info** menu.

Menu item	Description	Corresponding parameter
Drive	Shows the following information about the drive:	07.05 Firmware version
	Local♦ (* ACS480	07.07 Loading package version
	Drive 1 Panel bus id: 1 Product name: ACS480 Product type: ACS480 LP version: ASDDA v2.05.255.0 Backup version: 00.01.00.00 — FW version ASDKA v2.05.255.1 Feb. 6.2018 Back 14:22	
Control panel	Shows the following information about the control panel:	
	Local ♦ (~ ACS480	
	Control panel —————	
	Product type: ACS-AP-S	
	HW version: H Flash AT32/E FW version: GPAPS v5.20 Serial number: H6341498WU Manufacturing date: 19.08.2016	
	Back 14:22	

Menu item	Description	Corresponding parameter
QR code	The drive generates a QR code (or a series of QR codes), which contains drive identification data, information on the latest events, and values of status and counter parameters. You can read the QR code with a mobile device containing the ABB service application, which then sends the QR code to ABB for analysis.	
	□ 1	

Energy efficiency menu



To go the Energy efficiency menu from the Home view, select Menu - Energy efficiency.

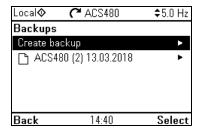
The **Energy efficiency** menu provides you with information about energy efficiency, such as saved energy and energy consumption. You can also configure energy calculation settings.

The table below lists the energy efficiency values shown in the Energy efficiency menu, as well as configurable energy calculation settings.

Menu item	Description	Corresponding parameter
Saved energy	Energy saved in kWh compared to direct-on-line motor connection.	45.04 Saved energy
Saved amount	Corresponding money saved compared to direct-on-line motor connection.	45.07 Saved amount
	You can define the currency unit you want to use in submenu Configuration .	
Total saved CO2	Reduction in CO2 emissions in metric tons compared to direct-on-line motor connection.	45.10 Total saved CO2
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.	01.50 Current hour kWh
Previous hour kWh	Previous hour energy consumption. The value 01.51 Previous hour kWh is stored here when its values has been cumulated for 60 minutes.	01.51 Previous hour kWh
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.	01.52 Current day kWh
Previous day kWh	Previous day energy consumption. The value 01.53 Previous day kWh is stored here when its value has been cumulated for 24 hours.	01.53 Previous day kWh
Configuration	In this submenu, you can configure energy calculation settings.	

Menu item	Description	Corresponding parameter
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	45.11 Energy optimizer
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.	45.12 Energy tariff 1
Energy tariff 1	Defines energy tariff 2 (price of energy per kWh).	45.13 Energy tariff 2
Tariff selection	Selects (or defines a source that selects) which pre-defined energy tariff is used.	45.14 Tariff selection
CO2 conversion factor	Defines a factor for conversion of saved energy into CO2 emissions (kg/kWh or tn/MWh).	45.18 CO2 conversion factor
Comparison power	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.	45.19 Comparison power
Energy calculations reset	Resets the savings counter parameters, eg. 45.04 Saved energy45.10 Total saved CO2.	45.21 Energy calculations reset
Currency	Defines the currency unit you want to use in energy calculations.	

Backups menu





To go the Backups menu from the Home view, select Menu - Backups.

For backups and restores, see section Backup and restore on page 172.

72	Settings, I/O and diagnostics on the control panel

Control macros

Contents of this chapter

This chapter describes the intended use, operation and default control connections of the application. At the end of chapter there are tables showing those parameter default values that are not the same for all macros.

General

Control macros are sets of default parameter values suitable for a certain control configuration. When starting up the drive, the user typically selects the best-suited control macro as a starting point, then makes any necessary changes to tailor the settings to their purpose. This usually results in a much lower number of user edits compared to the traditional way of programming a drive.

Note: Most of the macros uses I/O that exist only when I/O module is installed. If you do not use it, choose ABB limited macro or change the default use of the I/O by parameters.

Control macros can be selected in the Primary settings menu: Menu - Primary settings - Macro or with parameter 96.04 Macro select (page 392).

Note: All macros are made for scalar control except ABB standard which exists in two versions. If you want to use vector control, do as follows:

- Select the macro.
- Check nominal values of the motor: Menu -Primary settings - Motor - Nominal values.
- ⚠ Identification run

 Check motor limits

 These motor limits apply to vector control. Adjust the values if needed:

 Minimum speed

 Maximum speed

 Maximum speed

 Maximum current

 1500.00 rpm ►

 Maximum current

 3.24 A ►

 Back

 16:02

 Next
- · Change motor control mode to vector: Menu
 - **Primary settings Motor Control mode**, and follow the instructions (see the figure on the right).

ABB standard macro

This is the default macro. It provides a general purpose, 2-wire I/O configuration with three constant frequencies. One signal is used to start or stop the motor and another to select the direction. The ABB standard macro uses scalar control; for vector control, use the ABB standard (vector) macro on page 77.

This macro uses I/O that exist only when I/O module is installed.

Default control connections for the ABB standard macro

X1			Reference voltage and analog inputs and outputs		I/O available in base unit
110 kohm 1		SCR	Signal cable shield (screen)		
2		Al1	Output frequency reference: 010 V		
3		AGND	Analog input circuit common		
		4	+10V	Reference voltage 10 V DC	
		5	Al2	Not configured	
		6	AGND	Analog input circuit common	
_ ┌⊘─	/ ~ 	7	AO1	Output frequency: 020 mA	
	_ مُ	8	AO2	Motor current: 020 mA	
	/ <u> </u>	9	AGND	Analog output circuit common	
Max.	3)	X2 and X3	Aux. volta	age output and programmable DIs	
500 ohm	· —	10	+24V	Aux. voltage output +24 V DC, max. 250 mA	Х
Г	++	11	DGND	Aux. voltage output common for DIs	Х
	4)	12	DCOM	Digital input common for all	Х
		13	DI1	Stop (0) / Start (1)	Х
		14	DI2	Forward (0) / reverse (1)	Х
		15	DI3	Constant frequency selection ¹⁾	
		16	DI4	Constant frequency selection ¹⁾	
		17	DI5	Ramp set 1 (0) / Ramp set 2 (1)2)	
5) 18 DI6 Not configured X6, X7, X8 Relay output		18	DI6		
		19	RO1C	Ready run	Х
	1/4	20	RO1A	250 V AC / 30 V DC	Х
F	 	21	RO1B	├-`` 2 A	Х
		22	RO2C	Running	
	1 1/4	23	RO2A	250 V AC / 30 V DC	
_	- 	24	RO2B	├-`` 2A	
		25	RO3C	Fault (-1)	
	*	26	RO3A	250 V AC / 30 V DC	
L	<u> </u>	27	RO3B	<u> </u>	
	17	X5	EIA-485 N	Modbus RTU	
		29	B+	Embedded Modbus RTU (EIA-485). See	
		30	A-	chapter Fieldbus control through the	
		31	DGND	embedded fieldbus interface (EFB) on page	
S100		TERM	Serial data link termination switch		
		Safe torqu			
		34	SGND		х
		35	OUT	Safe torque off. Factory connection. Both circuits must be closed for the drive to start.	X
4.		36	IN1	See chapter <i>Delete safe torque</i> in drive	X
37		IN2	hardware manual.	X	
		X11		cy auxiliary voltage output	**
		42	+24 V	Aux. voltage output +24 V DC, max. 250 mA	
C = = #L	- not	43	DGND	Auxiliary voltage output common	
	e notes on	44	DCOM	Digital input common for all	
the next page.		200	1 - 3		

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

Notes:

¹⁾ See **Menu - Primary settings - Start, stop, reference - Constant frequencies** or parameter group *28 Frequency reference chain*.

DI3	DI4	Operation/Parameter
0	0	Set frequency through AI1
1	0	28.26 Constant frequency 1
0	1	28.27 Constant frequency 2
1	1	28.28 Constant frequency 3

²⁾ See Menu - Primary settings - Ramps or parameter group *28 Frequency reference chain.*

DI5	Ramp set	Parameters
0	1	28.72 Freq acceleration time 1
		28.73 Freq deceleration time 1
1	2	28.74 Freq acceleration time 2
		28.75 Freq deceleration time 2

³⁾ Ground the outer shield of the cable 360 degrees under the grounding clamp on the grounding shelf for the control cables.

Input signals

- Analog frequency reference (Al1)
- Start/stop selection (DI1)
- Forward/reverse (DI2)
- Constant frequency selection (DI3, DI4)
- Ramp set selection (DI5)

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)

⁴⁾ Connected with jumpers at the factory.

⁵⁾ Use shielded twisted-pair cables for digital signals.

ABB standard macro (vector)

The ABB standard (vector) uses vector control; otherwise it is similar to the ABB standard macro, providing a general purpose, 2-wire I/O configuration with three constant speeds. One signal is used to start or stop the motor and another to select the direction. To enable the macro, select it in the Primary settings menu or set parameter 96.04 Macro select to ABB standard (vector).

This macro uses I/O that exist only when I/O module is installed.

Default control connections for the ABB standard (vector) macro

		X1	Reference voltage and analog innuits and culticits		I/O available in base unit
110 kohm	_	1	SCR	Signal cable shield (screen)	
1	*	2	Al1	Output speed reference: 010 V ¹⁾	
7	<u>.'</u>	3	AGND	Analog input circuit common	
<u> </u>	- 	4	+10V	Reference voltage 10 V DC	
		5	Al2	Not configured	
		6	AGND	Analog input circuit common	
гØ /	<u>^ </u>	7	AO1	Output frequency: 020 mA	
<u></u>	, ,	8	AO2	Motor current: 020 mA	
M-1		9	AGND	Analog output circuit common	
Max. 500 ohm	3) ±	X2, X3	Aux. volta	ige output and programmable DIs	
300 011111		10	+24V	Aux. voltage output +24 VDC, max. 250 mA	Х
Γ	1	11	DGND	Aux. voltage output common for DIs	х
	4)	12	DCOM	Digital input common for all	х
	 	13	DI1	Stop (0) / Start (1)	Х
	 	14	DI2	Forward (0) / reverse (1)	х
			Constant speed sel 11)		
	 	16	DI4	Constant speed sel 21)	
	 	17	DI5	Ramp 1 (0) / Ramp 2 (1) ²⁾	
5		18	DI6	Not configured	
		X6, X7, X8	Relay out	puts	
		19	RO1C	Ready Run	х
	14	20	RO1A	250 V AC / 30 V DC	х
H	+	21	RO1B	¹	х
		22	RO2C	Running	
	1/2	23	RO2A	250 V AC / 30 V DC	
-	H \Box	24	RO2B	1	
	L	25	RO3C	Fault(-1)	
	1/2	26	RO3A	250 V AC / 30 V DC	
L	\overline{H}	27	RO3B	2 A	1
		X5		lodbus RTU	•
		29	B+	Internal Modbus RTU (EIA-485), see chapter	
		30	A-	Fieldbus control through the embedded	1
		31	DGND	fieldbus interface (EFB) on page 475.	
		S100	TERM	Serial data link termination switch	
34 35 36		X4	Safety tor	que off	•
		34	SGND	Safety torque off function. Factory	х
		35	OUT	connection. Both circuits must be closed for	Х
		IN1	the drive to start. See Safe torque off	х	
	37 IN2 function in the drive hardware manual.			х	
		X11	Redundar	ncy auxiliary voltage	•
		42	+24 V	Aux. voltage output +24 V DC, max. 250 mA	
43			DGND	Aux. voltage output common	
		44	DCOM	Digital input common for all	
				1 0 1	

Notes:

Terminal sizes: 0.14 ... 1.5 mm²

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

Terminals DGND, AGND and SGND are internally connected to same reference potential.

Reference from the integrated panel.

1) See Menu - Primary settings - Start, stop, reference - Constant speeds or parameter group 22 Speed reference selection.

Select the correct control mode from the Motor data view or with parameter 99.04 Motor control mode.

DI3	DI4	Operation/Parameter
0	0	Set speed through AI1
1	0	22.26 Constant speed 1
0	1	22.27 Constant speed 2
1	1	22.28 Constant speed 3

2) See Menu - Primary settings - Ramps or parameter group 23 Speed reference ramp.

DI5	Ramp set	Parameters
0	1	23.12 Acceleration time 1
		23.13 Deceleration time 1
1	2	23.14 Acceleration time 2
		23.15 Deceleration time 2

³⁾ Ground the outer shield of the cable 360 degrees under the grounding clamp on the grounding shelf for the control cables. Ground the outer shield of the cable 360 degrees under the grounding clamp on the grounding shelf for the control cables.

Input signals

- Analog speed reference (Al1)
- Start/Stop selection (DI1)
- Forward (0) / Reverse (1) (DI2)
- Constant speed selection (DI3, DI4)
- Ramp set 1 (0) / Ramp set 2 (1) selection (DI5)

⁴⁾ Connected with jumpers at the factory.

⁵⁾ Use shielded twisted-pair cables for digital signals.

Output signals

Analog output AO1: Output frequency

· Analog output AO2: Motor current

• Relay output 1: Ready run

• Relay output 2: Running

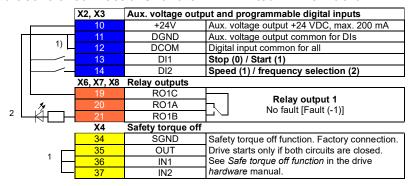
• Relay output 3: Fault (-1)

ABB limited 2-wire macro

This macro is used for limited amount of I/Os that exist only in the base unit.

To enable the macro, select the macro in the **Primary settings** menu or set parameter 96.04 Macro select to ABB limited 2-wire.

Default control connections for the ABB limited 2-wire macro



Notes:

Terminal sizes: 0.14 ... 1.5 mm²

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

Terminals DGND and SGND are internally connected to same reference potential.

Input signals

- Start / Stop (DI1)
- Output frequency or motor speed reference (DI2)

Output signals

Relay output 1: Fault (-1)

¹⁾ Connected with jumpers at the factory.

²⁾ Use shielded twisted-pair cables for digital signals.

3-wire macro

This macro is used when the drive is controlled using momentary push-buttons. It provides three constant speeds. To enable the macro, select it in the **Primary** settings menu or set parameter 96.04 Macro select to 3-wire.

Default control connections for the 3-wire macro

XI		Reference voltage and analog inputs and outputs		I/O available in base unit	
110 kohm		SCR	Signal cable shield (screen)		
, 		2	AI1	Ext. speed/frequency ref 1: 0 10 V1)	
_	/ 	3	AGND	Analog input circuit, common use	
4		+10V	Reference voltage 10 V DC		
5		Al2	Not configured		
	~ .	6	AGND	Analog input circuit common	
_ ┌ ⊘──	- 17 	7	AO1	Output frequency: 020 mA	
	_مُ ہ	8	AO2	Motor current: 020 mA	
	<u> </u>	9	AGND	Analog output circuit common	
Max. 500 ohm	3)	X2 and X3	Aux. volt	tage output and programmable digital	
500 01111		10	+24V	Aux. voltage output +24 V DC, max. 250 mA	х
Г	1	11	DGND	Aux. voltage output, common for DIs.	Х
	4)	12	DCOM	Digital input common for all	х
		13	DI1	Start (pulse _ /)	х
	صله—	14	DI2	Stop (pulse 1/2)	х
	 	15	DI3	Forward (0) / reverse (1)	
		16	DI4	Constant speed/frequency selection ²⁾	
		17	DI5	Constant speed/frequency selection ²⁾	
5)		18	DI6	Not configured	
		X6, X7, X8	Relay ou		
		19	RO1C	Ready run	х
	1/4	20	RO1A	250 V AC / 30 V DC	Х
-	 	21	RO1B	├- `	х
		22	RO2C	Running	
	14	23	RO2A	250 V AC / 30 V DC	
_	$+$ \leftarrow $-$	24	RO2B	├-`` 2 A	
		25	RO3C	Fault (-1)	
	14	26	RO3A	250 V AC / 30 V DC	
L	$ \!$	27	RO3B	├- -	
	· ¬ <u> </u>	X5	EIA-485	Modbus RTU	•
		29	B+	Embedded Modbus RTU (EIA-485). See	
		30	A-	chapter Fieldbus control through the	
		31	DGND	embedded fieldbus interface (EFB) page 475.	
		S100	TERM	Serial data link termination switch	
		X4	Safe torc	que off	
		34	SGND	Safe torque off. Factory connection. Both	Х
		35	OUT	circuits must be closed for the drive to start.	Х
4)36		36	IN1	See chapter <i>Delete safe torque</i> in drive	Х
37		IN2	hardware manual.	Х	
X11		Redunda	ancy auxiliary voltage output		
		42	+24 V	Aux. voltage output +24 V DC, max. 250 mA	
		43	DGND	Auxiliary voltage output common	
See the	e notes on t page.	44	DCOM	Digital input common for all	

Terminal size: 0.14...1.5 mm² Tightening torque: 0.5 (0.4 lbf·ft)

Notes:

In vector control: See Menu - Primary settings - Start, stop, reference - Constant speeds or parameter group 22 Speed reference selection.

DI4	DI5	Operation/Parameter				
		Scalar control (default)	Vector control			
0	0	Set frequency through AI1	Set speed through AI1			
1	0	28.26 Constant frequency 1	22.26 Constant speed 1			
0	1	28.27 Constant frequency 2	22.27 Constant speed 2			
1	1	28.28 Constant frequency 3	22.28 Constant speed 3			

³⁾ Ground the outer shield of the cable 360 degrees under the grounding clamp on the grounding shelf for the control cables.

Input signals

- Analog speed/frequency reference (Al1)
- Start, pulse (DI1)
- Stop, pulse (DI2)
- Direction selection (DI3)
- Constant speed/frequency selection (DI4, DI5)

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

¹⁾ Al1 is used as a speed reference if vector control is selected.

²⁾ In scalar control (default): See Menu - Primary settings - Start, stop, reference -Constant frequencies or parameter group 28 Frequency reference chain.

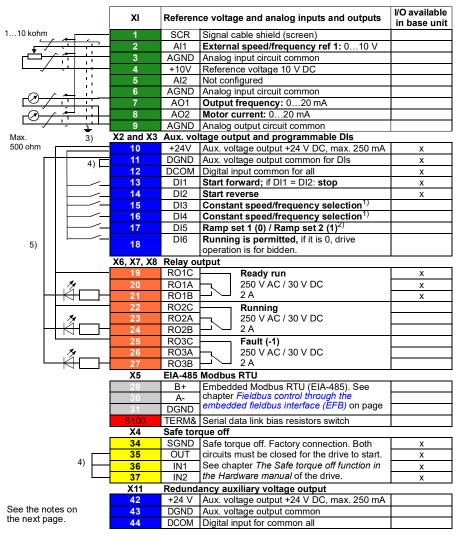
⁴⁾ Connected with jumpers at the factory.

⁵⁾ Use shielded twisted-pair cables for digital signals.

Alternate macro

This macro provides an I/O configuration where one signal starts the motor in the forward direction and another signal to start the motor in the reverse direction. To enable the macro, select it in the **Primary settings** menu or set parameter 96.04 Macro select to Alternate.

Default control connections for the Alternate macro



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

Notes:

1) In scalar control (default): See Menu - Primary settings - Start, stop, reference -Constant frequencies or parameter group 28 Frequency reference chain.

In vector control: See Menu - Primary settings - Start, stop, reference - Constant speeds or parameter group 22 Speed reference selection.

DI3	DI4	Operation/Parameter				
		Scalar control (default)	Vector control			
0	0	Set frequency through AI1	Set speed through AI1			
1	0	28.26 Constant frequency 1	22.26 Constant speed 1			
0	1	28.27 Constant frequency 2	22.27 Constant speed 2			
1	1	28.28 Constant frequency 3	22.28 Constant speed 3			

²⁾ In scalar control (default): See **Menu - Primary settings - Ramps** or parameter group 28 Frequency reference chain.

In vector control: See Menu - Primary settings - Ramps or parameter group 23 Speed reference ramp.

DI5	Ramp	Parameters				
	set	Scalar control (default)	Vector control			
0	1	28.72 Freq acceleration time 1	23.12 Acceleration time 1			
		28.73 Freq deceleration time 1	23.13 Deceleration time 1			
1	2	28.74 Freq acceleration time 2	23.14 Acceleration time 2			
		28.75 Freq deceleration time 2	23.15 Deceleration time 2			

³⁾ Ground the outer shield of the cable 360 degrees under the grounding clamp on the grounding shelf for the control cables.

Input signals

- Analog speed/frequency reference (Al1)
- Start motor forward (DI1)
- Start motor in reverse (DI2)
- Constant speed/frequency selection (DI3, DI4)
- Ramp set (1 of 2) selection (DI5)
- Run enable (DI6)

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

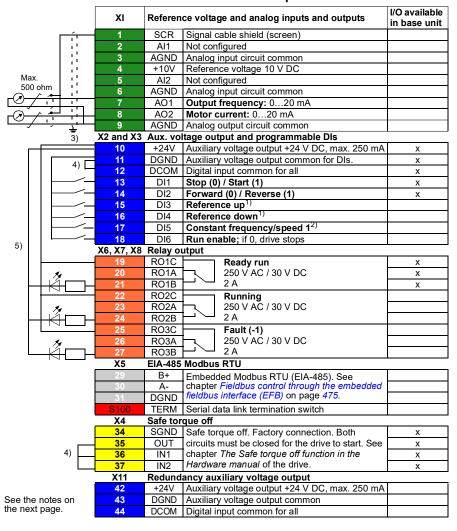
⁴⁾ Connected with jumpers at the factory.

⁵⁾ Use shielded twisted-pair cables for digital signals.

Motor potentiometer macro

This macro provides a way to adjust the speed with the help of two-push buttons, or a cost-effective interface for PLCs that vary the speed of the motor using only digital signals. To enable the macro, select it in the Primary settings menu or set parameter 96.04 Macro select to Motor potentiometer.

Default control connections for the Motor potentiometer macro



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

Notes:

- 1) If DI3 and DI4 are both active or inactive, the frequency/speed reference is unchanged. The existing frequency/speed reference is stored during stop and power down.
- 2) In scalar control (default): See Menu Primary settings Start, stop, reference -Constant frequencies or parameter 28.26 Constant frequency 1.

In vector control: See Menu - Primary settings - Start, stop, reference - Constant speeds or parameter 22.26 Constant speed 1.

- 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.
- 5) Use shielded twisted-pair cables for digital signals.

Input signals

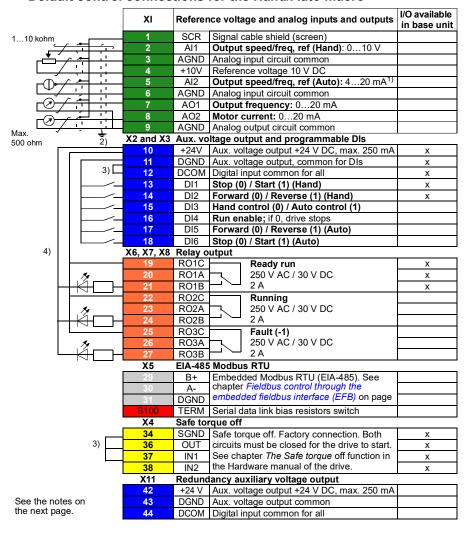
- Start/Stop selection (DI1)
- Direction selection (DI2)
- Reference up (DI3)
- Reference down (DI4)
- Constant frequency/speed 1 (DI5)
- Run enable (DI6)

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

Hand/Auto macro

This macro can be used when switching between two external control devices is needed. Both external control device have their own control and reference signals. One signal is used to switch between these two. To enable the macro, select it in the Primary settings menu or set parameter 96.04 Macro select to Hand/Auto.

Default control connections for the Hand/Auto macro



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

Notes:

- 1) The signal source is powered externally. See the manufacturer's instructions. To use sensors supplied by the drive aux. voltage output, see chapter Electrical installation, section Connection examples of two-wire and three-wire sensors in the Hardware manual of the drive.
- 2) Ground the outer shield of the cable 360 degrees under the grounding clamp on the grounding shelf for the control cables.
- 3) Connected with jumpers at the factory.
- 4) Use shielded twisted-pair cables for digital signals.

Input signals

- Two speed/frequency analog reference (Al1, Al2)
- Control location (Hand or Auto) selection (DI3)
- Start/stop selection, Hand (DI1)
- Direction selection, Hand (DI2)
- Start/stop selection, Auto (DI6)
- Direction selection, Auto (DI5)
- · Run enable (DI4)

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

Hand/PID macro

This macro controls the drive with the built-in process PID controller. In addition this macro has a second control location for the direct speed/frequency control mode. To enable the macro, select it in the **Primary settings** menu or set parameter 96.04 Macro select to Hand/PID.

Default control connections for the Hand/PID macro

ΧI			ΧI	Referen	ce voltage and analog inputs and outputs	I/O available in base unit
110 kohm 1		SCR	Signal cable shield (screen)			
2		Al1	Ext. Hand ref. or Ext. PID ref.: 010 V1)			
3		AGND	Analog input circuit common			
Щ,	/		4	+10V	Reference voltage 10 V DC	
⊢ ⊕	1		5	Al2	Actual PID feedback: 420 mA ²⁾	
	/ _ '		6	AGND	Analog input circuit common	
┌⊘	/ 	1 	7	AO1	Output frequency: 020 mA	
			8	AO2	Motor current: 020 mA	
M	/ ' .	<u> </u>	9	AGND	Analog output circuit common	
Max. 500 ohm		4)	X2 and X3	Aux. vo	tage output and programmable DIs	
300 011111	П		10	+24V	Aux. voltage output +24 V DC, max. 250 mA	Х
ſ	\pm	5)	11	DGND	Aux. voltage output common for DIs	Х
		3)∟	12	DCOM	Digital input common for all	Х
			13	DI1	Stop (0) / Start (1) Hand	Х
			14	DI2	Hand (0) / PID (1) selection	х
			15	DI3	Constant frequency selection ³⁾	
			16	DI4	Constant frequency selection ³⁾	
۵)			17	DI5	Run enable; if 0, drive stops	
6)			18	DI6	Stop (0) / Start (1) PID	
			X6, X7, X8	Relay or		4
	-		19	RO1C	Ready run	Х
		14	20	RO1A	250 V AC / 30 V DC	Х
	+	4 17-	21	RO1B	├ `	Х
	<u> </u>		22	RO2C	Running	
		14	23	RO2A	250 V AČ / 30 V DC	
	+	4 17-	24	RO2B	⊢	
			25	RO3C	Fault (-1)	
		14	26	RO3A	250 V AĆ / 30 V DC	
L	 k	$+\Box$ $-$	27	RO3B	├ `	
			X5	EIA-485	Modbus RTU	-
			29	B+	Embedded Modbus RTU (EIA-485). See	
			30	A-	chapter Fieldbus control through the	
31		DGND	embedded fieldbus interface (EFB) on page			
S100		TERM	Serial data link termination switch			
X4		Safe tor	que off			
			34	SGND	Safe torque off. Factory connection. Both	Х
		5)	35	OUT	circuits must be closed for the drive to start.	Х
36		IN1	See chapter <i>The Safe torque</i> off function in	Х		
37		IN2	the Hardware manual of the drive.	Х		
			X10		ancy auxiliary voltage output	
			42	+24 V	Aux. voltage output +24 V DC, max. 250 mA	
See the n		on	43	DGND	Aux. voltage output common	
the next p	age.		44	DCOM	Digital input common for all	

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

Notes:

- 1) Hand: 0...10 V -> frequency reference. PID: 0...10 V -> 0...100% PID setpoint.
- ²⁾ The signal source is powered externally. See the manufacturer's instructions. To use sensors supplied by the drive auxiliary voltage output, see chapter Electrical installation, section Connection examples of two-wire and three-wire sensors in the Hardware manual of the drive.
- 3) In scalar control (default): See Menu Primary settings Start, stop, reference -Constant frequencies or parameter group 28 Frequency reference chain.

DI3	DI4	Operation (parameter)
0	0	Set frequency through AI1
1	0	28.26 Constant frequency 1
0	1	28.27 Constant frequency 2
1	1	28.28 Constant frequency 3

- 4) Ground the outer shield of the cable 360 degrees under the grounding clamp on the grounding shelf for the control cables.
- ⁵⁾ Connected with jumpers at the factory.
- 6) Use shielded twisted-pair cables for digital signals.

Input signals

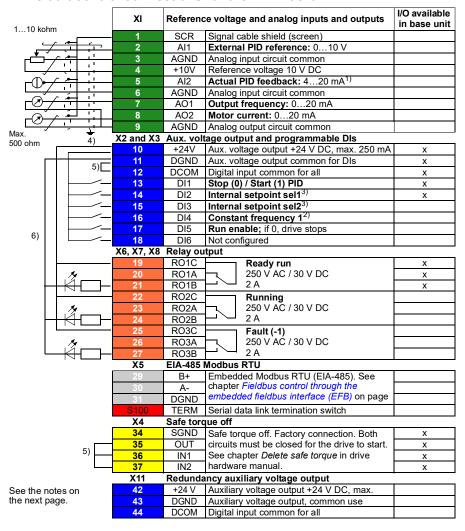
- Analog reference (Al1)
- Actual feedback from PID (Al2)
- Control location (Hand or PID) selection (DI2)
- Start/stop selection, Hand (DI1)
- Start/stop selection, PID (DI6)
- Constant frequency selection (DI3, DI4)
- Run enable (DI5)

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

PID macro

This macro provides parameter settings for closed-loop control systems such as pressure control, flow control, etc. To enable the macro, select it in the **Primary** settings menu or set parameter 96.04 Macro select to PID.

Default control connections for the PID macro



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

Notes:

- 1) The signal source is powered externally. See the manufacturer's instructions. To use sensors supplied by the drive auxiliary voltage output, see chapter *Electrical* installation, section Connection examples of two-wire and three-wire sensors in the Hardware manual of the drive.
- ²⁾ If Constant frequency is activated it overrides the reference from the PID controller output.
- ³⁾ See parameters 40.19 Set 1 internal setpoint sel1 and 40.20 Set 1 internal setpoint se/2 source table.

Source defined by par. 40.19	Source defined by par. 40.20	Internal setpoint active
DI2	DI3	
0	0	Setpoint source: Al1 (par. 40.16)
1	0	1 (parameter 40.21)
0	1	2 (parameter 40.22)
1	1	3 (parameter 40.23)

⁴⁾ Ground the outer shield of the cable 360 degrees under the grounding clamp on the grounding shelf for the control cables.

Input signals

- Analog reference (AI1)
- Actual feedback from PID (AI2)
- Start/Stop selection, PID (DI1)
- Constant setpoint 1 (DI2)
- Constant setpoint 1 (DI3)
- Constant frequency 1 (DI4)
- Run enable (DI5)

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

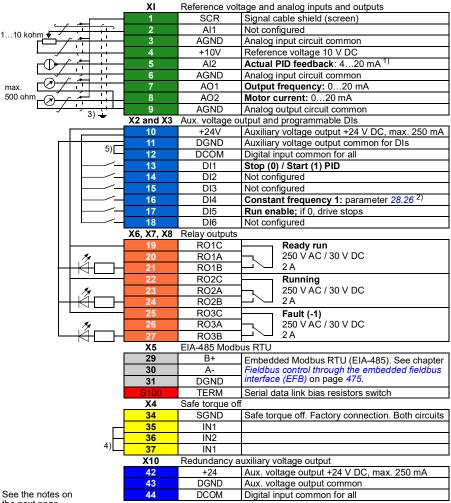
⁵⁾ Connected with jumpers at the factory.

⁶⁾ Use shielded twisted-pair cables for digital signals.

Panel PID macro

This macro is suitable for applications where the drive is always controlled by PID and the setpoint is defined with the control panel. To enable the macro, select it in the Primary settings menu or set parameter 96.04 Macro select to Panel PID.

Default control connections for the Panel PID macro



the next page.

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

Notes:

- 1) The signal source is powered externally. See the manufacturer's instructions. To use sensors supplied by the drive aux. voltage output, see chapter Electrical installation, section Connection examples of two-wire and three-wire sensors in the Hardware manual of the drive
- ²⁾ If Constant frequency is activated it overrides the reference from the PID controller output.
- 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

- PID setpoint given from the control panel
- Actual feedback from PID (Al2)
- Start/Stop selection, PID (DI1)
- Constant setpoint 1 (DI2)
- Constant setpoint 1 (DI3)
- Constant frequency 1 (DI4)
- Run enable (DI5)

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

PFC macro

Pump and fan control logic for controlling multiple pumps or fans through the drive relay outputs. To enable the macro, select it in the Primary settings menu or set parameter 96.04 Macro select to PFC.

Default control connections for the PFC macro

110 kohm 2	base unit
3 AGND Analog input circuit common 4 +10V Reference voltage 10 V DC 5 Al2 Actual PID feedback: 420 mA ¹⁾ 6 AGND Analog input circuit common 7 AO1 Output frequency: 020 mA 8 AO2 Motor current: 020 mA 9 AGND Analog output circuit common X2 & X3 Aux. voltage output and programmable DIs 10 +24V Aux. voltage output +24 V DC, max. 250 mA 11 DGND Aux. voltage output address common for DIs 12 DCOM Digital input common for all 13 DI1 Stop (0) / start (1) (EXT1) 14 DI2 Running permitted; if it is 0, transmission stops 15 DI3 Not configured 16 DI4 Not configured 17 DI5 Not configured 18 DI6 Stop (0) / start (1) (EXT2) X6, X7, X8 Relay output 19 RO1C Running 250 V AC / 30 V DC 21 RO1B	
4	
10	
Sample S	
6 AGND Analog input circuit common 7 AO1 Output frequency: 020 mA 8 AO2 Motor current: 020 mA 9 AGND Analog output circuit common X2 & X3 Aux. voltage output circuit common X2 & X3 Aux. voltage output and programmable DIs 10 +24V Aux. voltage output +24 V DC, max. 250 mA 11 DGND Aux. voltage output address common for DIs 12 DCOM Digital input common for all 13 DI1 Stop (0) / start (1) (EXT1) 14 DI2 Running permitted; if it is 0, transmission stops 15 DI3 Not configured 16 DI4 Not configured 17 DI5 Not configured 18 DI6 Stop (0) / start (1) (EXT2) X6, X7, X8 Relay output 19 RO1C 20 RO1A 21 RO1B 250 V AC / 30 V DC 2 A	
Sample S	
S	
X2 & X3	
2)	
10 +24V Aux. voltage output +24 V DC, max. 250 mA 11 DGND Aux. voltage output address common for Dls 12 DCOM Digital input common for all 13 DI1 Stop (0) / start (1) (EXT1) 14 DI2 Running permitted; if it is 0, transmission stops 15 DI3 Not configured 16 DI4 Not configured 17 DI5 Not configured 18 DI6 Stop (0) / start (1) (EXT2) X6, X7, X8 Relay output 19 RO1C 20 RO1A 250 V AC / 30 V DC 21 RO1B	
12 DCOM Digital input common for all 13 DI1 Stop (0) / start (1) (EXT1) 14 DI2 Running permitted; if it is 0, transmission stops 15 DI3 Not configured 16 DI4 Not configured 17 DI5 Not configured 18 DI6 Stop (0) / start (1) (EXT2) X6, X7, X8 Relay output 19 RO1C Running 20 RO1A 250 V AC / 30 V DC 21 RO1B	Х
13 DCOM Digital input common for all 13 DID Stop (0) / start (1) (EXT1) 14 DI2 Running permitted; if it is 0, transmission stops 15 DI3 Not configured 16 DI4 Not configured 17 DI5 Not configured 18 DI6 Stop (0) / start (1) (EXT2) X6, X7, X8 Relay output 19 RO1C Running 250 V AC / 30 V DC 21 RO1B	Х
4) 14 Dl2 Running permitted; if it is 0, transmission stops 15 Dl3 Not configured 16 Dl4 Not configured 17 Dl5 Not configured 18 Dl6 Stop (0) / start (1) (EXT2) X6, X7, X8 Relay output 19 RO1C 20 RO1A 21 RO1B 250 V AC / 30 V DC 2 A	Х
4) 15 DI3 Not configured 16 DI4 Not configured 17 DI5 Not configured 18 DI6 Stop (0) / start (1) (EXT2) X6, X7, X8 Relay output 19 RO1C 20 RO1A 250 V AC / 30 V DC 21 RO1B	Х
16 DI4 Not configured 17 DI5 Not configured 18 DI6 Stop (0) / start (1) (EXT2) X6, X7, X8 Relay output 19 RO1C Running 20 RO1A 250 V AC / 30 V DC 21 RO1B 2A	Х
4)	
4)	
X6, X7, X8 Relay output 19 RO1C Running 20 RO1A 250 V AC / 30 V DC 21 RO1B 2A	
19 RO1C Running 20 RO1A 250 V AC / 30 V DC 21 RO1B 250 V AC / 30 V DC	
20 RO1A 250 V AC / 30 V DC 21 RO1B 2 A	
21 RO1B 2 A	Х
	Х
22 RO2C Fault (-1)	Х
79 23 RO2A 250 V AC / 30 V DC	
24 RO2B 2 A	
PFC2 (the 2nd motor = the first	
Ay 26 RO3A auxiliary motor)	
27 RO3B 250 V AC / 30 V DC	
X5 EIA-485 Modbus RTU	
29 B+ Embedded Modbus RTU (EIA-485). See	
30 A- Chapter Fieldbus control through the embedded	
31 DGND fieldbus interface (EFB) on page 475.	
S100 TERM Serial data link termination switch	
X4 Safe torque off	
34 SGND Sefe terror off Footen connection Beth circuits	Х
Safe torque off. Factory connection. Both circuits must be closed for the drive to start. See chapter	Х
3) 36 IN1 Delete safe torque in drive hardware manual.	Х
37 IN2 Delete Sale torque in drive hardware mandar.	Х
X11 Redundancy auxiliary voltage output	
42 +24 V Auxiliary voltage output +24 V DC, max. 250 mA	
See the notes on 43 DGND Auxiliary voltage output common	
the next page 44 DCOM Digital input common for all	

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

Notes:

- 1) The signal source is powered externally. See the manufacturer's instructions. See chapter *Electrical installation* in the *Hardware manual* in case of supplying power by relay with drive auxiliary voltage output.
- ²⁾ Ground the outer shield of the cable 360 degrees by controlling grounding clamp on the grounding shelf for the control cables.
- 3) Connected with jumpers at the factory.
- 4) Use shielded twisted-pair cables for digital signals.

Input signals

- Setpoint for PID (AI1)
- PID actual feedback (AI2)
- Start/stop selection, EXT1 (DI1)
- Activate running (DI2)
- EXT1/EXT2 selection (DI3)
- Start/Stop selection EXT2 (DI6)

- Analog output AO1: Output frequency
- · Analog output AO2: Motor current
- Relay output 1: Running
- Relay output 2: Fault (-1)
- Relay output 3: PFC2 (first PFC auxiliary motor)

Parameter default values for different macros

Chapter *Parameters* on page 177 shows the default values of all parameters for the ABB standard macro (factory macro). Some parameters have different default values for other macros. The tables below lists the default values for those parameter for each macro.

96.04	Macro select	1 = ABB standard	17 = ABB stan- dard (vector)	11 = 3-wire	12 = Alternate	13 = Motor potenti- ometer
10.24	RO1 source	2 = Ready run	2 = Ready run	2 = Ready run	2 = Ready run	2 = Ready run
10.27	RO2 source	7 = Running	7 = Running	7 = Running	7 = Running	7 = Running
10.30	RO3 source	15 = Fault (-1)	15 = Fault (-1)	15 = Fault (-1)	15 = Fault (-1)	15 = Fault (-1)
12.20	Al1 scaled at Al1 max	50.000	1500.000	50.000	50.000	50.000
13.12	AO1 source	2 = Output frequency	1 = Motor speed used	2 = Output frequency	2 = Output frequency	2 = Output frequency
13.18	AO1 source max	50.0	1500.0	50.0	50.0	50.0
19.11	Ext1/Ext2 selection	0 = <i>EXT1</i>	0 = <i>EXT1</i>	0 = <i>EXT1</i>	0 = <i>EXT1</i>	0 = <i>EXT1</i>
20.01	Ext1 commands	2 = In1 Start; In2 Dir	2 = In1 Start; In2 Dir	5 = In1P Start; In2 Stop; In3 Dir	3 = In1 Start fwd; In2 Start rev	2 = In1 Start; In2 Dir
20.03	Ext1 in1 source	2 = <i>Dl1</i>	2 = <i>DI1</i>	2 = DI1	2 = DI1	2 = DI1
20.04	Ext1 in2 source	3 = <i>DI</i> 2	3 = <i>DI2</i>	3 = DI2	3 = DI2	3 = <i>DI</i> 2
20.05	Ext1 in3 source	0 = Always off	0 = Always off	4 = DI3	0 = Always off	0 = Always off
20.06	Ext2 commands	0 = Not selected	0 = Not selected	0 = Not selected	0 = Not selected	0 = Not selected
20.08	Ext2 in1 source	0 = Always off	0 = Always off	0 = Always off	0 = Always off	0 = Always off
20.09	Ext2 in2 source	0 = Always off	0 = Always off	0 = Always off	0 = Always off	0 = Always off
20.12	Run enable 1 source	1 = Selected	1 = Selected	1 = Selected	7 = DI6	7 = <i>DI6</i>
22.11	Ext1 speed ref1	1 = Al1 scaled	1 = Al1 scaled	1 = Al1 scaled	1 = Al1 scaled	15 = Motor potentiometer
22.18	Ext2 speed ref1	0 = Zero	0 = Zero	0 = Zero	0 = Zero	0 = Zero
22.22	Constant speed sel1	4 = <i>DI3</i>	4 = <i>DI3</i>	5 = <i>DI4</i>	4 = DI3	6 = <i>DI5</i>
22.23	Constant speed sel2	5 = <i>DI4</i>	5 = <i>DI4</i>	6 = <i>DI5</i>	5 = DI4	0 = Always off

96.04	Macro select	2 = Hand/Auto	3 = Hand/PID	14 = PID	15 = Panel PID	16 = PFC
10.24	RO1 source	2 = Ready run	2 = Ready run	2 = Ready run	2 = Ready run	7 = Running
10.27	RO2 source	7 = Running	7 = Running	7 = Running	7 = Running	15 = Fault (-1)
10.30	RO3 source	15 = Fault (-1)	15 = Fault (-1)	15 = Fault (-1)	15 = Fault (-1)	46 = <i>PFC</i> 2
12.20	Al1 scaled at Al1 max	50.000	50.000	50.000	50.000	50.000
13.12	AO1 source	2 = Output frequency	2 = Output frequency	2 = Output frequency	2 = Output frequency	2 = Output frequency
13.18	AO1 source max	50.0	50.0	50.0	50.0	50.0
19.11	Ext1/Ext2 selection	5 = DI3	4 = DI2	0 = <i>EXT1</i>	0 = <i>EXT1</i>	5 = <i>DI3</i>
20.01	Ext1 commands	2 = In1 Start; In2 Dir	1 = In1 Start	1 =In1 Start	1 =In1 Start	1 =In1 Start
20.03	Ext1 in1 source	2 = DI1	2 = DI1	2 = DI1	2 = DI1	2 = <i>Dl1</i>
20.04	Ext1 in2 source	3 = DI2	0 = Always off			
20.05	Ext1 in3 source	0 = Always off	0 = Always off	0 = Always off	0 = Always off	0 = Always off
20.06	Ext2 commands	2 = In1 Start; In2 Dir	1 = In1 Start	0 = Not selected	0 = Not selected	1 = In1 Start
20.08	Ext2 in1 source	7 = DI6	7 = DI6	0 = Always off	0 = Always off	7 = DI6
20.09	Ext2 in2 source	6 = <i>DI5</i>	0 = Always off			
20.12	Run enable 1 source	5 = DI4	6 = <i>DI5</i>	6 = <i>DI5</i>	6 = <i>DI5</i>	3 = DI2
22.11	Ext1 speed ref1	1 = Al1 scaled	1 = Al1 scaled	16 = <i>PID</i>	16 = <i>PID</i>	1 = Al1 scaled
22.18	Ext2 speed ref1	2 = Al2 scaled	16 = <i>PID</i>	0 = Zero	0 = Zero	16 = <i>PID</i>
22.22	Constant speed sel1	0 = Always off	4 = DI3	5 = DI4	5 = <i>DI4</i>	0 = Always off
22.23	Constant speed sel2	0 = Always off	5 = DI4	0 = Always off	0 = Always off	0 = Always off

96.04	Macro select	4 = ABB limited 2-wire
10.24	RO1 source	2 = Ready run
10.27	RO2 source	7 = Running
10.30	RO3 source	15 = Fault (-1)
12.20	Al1 scaled at Al1 max	50.000
13.12	AO1 source	3 = Output frequency
13.18	AO1 source max	50.0
19.11	Ext1/Ext2 selection	0 = <i>EXT1</i>
20.01	Ext1 commands	1 = In1 Start
20.03	Ext1 in1 source	2 = DI1
20.04	Ext1 in2 source	0 = Always off
20.05	Ext1 in3 source	0 = Always off
20.06	Ext2 commands	0 = Not selected
20.08	Ext2 in1 source	0 = Always off
20.09	Ext2 in2 source	0 = Always off
20.12	Run enable 1 source	1 = Selected
22.11	Ext1 speed ref1	18 = Control panel (ref saved)
22.18	Ext2 speed ref1	0 = Zero
22.22	Constant speed sel1	3 = <i>DI</i> 2
22.23	Constant speed sel2	0 = Always off

96.04	Macro select	1 = ABB standard	17 = ABB stan- dard (vector)	11 = 3-wire	12 = Alternate	13 = Motor potenti- ometer
22.71	Motor potentiometer function	0 = Disabled	0 = Disabled	0 = Disabled	0 = Disabled	1 = Enabled (init at stop /power-up)
22.73	Motor potentiometer up source	0 = Not used	0 = Not used	0 = Not used	0 = Not used	4 = DI3
22.74	Motor potentiometer down source	0 = Not used	0 = Not used	0 = Not used	0 = Not used	5 = DI4
23.11	Ramp set selection	6 = <i>DI5</i>	6 = <i>DI5</i>	0 = Acc/Dec time 1	6 = <i>DI5</i>	0 = Acc/Dec time 1
28.11	Ext1 frequency ref1	1 = Al1 scaled	1 = Al1 scaled	1 = Al1 scaled	1 = Al1 scaled	15 = Motor potentiometer
28.15	Ext1 frequency ref2	0 = Zero	0 = Zero	0 = Zero	0 = Zero	0 = Zero
28.22	Constant frequency sel1	4 = D/3	4 = DI3	5 = DI4	4 = DI3	6 = <i>DI5</i>
28.23	Constant frequency sel2	5 = <i>DI4</i>	5 = <i>DI4</i>	6 = <i>DI5</i>	5 = DI4	0 = Always off
28.71	Freq ramp set selection	6 = <i>DI5</i>	6 = <i>DI5</i>	0 = Acc/Dec time 1	6 = <i>DI5</i>	0 = Acc/Dec time 1
40.07	Process PID operation mode	0 = <i>Off</i>	0 = <i>Off</i>	0 = <i>Off</i>	0 = <i>Off</i>	0 = <i>Off</i>
40.16	Set 1 setpoint 1 source	11 = AI1 percent	11 = AI1 percent	11 = AI1 percent	11 = AI1 percent	11 = AI1 percent
40.17	Set 1 setpoint 2 source	0 = Not selected	0 = Not selected	0 = Not selected	0 = Not selected	0 = Not selected
40.19	Set 1 internal setpoint sel1	0 = Not selected	0 = Not selected	0 = Not selected	0 = Not selected	0 = Not selected
40.20	Set 1 internal setpoint sel2	0 = Not selected	0 = Not selected	0 = Not selected	0 = Not selected	0 = Not selected
40.32	Set 1 gain	1.00	1.00	1.00	1.00	1.00
40.33	Set 1 integration time	60.0	60.0	60.0	60.0	60.0
76.21	Multipump configuration	0 = <i>Off</i>	0 = <i>Off</i>	0 = <i>Off</i>	0 = Off	0 = <i>Off</i>
76.25	Number of motors	1	1	1	1	1
76.27	Max number of motors allowed	1	1	1	1	1
99.04	Motor control mode	1 = Scalar	0 = Vector	1 = Scalar	1 = Scalar	1 = Scalar

96.04	Macro select	2 =	3 =	14 =	15 =	16 =
30.04	Wacro Select	Hand/Auto	Hand/PID	PID	Panel PID	PFC
22.71	Motor potentiometer function	0 = Disabled	0 = Disabled	0 = Disabled	0 = Disabled	0 = Disabled
22.73	Motor potentiometer up source	0 = Not used	0 = Not used	0 = Not used	0 = Not used	0 = Not used
22.74	Motor potentiometer down source	0 = Not used	0 = Not used	0 = Not used	0 = Not used	0 = Not used
23.11	Ramp set selection	0 = Acc/Dec time 1	0 = Acc/Dec time 1	0 = Acc/Dec time 1	0 = Acc/Dec time 1	0 = Acc/Dec time 1
28.11	Ext1 frequency ref1	1 = Al1 scaled	1 = Al1 scaled	16 = <i>PID</i>	16 = <i>PID</i>	1 = Al1 scaled
28.15	Ext1 frequency ref2	2 = Al2 scaled	16 = <i>PID</i>	0 = Zero	0 = Zero	16 = <i>PID</i>
28.22	Constant frequency sel1	0 = Always off	4 = D/3	5 = <i>DI4</i>	5 = <i>DI4</i>	0 = Always off
28.23	Constant frequency sel2	0 = Always off	5 = <i>DI4</i>	0 = Always off	0 = Always off	0 = Always off
28.71	Freq ramp set selection	0 = Acc/Dec time 1	0 = Acc/Dec time 1	0 = Acc/Dec time 1	0 = Acc/Dec time 1	0 = Acc/Dec time 1
40.07	Process PID operation mode	0 = <i>Off</i>	2 = On when drive running			
40.16	Set 1 setpoint 1 source	11 = AI1 percent	11 = AI1 percent	11 = AI1 percent	13 = Control panel (ref	11 = AI1 percent
40.17	Set 1 setpoint 2 source	0 = Not selected	0 = Not selected	2 = Internal setpoint	0 = Not selected	0 = Not selected
40.19	Set 1 internal setpoint sel1	0 = Not selected	0 = Not selected	3 = <i>DI2</i>	0 = Not selected	0 = Not selected
40.20	Set 1 internal setpoint sel2	0 = Not selected	0 = Not selected	4 = <i>DI3</i>	0 = Not selected	0 = Not selected
40.32	Set 1 gain	1.00	1.00	1.00	1.00	2.50
40.33	Set 1 integration time	60.0	60.0	60.0	60.0	3.0
76.21	Multipump configuration	0 = <i>Off</i>	0 = Off	0 = Off	0 = Off	2 = <i>PFC</i>
76.25	Number of motors	1	1	1	1	2
76.27	Max number of motors allowed	1	1	1	1	2
99.04	Motor control mode	1 = Scalar	1 = Scalar	1 = Scalar	1 = Scalar	1 = Scalar

96.04	Macro select	4 = ABB limited 2-wire		
22.71	Motor potentiometer function	0 = Disabled		
22.73	Motor potentiometer up source	0 = Not used		
22.74	Motor potentiometer down source	0 = Not used		
28.11	Ext1 frequency ref1	18 = Control panel (ref saved)		
28.15	Ext1 frequency ref2	0 = Zero		
28.22	Constant frequency sel1	3 = DI2		
28.23	Constant frequency sel2	0 = Always off		
28.71	Freq ramp set selection	0 = Acc/Dec time 1		
40.07	Process PID operation mode	0 = Off		
40.08	Set 1 feedback 1 source	0 = Not selected		
40.16	Set 1 setpoint 1 source	0 = Not selected		
40.17	Set 1 setpoint 2 source	0 = Not selected		
40.19	Set 1 internal setpoint sel1	0 = Not selected		
40.20	Set 1 internal setpoint sel2	0 = Not selected		
40.32	Set 1 gain	1.00		
40.33	Set 1 integration time	60.0		
41.08	Set 2 feedback 1 source	0 = Not selected		
41.16	Set 2 setpoint 1 source	0 = Not selected		
50.01	FBA A enable	1 = Enable		
58.01	Protocol enable	0 = None		
71.08	Feedback 1 source	0 = Not selected		
71.16	Setpoint 1 source	0 = Not selected		

96.04	Macro select	4 = ABB limited 2-wire
76.21	Multipump configuration	0 = Off
76.25	Number of motors	1
76.27	Max number of motors allowed	1

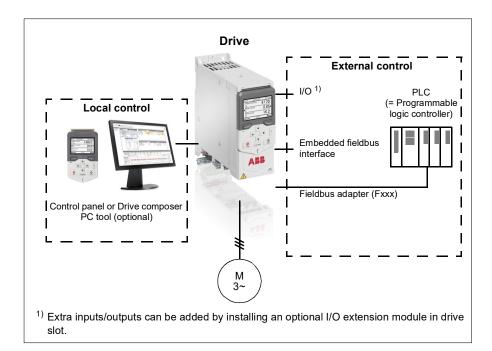
Program features

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 ACS480 has two main control locations: external and local. The control location is selected with the Loc/Rem key on the control panel or in the PC tool.



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 and torque control mode are available in vector motor control mode; frequency mode is available when scalar motor control mode is used (see parameter 19.16).

Local control is mainly used during commissioning and maintenance. The control panel always overrides the external control signal sources when used in local control. Changing the control location to local can be prevented by parameter 19.17.

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

Settings and diagnostics

Parameters: 19.16 Local control mode...19.17 Local control disable (page 228) and 49.05 Communication loss action (page 362).

Events: -

External control

When the drive is in external (remote) 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 in the Primary settings menu (Menu - Primary settings - Start, stop, reference) or 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 torque control. Selection between EXT1 and EXT2 is done via any binary source such as a digital input or fieldbus control word (Menu - Primary settings - Start, stop, reference - Secondary control location or parameter 19.11). The source of reference is selectable for each operating mode separately.

Settings and diagnostics

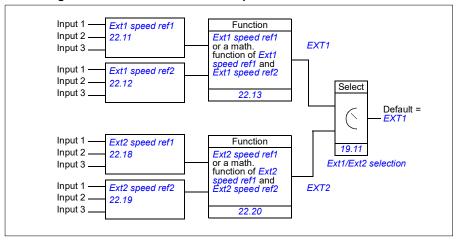
Parameters: 20.01 Ext1 commands...20.10 Ext2 in3 source (page 228), and 19.11 Ext1/Ext2 selection (page 227).

Events: -

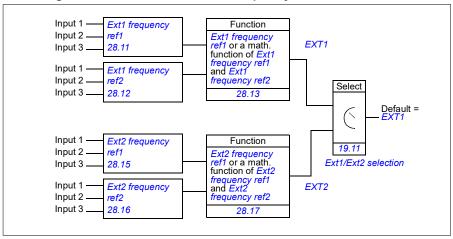
Communication fail functionality

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).

Block diagram: EXT1/EXT2 selection for speed control

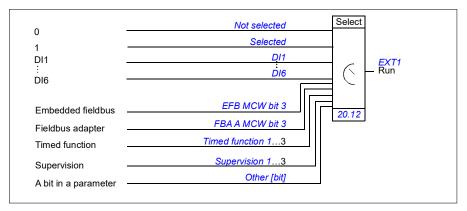


Block diagram: EXT1/EXT2 selection for frequency control



Block diagram: Run enable source for EXT1

The figure below shows the parameters that select the interface for run enable for external control location EXT1.



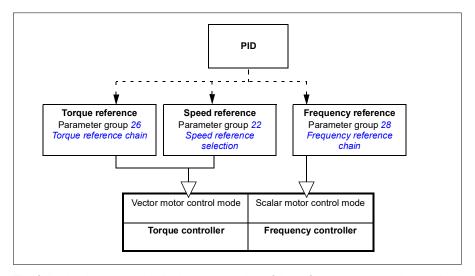
Settings and diagnostics

Menu - Primary settings - Start, stop, reference - Secondary control location; Menu - Primary settings - Start, stop, reference

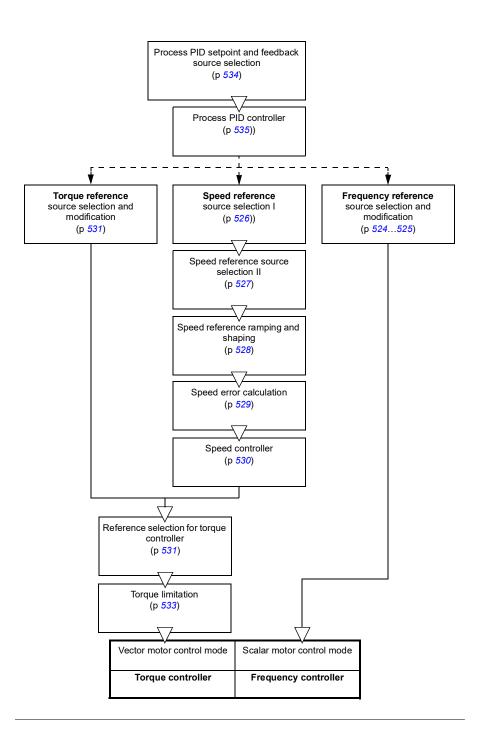
Parameters: 19.11 Ext1/Ext2 selection (page 227) and 20.01 Ext1 commands...20.10 Ext2 in3 source (page 228).

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.



The following is a more detailed representation of the reference types and control chains. The page numbers refer to detailed diagrams in chapter *Control chain diagrams*.



Speed control mode

The motor follows a speed reference given to the drive. This mode can be used either 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 247.

Settings and diagnostics

Parameter group: 22 Speed reference selection (page 247).

Events: -

Torque control mode

Motor torque follows a torque reference given to the drive. Torque control mode is available in both local and external control. It is supported in vector motor control only.

Torque control uses torque reference chain. Select torque reference with parameters in group 26 Torque reference chain on page 266.

Settings and diagnostics

Parameter group: 26 Torque reference chain (page 266)

Events: -

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 271.

Settings and diagnostics

Parameter group: 28 Frequency reference chain (page 271)

Special control modes

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

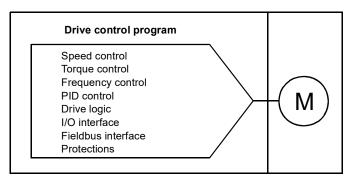
- Process PID control. For more information, see section *Process PID control* (page 129).
- Emergency stop modes OFF1 and OFF3: Drive stops along the defined deceleration ramp and drive modulation stops.
- · Jogging mode: Drive starts and accelerates to the defined speed when the jogging signal is activated. For more information, see section *Jogging* (page 150).
- · Pre-magnetization: DC magnetization of the motor before start. For more information, see section Pre-magnetization (page 146).
- DC hold: Locking the rotor at (near) zero speed in the middle of normal operation. For more information, see section DC hold (page 147).
- Pre-heating (motor heating): Keeping the motor warm when the drive is stopped. For more information, see section *Pre-heating (Motor heating)* (page 148).

Settings and diagnostics

Parameter groups: 06 Control and status words (page 189), 20 Start/stop/direction (page 228), 22 Speed reference selection (page 247), 23 Speed reference ramp (page 256 and 40 Process PID set 1 (page 332).

Drive configuration and programming

The drive control program performs the main control functions, including speed, torque and 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* (3AUA0000094606 [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 V DC power supply is used for the drive control unit, ABB highly recommends 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.

Settings and diagnostics

Parameters: 96.06 Parameter restore...96.07 Parameter save manually (page 393).

Adaptive programming

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

The Drive composer pro PC tool (version 1.10 or later, available separately) has an Adaptive programming feature with a graphical user interface for building the custom program. The function blocks include the usual arithmetic and logical functions, as well as for example, selection, comparison and timer blocks.

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

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

Example

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

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

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

Inputs available to the adaptive program		
Input	Source	
1/0		
DI1	10.02 DI delayed status, bit 0	
DI2	10.02 DI delayed status, bit 1	
DI3	10.02 DI delayed status, bit 2	
DI4	10.02 DI delayed status, bit 3	
DI5	10.02 DI delayed status, bit 4	
DI6	10.02 DI delayed status, bit 5	
Al1	12.11 Al1 actual value	
Al2	12.21 Al2 actual value	
Actual signals		
Motor speed	01.01 Motor speed used	
Output frequency	01.06 Output frequency	
Motor current	01.07 Motor current	
Motor torque	01.10 Motor torque	
Motor shaft power	01.17 Motor shaft power	
Status		
Enabled	06.16 Drive status word 1, bit 0	
Inhibited	06.16 Drive status word 1, bit 1	

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Inputs available to the adaptive program		
Input	Source	
Ready to start	06.16 Drive status word 1, bit 3	
Tripped	06.11 Main status word, bit 3	
At setpoint	06.11 Main status word, bit 8	
Limiting	06.16 Drive status word 1, bit 7	
Ext1 active	06.16 Drive status word 1, bit 10	
Ext2 active	06.16 Drive status word 1, bit 11	
Data storage	•	
Data storage 1 real32	47.01 Data storage 1 real32	
Data storage 2 real32	47.02 Data storage 2 real32	
Data storage 3 real32	47.03 Data storage 3 real32	
Data storage 4 real32	47.04 Data storage 4 real32	

Outputs available to the adaptive program		
Output	Target	
1/0		
RO1	10.24 RO1 source	
RO2	10.27 RO2 source	
RO3	10.30 RO3 source	
AO1	13.12 AO1 source	
AO2	13.22 AO2 source	
Start control	·	
Ext1/Ext2 selection	19.11 Ext1/Ext2 selection	
Run enable 1	20.12 Run enable 1 source	
Ext1 in1 cmd	20.03 Ext1 in1 source	
Ext1 in2 cmd	20.04 Ext2 in2 source	
Ext1 in3 cmd	20.05 Ext1 in3 source	
Ext2 in1 cmd	20.08 Ext2 in1 source	
Ext2 in2 cmd	20.09 Ext2 in2 source	
Ext2 in3 cmd	20.10 Ext2 in3 source	
Fault reset	31.11 Fault reset selection	
Speed control		
Ext1 speed reference	22.11 Ext1 speed ref1	
Speed proportional gain	25.02 Speed proportional gain	
Speed integration time	25.03 Speed integration time	
Acceleration time 1	23.12 Acceleration time 1	
Deceleration time 1	23.13 Deceleration time 1	
Frequency control		
Ext1 frequency reference	28.11 Ext1 frequency ref1	
Torque control		
Ext1 torque reference	26.11 Torque ref1 source	
Ext2 torque reference	26.12 Torque ref2 source	
Limit function		
Minimum torque 2	30.21 Min torque 2 source	
Maximum torque 2	30.22 Max torque 2 source	
Events		
External event 1	31.01 External event 1 source	
External event 2	31.03 External event 2 source	
External event 3	31.05 External event 3 source	

Outputs available to the adaptive program		
Output	Target	
External event 4	31.07 External event 4 source	
External event 5	31.09 External event 5 source	
Data Storage		
Data storage 1 real32	47.01 Data storage 1 real32	
Data storage 2 real32	47.02 Data storage 2 real32	
Data storage 3 real32	47.03 Data storage 3 real32	
Data storage 4 real32	47.04 Data storage 4 real32	
Process PID		
Set 1 setpoint 1	40.16 Set 1 setpoint 1 source	
Set 1 setpoint 2	40.17 Set 1 setpoint 2 source	
Set 1 feedback 1	40.08 Set 1 feedback 1 source	
Set 1 feedback 2	40.09 Set 1 feedback 2 source	
Set 1 gain	40.32 Set 1 gain	
Set 1 integration time	40.33 Set 1 integration time	
Set 1 tracking mode	40.49 Set 1 tracking mode	
Set 1 track reference	40.50 Set 1 tracking ref selection	

Adaptive program fault and aux code formats

The format of the aux code:

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

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

See fault 64A6.

Sequence program

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

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

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

Settings and diagnostics

Parameter groups: 01 Actual values (page 181), 06 Control and status words (page 189), 07 System info (page 194), 10 Standard DI, RO (page 196), 12 Standard AI (page 211), 13 Standard AO (page 216), 19 Operation mode (page 226), 20 Start/stop/direction (page 228), 23 Speed reference ramp (page 256), 25 Speed control (page 260), 26 Torque reference chain (page 260), 30 Limits (page 282), 31 Fault functions (page 290), 40 Process PID set 1 (page 332), 47 Data storage (page 361), and 96 System (page 391).

Event: 64A6 Adaptive program (page 467).

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 and diagnostics

Parameter group: 12 Standard AI (page 211).

Events: -

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 and diagnostics

Parameter group: 13 Standard AO (page 216).

Events: -

Programmable digital inputs and outputs

The control unit has six digital inputs.

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

Settings and diagnostics

Parameter groups: 10 Standard DI, RO (page 196) and 11 Standard DIO, FI, FO (page 205).

Events: -

Programmable frequency input and output

Digital input DI5 can be used as a frequency input.

Settings and diagnostics

Parameter groups: 10 Standard DI, RO (page 196) and 11 Standard DIO, FI, FO (page 205).

Programmable relay outputs

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

Settings and diagnostics

Parameter group: 10 Standard DI, RO (page 196).

Events: -

Programmable I/O extensions

Inputs and outputs can be added by using a BIO-01 multifunction extension module or digital input extension module. The module is mounted on option slot of the control unit

The table below shows the number of I/O on the base unit, on the I/O module of the standard drive variant (RIIO-01) as well as optional BIO-01 and BREL-01 modules.

Location	Digital inputs (DI)	Digital outputs (DO)	Digital I/Os (DIO)	Analog inputs (AI)	Analog outputs (AO)	Relay outputs (RO)
Base unit	2	-	-	-	-	1
RIIO-01	4	-	-	2	2	2
BREL	-	-	-	-	-	4
BIO-01	3	1	-	1	-	-

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.

Settings and diagnostics

Parameter groups: 10 Standard DI, RO (page 196), 11 Standard DIO, FI, FO (page 205), 12 Standard AI (page 211) and 13 Standard AO (page 216).

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 475) and Fieldbus control through a fieldbus adapter (page 505).

Settings and diagnostics

Parameter groups: 50 Fieldbus adapter (FBA) (page 364), 51 FBA A settings (page 368), 52 FBA A data in (page 370), and 53 FBA A data out (page 370) and 58 Embedded fieldbus (page 371).

Events: -

Application control

Reference ramping

Acceleration and deceleration ramping times can be set individually for speed, torque and frequency reference (Menu - Primary settings - Ramps).

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 or 46.02. The user can switch between two preset ramp sets using a binary source such as a digital input. For speed and frequency reference, also the shape of the ramp can be controlled.

With a torque reference, the ramps are defined as the time it takes for the reference to change between zero and nominal motor torque (parameter 01.30).

Variable slope

Variable slope controls the slope of the speed ramp during a reference change. With this feature a constantly variable ramp can be used. See parameters 23.28 and 23.29.

Variable slope is only supported in remote control.

Special acceleration/deceleration ramps

The acceleration/deceleration times for the jogging function can be defined separately; see section Jogging (page 150).

The change rate of the motor potentiometer function (page 135) is adjustable. The same rate applies in both directions.

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

Settings and diagnostics

Menu - Primary settings - Ramps

Parameters:

- Speed reference ramping: Parameters 23.11 Ramp set selection...23.15
 Deceleration time 2 (page 256) and 46.01 Speed scaling (pages 358).
- Torque reference ramping: Parameters 01.30 Nominal torque scale (page 182), 26.18 Torque ramp up time and 26.19 Torque ramp down time(pages 269).
- Frequency reference ramping: Parameters 28.71 Freq ramp set selection...28.75 Freq deceleration time 2 (page 279) and 46.02 Frequency scaling (pages 358).
- Jogging: Parameters 23.20 Acc time jogging and 23.21 Dec time jogging (page 257).
- Motor potentiometer: Parameter 22.75 Motor potentiometer ramp time (page 255).
- Emergency stop ("Off3" mode): Parameter 23.23 Emergency stop time (page 257).
- Variable slope: Parameters 23.28 Variable slope enable (page 258) and 23.29
 Variable slope rate (page 258).

Events: -

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 and diagnostics

Menu - Primary settings - Start, stop, reference - Constant frequencies, Menu - Primary settings - Start, stop, reference - Constant speeds

Parameter groups: 22 Speed reference selection (page 247) and 28 Frequency reference chain (page 271).

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.

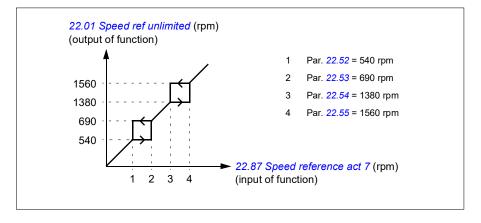
When the drive is limiting the allowed output speeds/frequencies, it limits to the absolutely lowest critical speed (critical speed low or critical frequency low) when accelerating from standstill, unless the speed reference is over the upper critical speed/ frequency limit.

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 fan 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.



Settings and diagnostics

Parameters:

- Critical speeds: Parameters 22.01 Speed ref unlimited (page 247), 22.51 Critical speed function...22.57 Critical speed 3 high (page 253) and 22.87 Speed reference act 7 (page 255).
- Critical frequencies: Parameters 28.51 Critical frequency function...28.57 Critical frequency 3 high (page 278) and 28.96 Frequency ref act 7 (page 282).

Events: -

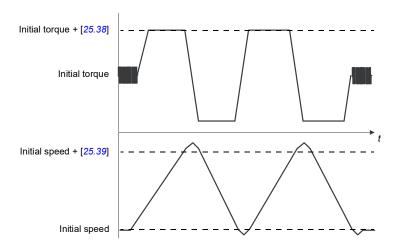
Speed controller autotune

The speed controller of the drive can be automatically adjusted using the autotune function. Autotuning is based on an estimation of the mechanical time constant (inertia) of the motor and machine.

The autotune routine will run the motor through a series of acceleration/deceleration cycles, the number of which can be adjusted by parameter *25.40*. Higher values will produce more accurate results, especially if the difference between initial and maximum speeds is small.

The maximum torque reference used during autotuning will be the initial torque (ie. torque when the routine is activated) plus 25.38, unless limited by the maximum torque limit (parameter group 30 Limits) or the nominal motor torque (99 Motor data). The calculated maximum speed during the routine is the initial speed (ie. speed when the routine is activated) + 25.39, unless limited by parameter 30.12 or 99.09.

The diagram below shows the behavior of speed and torque during the autotune routine. In this example, 25.40 is set to 2.



Notes:

- If the drive cannot produce the requested braking power during the routine, the results will be based on the acceleration stages only, and not as accurate as with full braking power.
- · The motor will exceed the calculated maximum speed slightly at the end of each acceleration stage.

Before activating the autotune routine

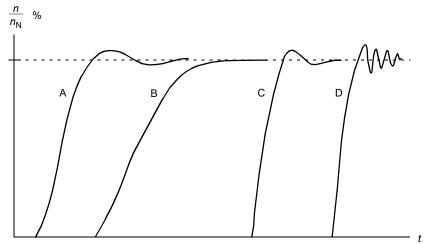
The prerequisites for performing the autotune routine are:

- The motor identification run (ID run) has been successfully completed
- Speed and torque limits (parameter group 30 Limits) have been set
- The drive has been started and is running in speed control mode.

After these conditions have been fulfilled, autotuning can be activated by parameter 25.33 (or the signal source selected by it).

Autotune modes

Autotuning can be performed in three different ways depending on the setting of parameter 25.34. The selections Smooth, Normal and Tight define how the drive torque reference should react to a speed reference step after tuning. The selection Smooth will produce a slow but robust response; Tight will produce a fast response but possibly too high gain values for some applications. The figure below shows speed responses at a speed reference step (typically 1...20%).



A: Undercompensated

B: Normally tuned (autotuning)

C: Normally tuned (manually). Better dynamic performance than with B

D: Overcompensated speed controller

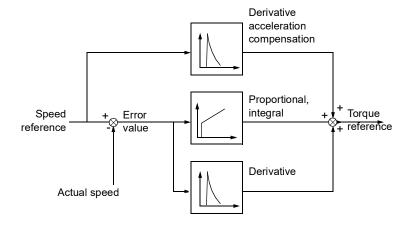
Autotune results

At the end of a successful autotune routine, its results are automatically transferred into parameters

- 25.02 (proportional gain of the speed controller)
- 25.03 (integration time of the speed controller)
- 25.37 (mechanical time constant of the motor and machine).

Nevertheless, it is still possible to manually adjust the controller gain, integration time and derivation time.

The figure below is a simplified block diagram of the speed controller. The controller output is the reference for the torque controller.



Warning indications

A warning message AF90, will be generated if the autotune routine does not complete successfully. See chapter Fault tracing (page 451) for further information.

Settings and diagnostics

Parameters groups: 25 Speed control (page 260), 30 Limits (page 282) and 99 Motor data (page 406).

Parameters: 25.02 Speed proportional gain (page 261), 25.03 Speed integration time (page 262), 25.33 Speed controller autotune...25.40 Autotune repeat times (page 265), 30.12 Maximum speed (page 284) and 99.09 Motor nominal speed (page 407).

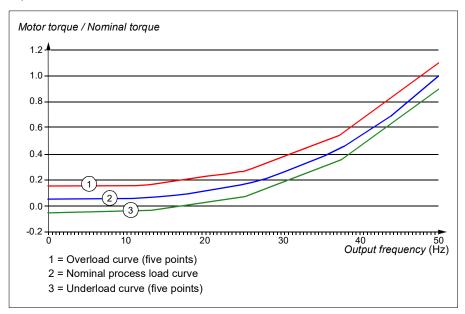
Events: AF90 Speed controller autotuning (page 462).

User load curve

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 saw blade hitting a knot or fan load profiles becoming too high.

Underload can be for example used to monitor for load dropping and breaking of conveyer belts or fan belts.

Settings and diagnostics

Parameter group: 37 User load curve (page 329).

Events: -

Control macros

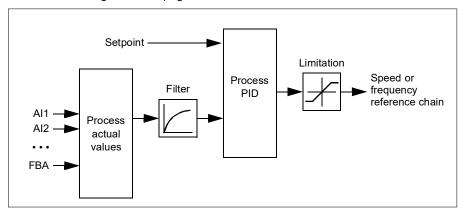
Control macros are predefined parameter edits and I/O configurations. See chapter *Control macros* (page 35).

Process PID control

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 534 and 535.



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; see section Local control vs. external control (page 105).

Quick configuration of the process PID controller

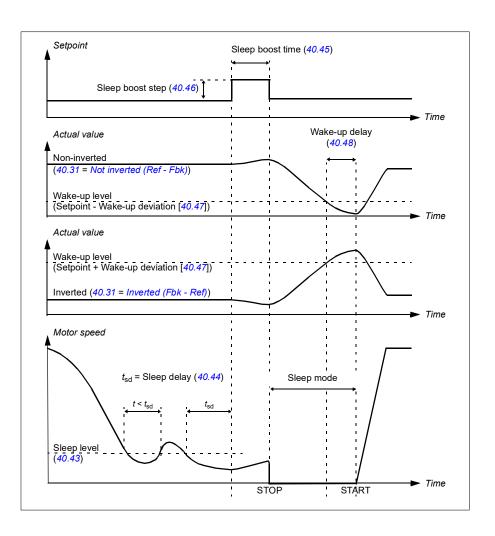
- Activate the process PID controller: Menu Primary settings PID PID controls
- 2. Select a feedback source: Menu Primary settings PID Feedback
- 3. Select a setpoint source: Menu Primary settings PID Setpoint
- Set the gain, integration time, derivation time: Menu Primary settings PID -Tuning
- 5. Set the PID output limits: Menu Primary settings PID PID output
- 6. Select the PID controller output as the source of, for example, 22.11 Ext1 speed ref1: Menu Primary settings Start, stop, reference Reference from

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 wake-up 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 and diagnostics

Menu - Primary settings - PID

Parameter: 96.04 Macro select (page 392) (macro selection)

Parameter groups: 40 Process PID set 1 (page 332) and 41 Process PID set 2 (page 348).

,

Events:-

Pump and fan control (PFC)

The Pump and fan control (PFC) is used in pump or fan systems consisting of one drive and multiple pumps or fans. The drive controls the speed of one of the pumps/fans and in addition connects (and disconnects) the other pumps/fans 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 Pump and fan 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/fans equal over time to even their wear. The other is to prevent any pump/fan 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 141).

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 and fan control (SPFC)

The Soft pump and fan control (SPFC) logic is a variant of the PFC logic for pump and fan 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/fan 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 and diagnostics

Parameter: 96.04 Macro select (page 392) (macro selection)

Parameter groups: 10 Standard DI, RO (page 196), 40 Process PID set 1 (page 332), 76 PFC configuration (page 380) and 77 PFC maintenance and monitoring (page 388).

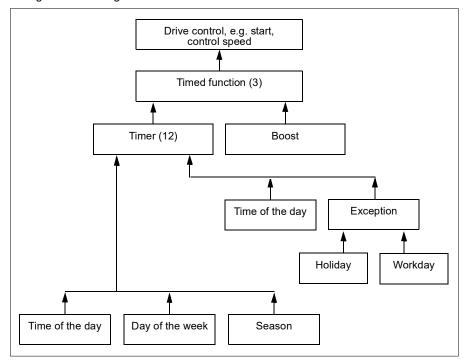
Timed functions

A Timer can be active based on time of the day, day of the week and season of the year. In addition to these time related parameters, the Timer activation can be influenced by so called exceptional days (configurable as holiday or workday). A Timer can be set to be active or inactive during the exceptional days.

Several Timers can be connected to a Timed function with the OR function. Thus if any of the Timers connected to a Timed function is active, the Timed function is also active. Timed function is then in turn controlling normal drive functions like starting the drive, choosing the right speed or right setpoint for the PID loop controller.

In many cases where a fan or pump is controlled with a Timed function, it is often required that there is a possibility to override the time program for a short while. The overriding functionality is called Boost. The Boost is directly affecting selected Timed function(s) and switches it (them) on for a predefined time. The Boost mode is typically activated through a digital input and its operation time is set in parameters.

A diagram illustrating the relations of the Timed functions entities is shown below.



Settings and diagnostics

Parameter group: 34 Timed functions (page 307).

Motor potentiometer

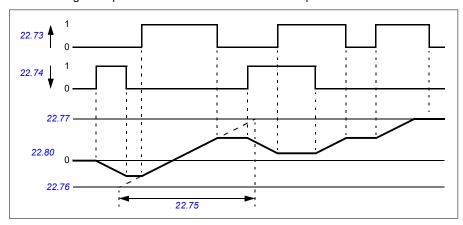
The motor potentiometer is, in effect, a counter whose value can be adjusted up and down using two digital signals selected by parameters 22.73 Motor potentiometer up source and 22.74 Motor potentiometer down source.

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.

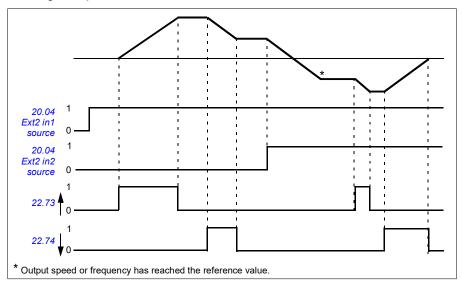
The change rate is defined in 22.75 Motor potentiometer ramp time as the time it would take for the value to change from the minimum (22.76 Motor potentiometer min value) to the maximum (22.77 Motor potentiometer max value) or vice versa. If the up and down signals are simultaneously on, the motor potentiometer 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.





Parameters 22.73 Motor potentiometer up source and 22.74 Motor potentiometer down source control speed or frequency from zero to maximum speed or frequency. The running direction can be changed with parameter 20.04 Ext1 in2 source. See the following example.



Settings and diagnostics

Parameters: 20.04 Ext2 in 2 source (page 231) and 22.71 Motor potentiometer function ... 22.80 Motor potentiometer ref act (page 253).

Events: -

Mechanical brake control

A mechanical brake can be used for holding the motor and driven machinery at zero speed when the drive is stopped, or not powered. The brake control logic observes the settings of parameter group 44 Mechanical brake control as well as several external signals, and moves between the states presented in the diagram on page 137. The tables below the state diagram detail the states and transitions. The timing diagram on page 139 shows an example of a close-open-close sequence.

Inputs of the brake control logic

The start command of the drive (bit 5 of 06.16 Drive status word 1) is the main control source of the brake control logic.

Outputs of the brake control logic

The mechanical brake is to be controlled by bit 0 of parameter 44.01 Brake control status. This bit should be selected as the source of a relay output (or a digital input/output in output mode) which is then wired to the brake actuator through a relay. See the wiring example on page 140.

The brake control logic, in various states, will request the drive control logic to hold the motor or ramp down the speed. These requests are visible in parameter 44.01 Brake control status.

Settings and diagnostics

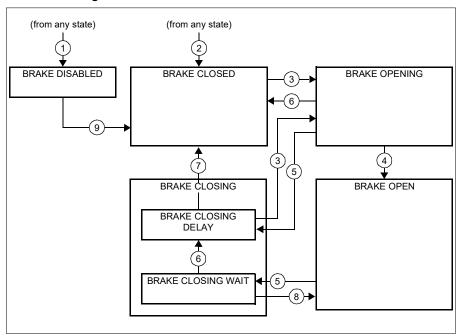
Parameter group: 44 Mechanical brake control (page 352).

Parameters: 06.16 Drive status word 1 (page 191) and 44.01 Brake control status

(page 352).

Events: -

Brake state diagram



State descriptions

State name	Description
BRAKE DISABLED	Brake control is disabled (parameter 44.06 Brake control enable = 0, and 44.01 Brake control status b4 = 0). The open signal is active (44.01 Brake control status b0 = 1).
BRAKE OPENING:	Brake has been requested to open. (44.01 Brake control status b2 = 1). Open signal has been activated (44.01 Brake control status b0 is set). The load is held in place by the speed control of the drive until 44.08 Brake open delay elapses.
BRAKE OPEN	The brake is open (44.01 Brake control status b0 = 1). Hold request is removed (44.01 Brake control status b2 = 0), and the drive is allowed to follow the reference.

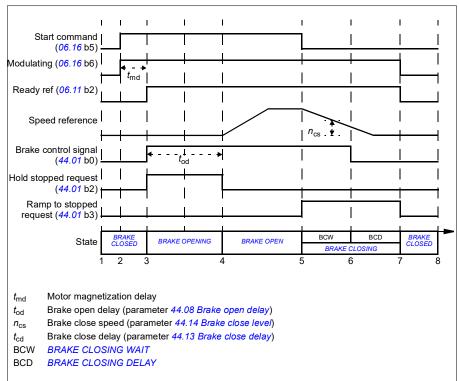
State name	Description
BRAKE CLOSING:	
BRAKE CLOSING WAIT	Brake has been requested to close. The drive logic is requested to ramp down the speed to a stop (44.01 Brake control status b3 = 1). The open signal is kept active (44.01 Brake control status b0 = 1). The brake logic will remain in this state until the motor speed is below 44.14 Brake close level.
BRAKE CLOSING DELAY	Closing conditions have been met. The open signal is deactivated (44.01 Brake control status b0 \rightarrow 0). The ramp-down request is maintained (44.01 Brake control status b3 = 1). The brake logic will remain in this state until 44.13 Brake close delay has elapsed. At this point, the logic proceeds to BRAKE CLOSED state.
BRAKE CLOSED	The brake is closed (44.01 Brake control status b0 = 0). The drive is not necessarily modulating.

State change conditions (n)

- 1 Brake control disabled (parameter 44.06 Brake control enable \rightarrow 0).
- 2 06.11 Main status word, bit 2 = 0.
- 3 Brake has been requested to open.
- 4 44.08 Brake open delay has elapsed.
- 5 Brake has been requested to close.
- 6 Motor speed is below closing speed 44.14 Brake close level.
- 7 44.13 Brake close delay has elapsed.
- 8 Brake has been requested to open.
- 9 Brake control enabled (parameter 44.06 Brake control enable \rightarrow 1).

Timing diagram

The simplified timing diagram below illustrates the operation of the brake control function. Refer to the state diagram above.

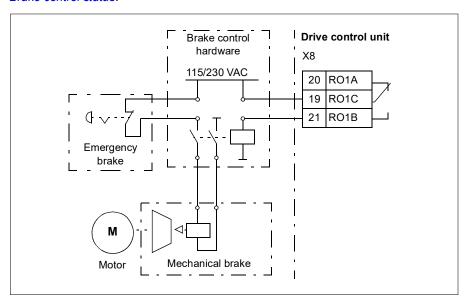


Wiring example

The figure below shows a brake control wiring example. The brake control hardware and wiring is to be sourced and installed by the customer.

WARNING! Make sure that the machinery into which the drive with brake control function is integrated fulfils the personnel safety regulations. Note that the frequency converter (a Complete Drive Module or a Basic Drive Module, as defined in IEC/EN 61800-2), is not considered as a safety device mentioned in the European Machinery Directive and related harmonised standards. Thus, the personnel safety of the complete machinery must not be based on a specific frequency converter feature (such as the brake control function), but it has to be implemented as defined in the application specific regulations.

The brake is controlled by bit 0 of parameter 44.01 Brake control status. In this example, parameter 10.24 RO1 source is set to Brake command (ie. bit 0 of 44.01 Brake control status.



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 and diagnostics

Parameter: 99.13 ID run requested (page 409).

Events: -

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.

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

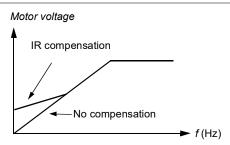
- If the exact nominal motor values are not available or the drive needs to run different motor after the commissioning phase
- If a short commissioning time is needed or no ID run is wanted
- In multimotor systems: 1) if the load is not equally shared between the motors, 2) if the motors are of different 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 110).

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 and diagnostics

Menu - Primary settings - Motor - IR compensation

Parameter group: 28 Frequency reference chain (page 271).

Parameters: 97.13 IR compensation (page 403) and 99.04 Motor control mode (page 406).

Events: -

Vector control

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

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

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

See also section Speed compensated stop (page 153).

Settings and diagnostics

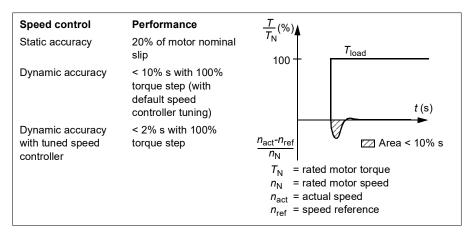
Menu - Primary settings - Motor - Control mode

Parameters: 99.04 Motor control mode (page 406) and 99.13 ID run requested (page 409).

Events: -

Speed control performance figures

The table below shows typical performance figures for speed control.

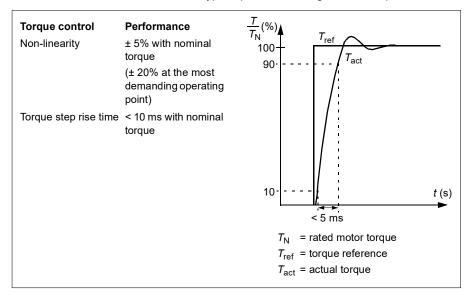


Settings and diagnostics

Parameter group: 25 Speed control (page 260).

Torque control performance figures

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



Power loss ride-through

See section Undervoltage control (power loss ride-through) on page 154.

U/f ratio

The *U*/f 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 or fan 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 and diagnostics

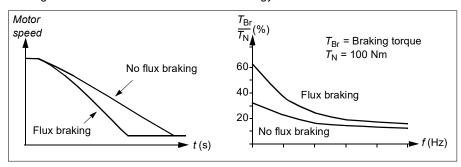
Menu - Primary settings - Motor - U/f ratio

Parameters: 45.11 Energy optimizer (page 355) and 97.20 U/F ratio (page 404).

Events: -

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 401).

Events: -

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

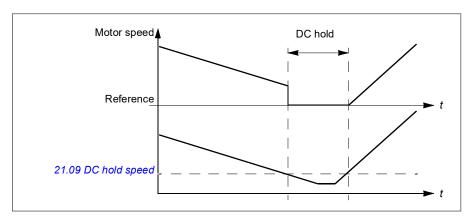
Pre-magnetization refers to DC magnetization of the motor before start. Depending on the selected start mode (21.01 Start mode or 21.19 Scalar start mode), pre-magnetization can be applied to guarantee the highest possible breakaway torque, up to 200% of the nominal torque of the motor. By adjusting 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 and diagnostics

Parameters: 21.01 Start mode (page 238), 21.02 Magnetization time (page 239) and 21.19 Scalar start mode (page 243).

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 and diagnostics

Parameters: 21.08 DC current control (page 242) and 21.09 DC hold speed (page 242).

Events: -

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).

Settings and diagnostics

Parameters: 21.03 Stop mode (page 239), 21.08 DC current control (page 242) and 21.11 Post magnetization time (page 242).

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 the zero speed limit (see bit 0 in parameter 06.19 Speed control status word). If the drive is running above the zero speed limit, 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.

When the pre-heating is active, an icon is shown on the status bar to indicate that current is being fed to the motor, see page 42.

Notes:

- In applications where the motor keeps rotating for a long time after the modulation is stopped, ABB recommends 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 and diagnostics

Menu - Primary settings - Motor - Pre-heating

Parameters: 21.14 Pre-heating input source (page 242) and 21.16 Pre-heating current (page 243).

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 and diagnostics

Menu - Energy efficiency

Parameter: 45.11 Energy optimizer (page 355).

Events: -

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 drive hardware manual

Example 1: If you need to fix the switching frequency to a certain value as with some external filters, e.g. with EMC C1 or sine filters (see the Hardware manual of the drive), set both the reference and the minimum switching frequency to this value and the drive will retain this switching frequency.

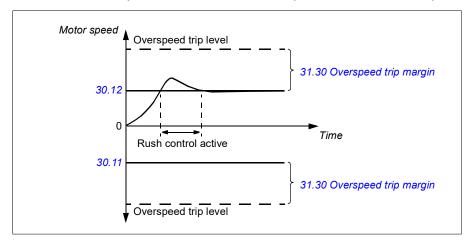
Example 2: If the reference switching frequency is set to 12 kHz and the minimum switching frequency is set to the smallest available value, the drive maintains the highest possible switching frequency to reduce motor noise and only when the drive heats it will decrease the switching frequency. This 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 and diagnostics

Parameters: 97.01 Switching frequency reference and 97.02 Minimum switching frequency (page 389).

Rush control

In torque control, the motor could potentially rush if the load were suddenly lost. The control program has a rush control function that decreases the torque reference whenever the motor speed exceeds 30.11 Minimum speed or 30.12 Maximum speed.



The function is based on a PI controller. The proportional gain and integration time can be defined by parameters. Setting these to zero disables rush control.

Settings and diagnostics

Parameters: 30.11 Minimum speed (page 284), 30.12 Maximum speed (page 284) and 31.30 Overspeed trip margin (page 288).

Events: -

Jogging

The jogging function enables the use of a momentary switch to briefly rotate the motor. The jogging function is typically used during servicing or commissioning to control the machinery locally.

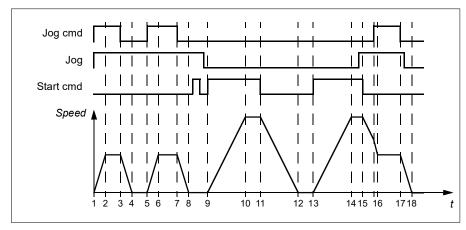
Two jogging functions (1 and 2) are available, each with their own activation sources and references. The signal sources are selected by parameters 20.26 Jogging 1 start source and 20.27 Jogging 2 start source (Menu - Primary settings - Start, stop, reference - Jogging). When jogging is activated, the drive starts and accelerates to the defined jogging speed (22.42 Jogging 1 ref or 22.43 Jogging 2 ref) along the defined jogging acceleration ramp (23.20 Acc time jogging). After the activation signal switches off, the drive decelerates to a stop along the defined jogging deceleration ramp (23.21 Dec time jogging).

The figure and table below provide an example of how the drive operates during jogging. In the example, the ramp stop mode is used (see parameter 21.03 Stop mode).

Jog cmd = State of source set by 20.26 Jogging 1 start source or 20.27 Jogging 2 start source

Jog = State of source set by 20.25 Jogging enable

Start cmd = State of drive start command.



Phase	Jog cmd	Jog	Start cmd	Description
1-2	1	1	0	Drive accelerates to the jogging speed along the acceleration ramp of the jogging function.
2-3	1	1	0	Drive follows the jog reference.
3-4	0	1	0	Drive decelerates to zero speed along the deceleration ramp of the jogging function.
4-5	0	1	0	Drive is stopped.
5-6	1	1	0	Drive accelerates to the jogging speed along the acceleration ramp of the jogging function.
6-7	1	1	0	Drive follows the jog reference.
7-8	0	1	0	Drive decelerates to zero speed along the deceleration ramp of the jogging function.
8-9	0	1->0	0	Drive is stopped. As long as the jog signal is on, start commands are ignored. After jog switches off, a fresh start command is required.
9-10	х	0	1	Drive accelerates to the speed reference along the selected acceleration ramp (parameters 23.1123.15).
10-11	х	0	1	Drive follows the speed reference.
11-12	х	0	0	Drive decelerates to zero speed along the selected deceleration ramp (parameters 23.1123.15).

Phase	Jog cmd	Jog	Start cmd	Description
12-13	х	0	0	Drive is stopped.
13-14	х	0	1	Drive accelerates to the speed reference along the selected acceleration ramp (parameters 23.1123.15).
14-15	х	0->1	1	Drive follows the speed reference. As long as the start command is on, the jog signal is ignored. If the jog signal is on when the start command switches off, jogging is enabled immediately.
15-16	0->1	1	0	Start command switches off. The drive starts to decelerate along the selected deceleration ramp (parameters 23.1123.15).
				When the jog command switches on, the decelerating drive adopts the deceleration ramp of the jogging function.
16-17	1	1	0	Drive follows the jog reference.
17-18	0	1->0	0	Drive decelerates to zero speed along the deceleration ramp of the jogging function.

See also the block diagram on page 528.

Notes:

- Jogging is not available when the drive is in local control.
- Jogging cannot be enabled when the drive start command is on, or the drive started when jogging is disabled. Starting the drive after the jog switches off requires a fresh start command.



WARNING! If jogging is enabled and activated while the start command is on, jogging will activate as soon as the start command switches off.

- If both jogging functions are activated, the one that was activated first has priority.
- Jogging uses vector control.
- The inching functions activated through fieldbus (see 06.01 Main control word, bits 8...9) use the references and ramp times defined for jogging, but do not require the jog signal.

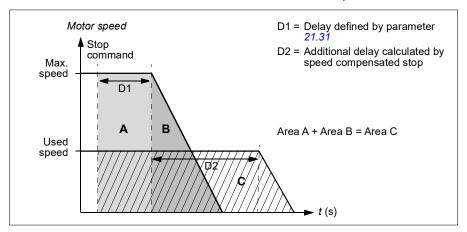
Settings and diagnostics

Menu - Primary settings - Start, stop, reference - Jogging

Parameters: 20.25 Jogging enable...20.27 Jogging 2 start source (page 236), 22.42 Jogging 1 ref...22.43 Jogging 2 ref (page 252) and 23.20 Acc time jogging...23.21 Dec time jogging (page 257).

Speed compensated stop

Speed compensation stop is available for example for applications where a conveyer needs to travel a certain distance after receiving the stop command. At maximum speed, the motor is stopped normally along the defined deceleration ramp, after the application of a user defined delay to adjust the distance traveled. Below maximum speed, stop is delayed still more by running the drive at current speed before the motor is ramped to a stop. As shown in the figure, the distance traveled after the stop command is the same in both cases, that is, area A + area B equals area C.



Speed compensation does not take into account shape times (parameters 23.32 Shape time 1 and 23.33 Shape time 2). Positive shape times lengthen the distance traveled.

Speed compensation can be restricted to forward or reverse rotating direction.

Speed compensation is supported in both vector and scalar motor control.

Settings and diagnostics

Parameters: 21.30 Speed compensated stop mode...21.32 Speed comp stop threshold (page 246).

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. The overvoltage controller also increases any programmed deceleration times if the limit is reached; to achieve shorter deceleration times, a brake chopper and resistor may be required.

Settings and diagnostics

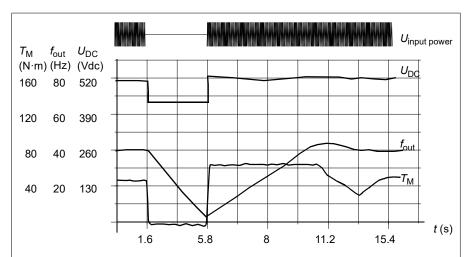
Parameter: 30.30 Overvoltage control (page 288).

Events: A3A1 DC link overvoltage (page 455) and 3210 DC link overvoltage (page 465).

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 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. 10 seconds) power supply failure by using the Automatic restart function, provided that the drive is allowed to run for 10 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.

If parameter 21.34 Force auto restart is set to Enable, the drive never trips on the undervoltage fault and the start signal is on forever. When he DC voltage is restored, the normal operation continues.

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.

Settings and diagnostics

Parameters: 21.01 Start mode (page 238), 21.18 Auto restart time...21.19 Scalar start mode (page 243), 21.34 Force auto restart (page 246) and 30.31 Undervoltage control (page 288).

Events: A3A2 DC link undervoltage (page 455) and 3220 DC link undervoltage (page 465).

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 ($U_{\rm DC}$) 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 voltag	je 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	0.78×1.41×par 95.03 value ¹⁾	0.78×1.41×par 95.03 value 1)
	0.78×1.41×380 = 402 ²⁾	0.78×1.41×440 = 465 ²⁾
Charging relay opening limit	0.73×1.41×par 95.03 value ¹⁾	0.73×1.41 ×par 95.03 value 1)
	0.73×1.41×380 = 348 ²⁾	0.73×1.41×440 = 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)	0.73×1.41×par 95.03 value 1)	0.73×1.41×par 95.03 value 1)
	0.73×1.41×380 = 348 ²⁾	0.73×1.41×440 = 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 and diagnostics

Parameters 01.11 DC voltage (page 181), 30.30 Overvoltage control...30.31 Undervoltage control (page 288) and 95.01 Supply voltage...95.02 Adaptive voltage limits (page 389).

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.

Brake chopper

A brake chopper can be used to handle the energy generated by a decelerating motor. When the DC voltage rises high enough, the chopper connects the DC circuit to an external brake resistor. The chopper operation is based on hysteresis.

The internal brake choppers in the drive (in frames R1...R4) start conducting at internal brake chopper start limit 780 V and stop conducting at internal brake chopper stop limit 760 V (AC supply 380...480 V).

For information on external brake choppers, refer to their documentation.

Note: Overvoltage control needs to be disabled for the chopper to operate.

Settings and diagnostics

Parameter group: 43 Brake chopper (page 350).

Parameter: 01.11 DC voltage (page 181).

Events: A792 Brake resistor wiring (page 458), A793 BR excess temperature (page 458), A79C BC IGBT excess temperature (page 459), 7183 BR excess temperature (page 469) and 7192 BC IGBT excess temperature (page 470).

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 154.

DC undervoltage

See section Undervoltage control (power loss ride-through) on page 154.

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.

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 and diagnostics

Menu - Primary settings - Start, stop, reference - Run permissions

Parameters: 21.04 Emergency stop mode...21.05 Emergency stop source (page 239), 23.23 Emergency stop time (page 257) and 31.32 Emergency ramp supervision...31.33 Emergency ramp supervision delay (page 298).

Events: AFE1 Emergency stop (off2)...AFE2 Emergency stop (off1 or off3) (page 462) and 73B0 Emergency ramp failed (page 470).

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.

Implementing a motor temperature sensor connection

WARNING! IEC 60664 and IEC 61800-5-1 require 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.

You have four implementation alternatives:

- If there is double or reinforced insulation between the sensor and the live parts of the motor, you can connect the sensor directly to the analog/digital input(s) of the drive.
- If there is basic insulation between the sensor and the live parts of the motor, you can connect the sensor to the analog/digital input(s) of the drive if all other circuits connected to the digital and analog inputs (typically extra-low voltage circuits) are protected against contact and insulated with basic insulation from other lowvoltage circuits. The insulation must be rated for the same voltage level as the drive main circuit. Note that extra-low voltage circuits (such as 24 V DC) typically do not meet these requirements.
 - Alternative: You can connect the sensor with a basic insulation to the analog/digital input(s) of the drive if you do not connect any other external control circuits to drive digital and analog inputs.
- You can connect a sensor to a digital input of the drive via an external thermistor relay. The insulation of the relay of must be rated for the main circuit voltage of the motor.

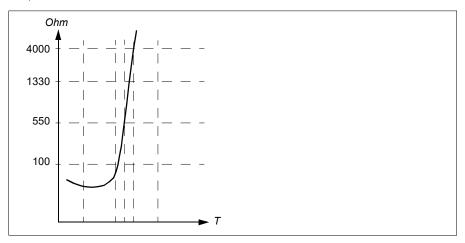
Temperature monitoring using PTC sensors

1...3 PTC sensors can be connected in series to an analog input and an analog output. The analog output feeds a constant excitation current of 1.6 mA through the sensor. The sensor resistance increases as the motor temperature rises, as does the voltage over the sensor. The temperature measurement function calculates the resistance of the sensor and generates an indication if overtemperature is detected.

Leave the sensor end of the cable shield unconnected.

For wiring of the sensor, refer to the drive hardware manual.

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



When an analog output is not available or used for other purposes, it is possible to setup a voltage divider connection that uses the internal resistance of a digital input. 1...3 PTC sensors can be connected in series with 10 V reference and digital and analog inputs. The temperature measurement function reads the voltage over the internal resistance of the digital input from the analog input and calculates the PTC resistance.

For wiring of the sensor, refer to the drive hardware manual.

Make sure that the DI used is not configured to any other use in the drive control program.

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 Implementing a motor temperature sensor connection on page 161.

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 drive *hardware manual*.

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 Implementing a motor temperature sensor connection on page 161.

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 drive hardware manual.

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 Implementing a motor temperature sensor connection on page 161.

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 drive hardware manual.

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 164 show typical KTY84 sensor resistance values as a function of the motor operating temperature.

See section Implementing a motor temperature sensor connection on page 161.

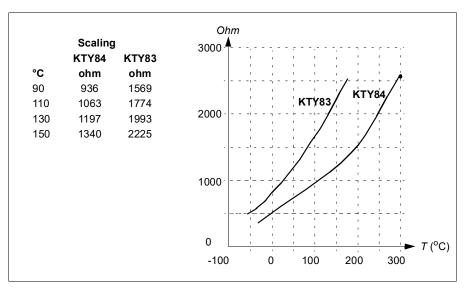
For the wiring of the sensor, see chapter Electrical installation, Al1 and Al2 as Pt100. Pt1000, Ni1000, KTY83 and KTY84 sensor inputs (X1) in the drive hardware manual.

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 Implementing a motor temperature sensor connection on page 161.

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 drive *hardware manual*.

Connection of motor temperature sensor to the drive via a relay

PTC alternative A: This table shows the insulation requirement for a customer's external relay, and the insulation requirement for the sensor to fulfill decisive voltage class A (double insulation) of IEC 60800-5-1.

PTC	relay	Temperature sensor insulation requirement
Type	Insulation	
External relay	Basic insulation 6 kV	Basic insulation

PTC alternative B: Decisive voltage class B of IEC 60800-5-1 (basic insulation) is provided with a 6 kV relay. Circuits connected to all motor protection relay inputs and outputs must be protected against direct contact.

Pt100 alternative A: This table shows the insulation requirement for a customer's external relay, and the insulation requirement for the sensor to fulfill decisive voltage class A (double insulation) of IEC 60800-5-1.

Pt10	0 relay	Temperature sensor insulation requirement
Туре	Insulation	between sensor and live parts of motor
External relay	Basic insulation 6 kV	Basic insulation

Pt100 alternative B: Decisive voltage class B of IEC 60800-5-1 (basic insulation) can be achieved when there is basic insulation between the sensor and live parts of the motor. Circuits connected to all motor protection relay inputs and outputs must be protected against direct contact.

Settings and diagnostics

Menu - Primary settings - Motor - Thermal protection estimated. Menu - Primary settings - Motor - Thermal protection measured

Parameter group: 35 Motor thermal protection (page 316).

Events: -

Motor overload protection

This section describes motor overload protection without using motor thermal protection model, either with estimated or measured temperature. For protection with the motor thermal protection model, see section *Motor thermal protection* on page 160.

Motor overload protection is required and specified by multiple standards including the US National Electric Code (NEC), UL 508C and the common UL\IEC 61800-5-1 standard in conjunction with IEC 60947-4-1. The standards allow for motor overload protection without external temperature sensors.

The protection feature allows the user to specify the class of operation in the same manner as the overload relays are specified in standards IEC 60947-4-1 and NEMA ICS 2.

Motor overload protection requires that you specify a motor current tripping level. This is defined by a curve using parameters 35.51, 35.52 and 35.53. The tripping level is the motor current at which the overload protection will ultimately trip if the motor current remains at this level continuously.

The motor overload class (class of operation), parameter 35.57 Motor overload class, is given as the time required for the overload relay to trip when operating at 7.2 times

the tripping level in the case of IEC 60947-4-1 and 6 times the tripping level in the case of NEMA ICS 2. The standards also specify the time to trip for current levels between the tripping level and the 6 times tripping level. The drive satisfies the IEC standard and NEMA standard trip times.

Using class 20 satisfies the UL 508C requirements.

The motor overload algorithm monitors the squared ratio (motor current / tripping level)² and accumulates this over time. This is sometimes to as I^2 t protection. The accumulated value is shown with parameter 35.05.

You can define with parameter 35.56 that when 35.05 reaches 88%, a motor overload warning will be generated, and when it reaches 100%, the drive will trip on the motor overload fault. The rate at which this internal value is increased depends on the actual current, tripping level current and overload class selected.

Parameters *35.51*, *35.52* and *35.53* serve a dual purpose. They determine the load curve for temperature estimate as well as specify the overload tripping level.

Settings and diagnostics

Parameters common to motor thermal protection and motor overload protection: 35.51 Motor load curve...35.53 Break point (page 323).

Parameters specific to motor overload protection: 35.05 Motor overload level (page 316), 35.56 Motor overload action...35.57 Motor overload class (page 325).

Events: A783 Motor overload (page 458) and 7122 Motor overload (page 469).

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

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 and 31.31)

The user can set overspeed and overfrequency limits by specifying a margin that is added to the currently-used maximum and minimum speed or frequency 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.

Settings and diagnostics

Parameters: 12.03 Al supervision function...12.04 Al supervision selection (page 211), 31.01 External event 1 source...31.31 Frequency trip margin (page 290) and 49.05 Communication loss action (page 362).

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.

Settings and diagnostics

Menu - Primary settings - Advanced functions - Autoreset faults

Parameters: 31.12 Autoreset selection...31.16 Delay time (page 292)

Events: -

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 and diagnostics

Parameter group: 32 Supervision (page 299).

Parameter: 32.01 Supervision status (page 299).

Events: -

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 169).

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.

The amount of energy that has passed through the drive (in either direction) is counted and shown full as GWh, MWh and kWh. The cumulative energy is also shown as full kWh. All these counters are resettable.

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.

Settings and diagnostics

Menu - Energy efficiency

Parameter group: 45 Energy efficiency (page 353).

Parameters: 01.50 Current hour kWh...01.53 Previous day kWh (page 182), 01.55 Inverter GWh counter (resettable)...01.58 Cumulative inverter energy (resettable) (page 183)

Events: -

Load analyzer

Peak value logger

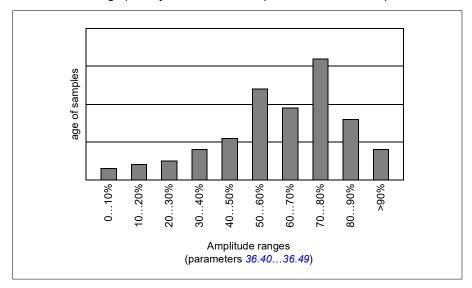
The user can select a signal to be monitored by a peak value logger. The logger records the peak value of the signal along with the time the peak occurred, as well as motor current, DC voltage and motor speed at the time of the peak. The peak value is sampled at 2 ms intervals.

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.

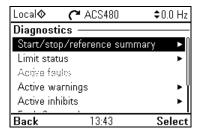
Settings and diagnostics

Menu - Diagnostics - Load profile

Parameter group: 36 Load analyzer (page 326).

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.



- 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.
- 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 and event log: Shows lists faults and other events.
- · Fieldbus: Use this view to find out status information and sent and received data from fieldbus.
- 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.

Settings and diagnostics

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.

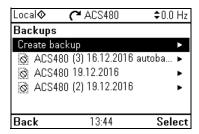
Parameter changes from fieldbus interfaces are ignored unless you have forced parameter saving with parameter 96.07 Parameter save manually.

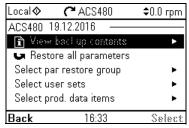
Restore

The backups are shown on the panel. Automatic backups are marked with icon and manual backups with . To restore a backup, select it and press . In the following display you can view backup contents and restore all parameters or select a subset to be restored.

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

Note: There is a risk of removing the QR code menu entry permanently if a backup from a drive with an old firmware or old panel firmware is restored to a drive with a new firmware.





Settings and diagnostics

Menu - Backups

Parameter: 96.07 Parameter save manually (page 393).

Events: -

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 and diagnostics

Menu - Primary settings - Advanced functions - User sets

Parameters: 10.03 DI force selection...10.04 DI forced data (page 197), 95.01 Supply voltage (page 389) and 96.10 User set status...96.13 User set I/O mode in2 (page 394).

Events: -

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 and diagnostics

Parameter group: 47 Data storage (page 361).

Events: -

Parameter checksum calculation

Two parameter checksums, A and B, can be calculated from a set of parameters to monitor changes in the drive configuration. The sets are different for checksums A and B. Each of these checksum is compared to the corresponding reference checksum; in case of a mismatch, an event (a pure event, warning or fault) is generated. The calculated checksum can be set as the new reference checksum.

The set of parameters for checksum A does not include fieldbus settings.

The parameters included in the checksum A calculation are user editable parameters in parameter groups 10, 11, 12, 13, 15, 19, 20, 21, 22, 23, 24, 25, 28, 30, 31, 32, 34, 35, 36, 37, 40, 41, 43, 45, 46, 71, 76, 95, 96, 97, 98, 99.

The set of parameters for checksum B does not include

- fieldbus settings
- · motor data settings
- energy data settings.

The parameters included in the checksum B calculation are user editable parameters in parameter groups 10, 11, 12, 13, 15, 19, 20, 21, 22, 23, 24, 25, 28, 30, 31, 32, 34, 35, 36, 37, 40, 41, 43, 46, 71, 76, 95, 96, 97.

Settings and diagnostics

Parameters: 96.54 Checksum action...96.69 Actual checksumB (page 397) and 96.71 Approved checksum A...96.72 Approved checksum B (page 399).

User lock

For better cybersecurity, ABB highly recommends that you set a master pass code to prevent e.g. 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 18).

- To activate the user lock for the first time:
- Enter the default pass code, 10000000, into 96.02 Pass code. This will make parameters 96.100...96.102 visible.
- Enter a new pass code into 96.100 Change user pass code. Always use eight digits; if using Drive composer, finish with Enter.
- Confirm the new pass code in 96.101 Confirm user pass code.



WARNING! Store the pass code in a safe place – the user lock cannot be opened even by ABB if the pass code is lost.

- In 96.102 User lock functionality, define the actions that you want to prevent (ABB) recommends you select all the actions unless otherwise required by the application).
- Enter an invalid pass code into 96.02 Pass code to close the user lock.
- Activate 96.08 Control board boot, or cycle the power to the drive.

Check that parameters 96.100...96.102 are hidden. If they are not, enter another random pass code into 96.02. To reopen the lock, enter your pass code into 96.02 Pass code. This will again make parameters 96.100...96.102 visible.

Settings and diagnostics

Parameters: 96.02 Pass code (page 392) and 96.100 Change user pass code...96.102 User lock functionality (page 399).

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 412, 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>Control macros</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 415).
Other	The value is taken from another parameter. Choosing "Other" displays a parameter list in which the user can specify the source parameter.
Other [bit]	The value is taken from a specific bit in another parameter. Choosing "Other" displays a parameter list in which the user can specify the source parameter and bit.
Parameter	Either a user-adjustable operating instruction for the drive, or an actual signal.
p.u.	Per unit
[parameter number]	Value of the parameter

Summary of parameter groups

Group	Contents	Page
01 Actual values	Basic signals for monitoring the drive.	181
03 Input references	Values of references received from various sources.	184
04 Warnings and faults	Information on warnings and faults that occurred last.	185
05 Diagnostics	Various run-time-type counters and measurements related to drive maintenance.	186
06 Control and status words	Drive control and status words.	189
07 System info	Drive hardware and firmware information.	194
10 Standard DI, RO	Configuration of digital inputs and relay outputs.	196
11 Standard DIO, FI, FO	Configuration of the frequency input.	205
12 Standard Al	Configuration of standard analog inputs.	211
13 Standard AO	Configuration of standard analog outputs.	216
15 I/O extension module	Configuration of the I/O extension module installed in slot 2.	221
19 Operation mode	Selection of local and external control location sources and operating modes.	226
20 Start/stop/direction	Start/stop/direction and run/start/jog enable signal source selection; positive/negative reference enable signal source selection.	228
21 Start/stop mode	Start and stop modes; emergency stop mode and signal source selection; DC magnetization settings.	238
22 Speed reference selection	Speed reference selection; motor potentiometer settings.	247
23 Speed reference ramp	Speed reference ramp settings (programming of the acceleration and deceleration rates for the drive).	256
24 Speed reference conditioning	Speed error calculation; speed error window control configuration; speed error step.	260
25 Speed control	Speed controller settings.	260
26 Torque reference chain	Settings for the torque reference chain.	266
28 Frequency reference chain	Settings for the frequency reference chain.	271
30 Limits	Drive operation limits.	282
31 Fault functions	Configuration of external events; selection of behavior of the drive upon fault situations.	290
32 Supervision	Configuration of signal supervision functions 16.	299
34 Timed functions	Configuration of the timed functions.	307
35 Motor thermal protection	Motor thermal protection settings such as temperature measurement configuration, load curve definition and motor fan control configuration.	316
36 Load analyzer	Peak value and amplitude logger settings.	326
37 User load curve	Settings for user load curve.	329
40 Process PID set 1	Parameter values for process PID control.	332
41 Process PID set 2	A second set of parameter values for process PID control.	348
43 Brake chopper	Settings for the internal brake chopper.	350
44 Mechanical brake control	Configuration of mechanical brake control.	352
45 Energy efficiency	Settings for the energy saving calculators as well as peak and energy loggers.	353

180 Parameters

Group	Contents	Page
46 Monitoring/scaling settings	Speed supervision settings; actual signal filtering; general scaling settings.	358
47 Data storage	Data storage parameters that can be written to and read from using other parameters' source and target settings.	361
49 Panel port communication	Communication settings for the control panel port on the drive.	362
50 Fieldbus adapter (FBA)	Fieldbus communication configuration.	364
51 FBA A settings	Fieldbus adapter A configuration.	368
52 FBA A data in	Selection of data to be transferred from drive to fieldbus controller through fieldbus adapter A.	370
53 FBA A data out	Selection of data to be transferred from fieldbus controller to drive through fieldbus adapter A.	370
58 Embedded fieldbus	Configuration of the embedded fieldbus (EFB) interface.	371
71 External PID1	Configuration of external PID.	378
76 PFC configuration	PFC (Pump and fan control) and Autochange configuration parameters. See also section Pump and fan control (PFC) on page 132.	380
77 PFC maintenance and monitoring	PFC (Pump and fan control) and Autochange configuration parameters. See also section Pump and fan control (PFC) on page 132.	388
95 HW configuration	Various hardware-related settings.	389
96 System	Language selection; access levels; macro selection; parameter save and restore; control unit reboot; user parameter sets; unit selection.	391
97 Motor control	Switching frequency; slip gain; voltage reserve; flux braking; anticogging (signal injection); IR compensation.	400
98 User motor parameters	Motor values supplied by the user that are used in the motor model.	404
99 Motor data	Motor configuration settings.	406

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.	10 = 1A
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 <i>Unit selection</i> . A filter time constant for this signal can be defined by parameter 46.14 Filter time power.	-
	-32768.00 32767.00 kW	Output power.	See par. 46.04
01.15	Output power % of motor nom	Output power in percent of the nominal motor power.	-
	-300.00 300.00%	Output power.	10 = 1%
01.16	Output power % of drive nom	Output power in percent of the nominal drive power.	-
	-300.00 300.00%	Output power.	10 = 1%
01.17	Motor shaft power	Estimated mechanical power at motor shaft.	-
	-32768.00 32767.00 kW or hp	Motor shaft power.	See par. 46.04
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.	-
	0.000 4000000.000 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. If the power is cycled, after the drive is again up and running, the parameter value is set to the value it had before the power cycle.	-
	0.00 1000000.00 kWh	Energy.	1 = 1 kWh

No.	Name/Value	Description	Def/FbEq16
01.51	1.51 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. If the power is cycled, after the drive is again up and running, the parameter value is set to the value it had before the power cycle.		-
	0.00 1000000.00 kWh	Energy.	1 = 1 kWh
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. If the power is cycled, after the drive is again up and running, the parameter value is set to the value it had before the power cycle.	-
	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. If the power is cycled, after the drive is again up and running, the parameter value is set to the value it had before the power cycle.	-
	0.00 1000000.00 kWh	Energy.	1 = 1 kWh
01.54	Cumulative inverter energy	Amount of energy that has passed through the drive (in either direction) in full kilowatt-hours. The minimum value is zero.	-
	-200000000.0 2000000000.0 kWh	Energy in kWh.	10 = 1 kWh
01.55	Inverter GWh counter (resettable)	Amount of energy that has passed through the drive (in either direction) in full gigawatt-hours. The minimum value is zero. You can reset the value by setting it to zero. Resetting any of parameters 01.5501.58 resets all of them.	-
	065535 GWh	Energy in GWh.	1 = 1 GWh
01.56	Inverter MWh counter (resettable)	Amount of energy that has passed through the drive (in either direction) in full megawatt-hours. Whenever the counter rolls over, 01.55 Inverter GWh counter (resettable) is incremented. The minimum value is zero. You can reset the value by setting it to zero. Resetting any of parameters 01.5501.58 resets all of them.	-
	01000 MWh	Energy in MWh.	1 = 1 MWh
01.57	Inverter kWh counter (resettable)	Amount of energy that has passed through the drive (in either direction) in full kilowatt-hours. Whenever the counter rolls over, 01.56 Inverter MWh counter (resettable) is incremented. The minimum value is zero. You can reset the value by setting it to zero. Resetting any of parameters 01.5501.58 resets all of them.	-
	01000 kWh	Energy in kWh.	10 = 1 kWh
01.58	Cumulative inverter energy (resettable)	Amount of energy that has passed through the drive (in either direction) in full kilowatt-hours. The minimum value is zero. You can reset the value by setting it to zero. Resetting any of parameters 01.5501.58 resets all of them.	-
	-200000000.0 200000000.0 kWh	Energy in kWh.	10 = 1 kWh

03.06

FB A reference 2

-100000.00... 100000.00

No. Name/Value		Description	Def/FbEq16	
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 %.	-	
	0.001000.00%	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	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.	-	
	-100000.00 100000.00	Control panel or PC tool reference.	1 = 10	
03.02	Panel reference 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 <i>505</i>).	-	
	-100000.00 100000.00	Reference 1 from fieldbus adapter A.	1 = 10	

Reference 2 received through fieldbus adapter A.

1 = 10

Reference 2 from fieldbus adapter A.

No.	Name/Value	Description	Def/FbEq16
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 Warnings 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
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

No.	Name/\	/alue	Description	Description		
04.40	Event word 1		status of the	user-defined event word. This word collects the le events (warnings, faults or pure events) selected ters 04.4104.71. leter is read-only.	-	
	Bit	Name		Description		
	0	User bit 0		1 = Event selected by parameter <i>04.41</i> is active		
	1	User bit 1	1 = Event selected by parameter 04.43 is active			
	15	User bit 15		1 = Event selected by parameter <i>04.71</i> is active		
	0000h.	FFFFh	User-defin	ed event word.	1 = 1	
04.41	Event v code	vord 1 bit 0	pure event	e hexadecimal code of an event (warning, fault or) whose status is shown as bit 0 of 04.40 Event e event codes are listed in chapter Fault tracing).	0x2310h	
	0000h.	.FFFFh	Code of ev	vent.	1 = 1	
04.43	code p		pure event	e hexadecimal code of an event (warning, fault or) whose status is shown as bit 1 of 04.40 Event e event codes are listed in chapter Fault tracing).	0x3210h	
	0000h	FFFFh	Code of ev	Code of event.		
04.45, 04,47, 04,49,						
04.71	Event v code	code pure event) whose status is shown as bit 15 of 0		e hexadecimal code of an event (warning, fault or) whose status is shown as bit 15 of 04.40 Event e event codes are listed in chapter Fault tracing	0x2330h	
	0000h	FFFFh	Code of ev	rent.	1 = 1	
05 Diagnostics		drive main	n-time-type counters and measurements related to tenance. ters in this group are read-only unless otherwise			
05.01	On-time	e counter	On-time co	ounter. The counter runs when the drive is	-	
	0655	35 d	On-time co	ounter.	1 = 1 d	
05.02	Run-tim	ne counter		time counter in full days. The counter runs when r modulates.	-	
	0655	35 d	Motor run-	time counter.	1 = 1 d	
05.03	Hours r	run		ding parameter to 05.02 Run-time counter in is, 24 * 05.02 value + fractional part of a day.	-	
	0.0 429496	729.5 h	Hours.		1 = 1 h	
05.04	Fan on- counter			me of the drive cooling fan. Can be reset from the nel by keeping Reset down for over 3 seconds.	-	
	0655	35 d	Cooling far	n run-time counter.	1 = 1 d	

No.	Name/Value	Description	Def/FbEq16	
05.10	Control board temperature	Measured temperature of the control unit.	-	
	-100 300 °C or °F	Control unit 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%	
05.20	Diagnostic word 1	Diagnostic word 1. For possible causes and remedies, see chapter Fault tracing.	-	

Bit	Name	Value
0	Any warning or fault	Yes = Drive has generated a warning or tripped on a fault.
1	Any warning	Yes = Drive has generated a warning.
2	Any fault	Yes = Drive has tripped on a fault.
3	Reserved	
4	Overcurrent fault	Yes = Drive has tripped on fault 2310 Overcurrent.
5	Reserved	
6	DC overvoltage	Yes = Drive has tripped on fault 3210 DC link overvoltage.
7	DC undervoltage	Yes = Drive has tripped on fault 3220 DC link undervoltage.
8	Reserved	
9	Device overtemperature fault	Yes = Drive has tripped on fault 4310 Excess temperature.
101	5 Reserved	

	0000hFFFFh	Diagnostic word 1.	1 = 1
05.21	Diagnostic word 2	Diagnostic word 2. For possible causes and remedies, see	-
		chapter Fault tracing.	

Bit	Name	Value
09	Reserved	
10	Motor overtemperature fault	Yes = Drive has tripped on fault 4981 External temperature 1 and 4982 External temperature 2.
1115	Reserved	

0000hFFFFh	Diagnostic word 2.	1 = 1

No.	Name/Value		Description	Def/FbEq16		
05.22	Diagnostic word 3		Diagnostic word 3.	-		
	Bit Name		Value			
	80	Reserved	<u> </u>			
	9	kWh pulse	Yes = kWh pulse is active.			
	10	Reserved				
	11	Fan comma	and On = Drive fan is rotating above idle speed.			
	1215	Reserved				
	0000h	FFFFh	Diagnostic word 3.	1 = 1		
05.80	Motor speed at fault		Shows the value of copy of parameter 28.01 Frequency ref ramp input (in scalar control mode) or 23.01 Speed ref ramp input (in speed control mode) at the occurrence of the latest fault.	-		
	-30000.		Estimated motor speed.	10 = 1 rpm		
05.81	Output i	frequency at	Shows the value of copy of parameter 01.06 Output frequency at the occurrence of the latest fault.	-		
	-500.00500.00 Hz		Estimated output frequency.			
05.82	2 DC voltage at fault		Shows the value of copy of parameter 01.11 DC voltage at the occurrence of the latest fault.	-		
	0.002	V 00.000	DC link voltage.	10 = 1 V		
05.83	Motor current at fault		Shows the value of copy of parameter 01.07 Motor current at the occurrence of the latest fault.	-		
	0.0030000.00 A		Motor current.	10 = 1 V		
05.84	Motor torque at fault		Shows the value of copy of parameter 01.10 Motor torque at the occurrence of the latest fault.	-		
	-1600.0	1600.0 %	Motor torque.	1 = 1 %		
05.85	Main sta	atus word at	Shows the value of copy of parameter 06.11 Main status word at the occurrence of the latest fault.	-		
	0000h	.FFFFh	Main status word.	1 = 1		
05.86	DI delay fault	ed status at	Shows the value of copy of parameter 10.02 DI delayed status at the occurrence of the latest fault.	-		
	0000h	.FFFFh	Delayed status for digital inputs.	1 = 1		
05.87	Inverter tempera	ature at fault	Shows the value of copy of parameter 05.11 Inverter temperature at the occurrence of the latest fault.	-		
	-4016	0 °C	Drive temperature in °C.	1 = 1 °C		
05.88	Referer fault	ice used at	Shows the value of copy of parameter 28.01 Frequency ref ramp input (in scalar control mode) or 23.01 Speed ref ramp input (in speed control mode) at the occurrence of the latest fault.	-		
	-30000.		Frequency or speed reference.	1 = 1 Hz		

No.	Name/Value	Descrip	tion	Def/FbEq16				
06 Co words	entrol and status	Drive co	ntrol and status words.					
06.01	Main control word	sources application The main For the band state respective Note: We not same For the emode.	Shows the control signals as received from the selected sources (such as digital inputs, the fieldbus interfaces and the application program). The main control word of the drive. For the bit descriptions see page 511. The related status word and state diagram are presented on pages 513 and 514 respectively. Note: When using fieldbus control, this parameter value is not same as Control word value that drive receives from PLC. For the exact value, see parameter 50.12 FBA A debug mode. This parameter is read-only.					
		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	Inching 1					
		9	Inching 2					
		10	Remote cmd					
		11	Ext ctrl loc					
		12	User bit 0					
		13	User bit 1					
		14	User bit 2					
		15	User bit 3					
	0000hFFFFh	Main co	ntrol word.	1 = 1				
	555011 1 1 1 11	.714111 501		L				

No.	Name/Value	Descri	ption	Def/FbEq16				
06.11	Main status word	For the word an respect Note: W not san the exa	Main status word of the drive. For the bit descriptions see page 513. The related control word and state diagram are presented on pages 511 and 514 respectively. Note: When using fieldbus control, this parameter value is not same as Status word value that drive sends to PLC. For the exact value, see parameter 50.12 FBA A debug mode. This parameter is read-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 st	atus word.	1 = 1				

No.	Name/Value		Desc	Description Def/FbEq1			
06.16	Drive status word 1		Drive	Drive status word 1.			
			This	parameter is read-only.			
	Bit	Name		Description			
	0	Enabled		1 = Both run enable (see par. 20.12) and start enable (2 are present. Note: This bit is not affected by the presence of a fault.	, 0		
	1	Inhibited		1 = Start inhibited. To start the drive, the inhibiting signal (see p. 06.18) must be removed and the start signal cycled.			
	2	DC charge	d	1 = DC circuit has been charged			
	3	Ready to s	art	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 contr	ol	1 = Drive is in local control			
	9	Network co	ntrol	1 = Drive is in <i>network control</i> (see page 17).			
	10	Ext1 active		1 = Control location EXT1 active			
	11	Ext2 active		1 = Control location EXT2 active			
	12	Reserved					
	13	Start reque	st	1 = Start requested. 0 = When Enable to rotate signal (see par. 20.22) is 0 (rotating of the motor is disabled).			
	14	Running		1 = Drive is running.			
	15	Reserved					

No.	Name/V	alue	Description	on	Def/FbEq16	
6.17	Drive status word 2		Drive status word 2.			
			This paran	neter is read-only.		
	Bit	Name		Description		
	0	Identification	n run done	1 = Motor identification (ID) run has been performe	ed	
	1	Torque control		1 = The motor has been magnetized		
	2			1 = Torque control mode active 1 = Speed control mode active		
	3					
	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 parameters 49.05 and 50.02	s such as	
	7	Reserved				
	8	Emergency	stop failed	1 = Emergency stop failed (see parameters 31.32 and 31.33)		
	9	Jogging active		1 = Jogging enable signal is on		
	10	Above limit		1 = Actual speed or frequency equals or exceeds limit (defined by parameters 46.3146.32). Valid in both directions of rotation.		
	1112	Reserved				
	13	Start delay	active	1 = Start delay (par. 21.22) active.		
	1415	Reserved				
	·					
	0000h	FFFFh	Drive statu	is word 2.	1 = 1	

No.	Name/Value Description		Description	on	Def/FbEq16	
06.18	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 is marked with an asterisk (*) only require that command is cycled. In all other instances, the condition must be removed first. It is considered to the condition must be removed first. It is considered to the condition must be removed first. It is considered to the condition must be removed first. It is considered to the condition of the	-	
	Bit	Name		Description		
	0	Not ready r	un	1 = DC voltage is missing or drive has not been pa correctly. Check the parameters in groups 95 and 9		
	1	Ctrl location changed SSW inhibit		* 1 = Control location has changed		
	2			1 = Control program is keeping itself in inhibited sta	ate	
	3	Fault reset		* 1 = A fault has been reset		
	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 calibration ended		* 1 = Current calibration routine has finished		
	9	ID run ended		* 1 = Motor identification run has finished		
	10	Reserved				
	11	Em Off1		1 = Emergency stop signal (mode off1)		
	12	Em Off2		1 = Emergency stop signal (mode off2)		
	13	Em Off3		1 = Emergency stop signal (mode off3)		
	14	Auto reset	nhibit	1 = The autoreset function is inhibiting operation		
	15	Jogging active		1 = The jogging enable signal is inhibiting operation	1	
	0000hFFFFh		Start inhibit status word.		1 = 1	
06.19	Speed control status word		Speed control status word. This parameter is read-only.		-	
	Bit	Name		Description		
	0	Zero speed		1 = Drive has been running below zero speed limit (par. 21.0 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 zero speed lii (par. 21.06)		
	36	Reserved				
	7	Any consta request	nt speed	1 = A constant speed or frequency has been selected 06.20.	cted; see par	
	815	Reserved				
	0000hFFFFh		Speed cor	ntrol status word.	1 = 1	

No.	Name/V	/alue	Descr	iption		Def/FbEq16	
06.20	Constant speed status word		consta param Consta	ant spe leter <i>06</i> ant spe	ped/frequency status word. Indicates which led or frequency is active (if any). See also 6.19 Speed control status word, bit 7, and section leds/frequencies (page 122). The read-only.	-	
	Bit	Name			Description		
	0	Constant s	peed 1		1 = Constant speed or frequency 1 selected		
	1	Constant s	peed 2		1 = Constant speed or frequency 2 selected		
	2	Constant sp	peed 3		1 = Constant speed or frequency 3 selected		
	3	Constant sp	peed 4		1 = Constant speed or frequency 4 selected		
	4	Constant sp			1 = Constant speed or frequency 5 selected		
	5	Constant sp			1 = Constant speed or frequency 6 selected		
	6	Constant s	peed 7		1 = Constant speed or frequency 7 selected		
	715	Reserved					
	00001				15	1	
	0000h				ed/frequency status word.	1 = 1	
06.21	Drive status word 3		Drive status word 3. This parameter is read-only.		-		
	Bit	Name		Description			
	0	DC hold active 1 = I		1 = D(C hold is active		
	1	Post-magnetizing 1 = l		1 = Po	ost-magnetizing is active		
	2	Motor pre-h active			Motor pre-heating is active		
	3	PM smooth active			M smooth start active		
	4	Reserved					
	5	DC brake a	ctive	1 = br	ake is active		
	615	Reserved					
	0000h	.FFFFh	Drive status word 1.		1 = 1		
	0000h	.FFFFh	Start in	nhibit s	tatus word.	1 = 1	
06.29	MSW bi			Selects a binary source whose status is transmitted as bit 10 (User bit 0) of 06.11 Main status word.			
	False		0.			0	
	True		1.			1	
	Above I	imit	Bit 10	of 06.1	7 Drive status word 2 (see page 191).	2	
	Other [b	oit]	Source selection (see <i>Terms and abbreviations</i> on page <i>178</i>).			-	
06.30	MSW bit 11 selection		Selects a binary source whose status is transmitted as bit 11 (User bit 0) of <i>06.11 Main status word</i> .			Ext ctrl loc	
	False		0.			0	
	True		1.			1	
	Ext ctrl	ос	Bit 11	of 06.0	11 Main control word (see page 190).	2	
	Other [b	oit1	Source	e selec	tion (see <i>Terms and abbreviations</i> on page 178).	-	

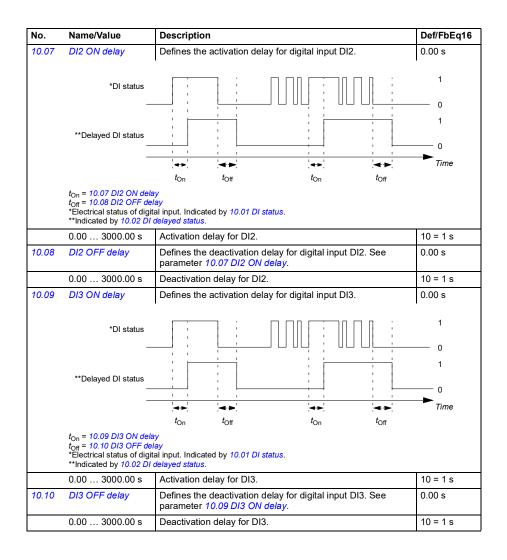
No.	Name/Value	Description	Def/FbEq16
06.31	MSW bit 12 selection	,	
	False	0.	0
	True	1.	1
	Ext run enable	Status of the external run enable signal (see parameter 20.12 Run enable 1 source).	2
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 178).	-
06.32	MSW bit 13 selection	Selects a binary source whose status is transmitted as bit 13 (User bit 2) of 06.11 Main status word.	False
	False	0.	0
	True	1.	1
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 178).	-
06.33	MSW bit 14 selection	Selects a binary source whose status is transmitted as bit 14 (User bit 3) of 06.11 Main status word.	False
	False	0.	0
	True	1.	1
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 178).	-

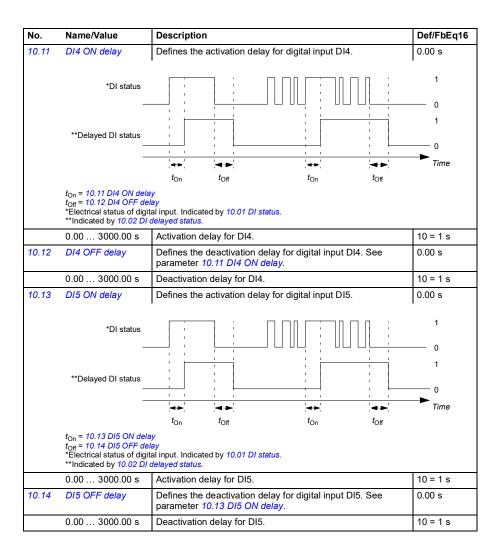
07 Sys	stem info	Drive hardware and firmware information. All parameters in this group are read-only.	
07.03	Drive rating id	Type of the drive. (Rating ID in brackets.)	-
07.04	Firmware name	Firmware identification.	-
07.05	Firmware version	Version number of the firmware.	-
07.06	Loading package name	Name of the firmware loading package.	-
07.07	Loading package version	Version number of the firmware loading package.	-
07.11	Cpu usage	Microprocessor load in percent.	-
	0100%	Microprocessor load.	1 = 1%
07.25	Customization package name	First five ASCII letters of the name given to the customization package. The full name is visible in the System info menu under the Main menu on the control panel or the Drive composer PC tool. _N/A_ = None.	-
07.26	Customization package version	Customization package version number. Also visible in the System info menu under the Main menu on the control panel or the Drive composer PC tool.	-

No.	Name/	e/Value Description		on	Def/FbEq16		
07.30	Adaptiv status	ve program		e status of the adaptive program. on <i>Adaptive programming</i> (page <i>115</i>).	-		
	Bit	Name		Description			
	0	Initialized		1 = Adaptive program initialized			
	1	Editing		1 = Adaptive program is being edited			
	2	Edit done		1 = Editing of adaptive program finished			
	3	Running		1 = Adaptive program running			
	413	Reserved					
	14	State chan	ging	1 = State change in progress in adaptive programm	ning engine		
	15	Faulted		1 = Error in adaptive program			
	0000h.	FFFFh	Adaptive p	program status.	1 = 1		
07.31		quence state	Shows the program programm	number of the active state of the sequence art of the adaptive program (AP). If adaptive ing is not running, or it does not contain a program, the parameter is zero.			
	020				1 = 1		
07.35	Drive o	Drive configuration		Performs HW initialization, and shows the detected option module configuration of the drive. Plug 'n' play configuration during the HW initialization, if the drive is not able to detect any option module, the value is set to 1, Base unit. For information on automatic setting of parameters after detecting a module, see section Automatic drive configuration for fieldbus control on page 518.			
	Bit	Name	Desc	ription			
	0	Not initializ	ed 1 = D	rive configuration has not been initialized			
	1	Base unit	1 = D	1 = Drive has not detected any option modules.			
	2	Reserved					
	3	FENA-21	1 = F	ENA-21 Two-port Ethernet adapter module included			
	4	FECA-01		ECA-01 EtherCAT adapter module included			
	5	FPBA-01		PBA-01 PROFIBUS DP adapter module included			
	6	FCAN-01	1 = F	CAN-01 CANopen adapter module included			
	7	Reserved	1. –				
	8	BIO-01		rontal I/O extension			
	9	RIIO-01		rontal standard I/O extension			
	10	FSCA-01		FSCA-01 Modbus/RTU adapter module included			
	11 12	FEIP-21 FMBT-21		EIP-21 Two-port EtherNet/IP adapter module includ			
			T = F	MBT-21 Two-port Modbus/TCP adapter module incl	uueu		
	13 14	Reserved FPNO-21	11 – ⊏	PNO-21 Two-port PROFINET IO adapter module in	cludod		
	15	FEPL-02		EPL-02 Ethernet POWERLINK adapter module inclination			
		1 2 2 2	11-1				
	000h	FFFh	Drive confi	iguration	1 = 1		
07.36	Drive configuration			detected module configuration. See parameter	0000h		

No.	Name/Value		Description		Def/FbEq16	
	Bit	Name	Des	cription		
	0	Reserved	500	on paron		
	1	FDNA-01	1 = 1	FDNA-01 DeviceNet™ adapter module includ	led	
	2	FCNA-01		FCNA-01 ControlNet™ adapter module include		
	3	CMOD-01		CMOD-01 adapter module included	ieu -	
	4	CMOD-01		CMOD-01 adapter module included		
	5	CPTC-02		CPTC-02 adapter module included		
	6	CHDI-01		CHDI-01 adapter module included		
	7	FSPS-21		FSPS-21 adapter module included		
	815	Reserved		101 0-21 adapter module moduced		
	0000h.	FFFFh	Drive configuration	on	1 = 1	
40.04-	and and	DI DO				
	ndard	DI, KU	ū	ligital inputs and relay outputs.		
10.01	DI stat	ius	Displays the statu This parameter is	us of digital inputs DI1DI6. read-only.	-	
	Bit	Name	Des	cription		
	0	DI1		Digital input 1 is ON.		
	1	DI2		Digital input 2 is ON.		
	2	DI3		1 = Digital input 3 is ON.		
	3	DI3		Digital input 4 is ON.		
	4	DI5		Digital input 4 is ON.		
	5	DI6		Digital input 6 is ON.		
	615	Reserved		Digital iliput 0 is ON.		
	0000h	FFFFh	Status for digital i	•	1 = 1	
10.02 DI delayed status		Displays the status of digital inputs DI1DI6. Bits 05 reflect the delayed status of DI1DI6. Example: 000000000010011b = DI5, DI2 and DI1 are on, DI3, DI4 and DI6 are off. This word is updated only after a 2 ms activation/deactivation delay. When the value of a digital input changes, it must remain the same in two consecutive samples, that is for 2 ms, for the new value to be accepted.				
			This parameter is	•		
	Bit	Name	Des	cription		
	0	DI1	1 = 1	Digital input 1 is ON.		
	1	DI2	1 = 1	Digital input 2 is ON.		
	2	DI3	1 = 1	Digital input 3 is ON.		
	3	DI4	1 = 1	Digital input 4 is ON.		
	4	DI5		Digital input 5 is ON.		
	5	DI6		Digital input 6 is ON.		
	615	Reserved		- -		
	0000h	FFFFh	Delayed status fo	r digital inpute	1 = 1	

N1 -		A / . I		Description Desiration						
No. 10.03	Name/Value DI force selection			Description The electrical statuses of the digital inputs can be overridden for e.g. 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).	Def/FbEq16 0000h					
	Bit	Name	Value							
	0	DI1		e orce DI1 to value of bit 0 of parameter <i>10.04 DI forced data</i> . (0 = No						
	1	DI2		rce DI2 to value of bit 1 of parameter 10.04 DI forced data. (0 =						
	2	DI3	1 = Fo	rce DI3 to value of bit 2 of parameter 10.04 DI forced data. (0 =	Normal mode)					
	3	DI4	1 = Fo	rce DI4 to value of bit 3 of parameter 10.04 DI forced data. (0 =	Normal mode)					
	4	DI5	1 = Fo	rce DI5 to value of bit 4 of parameter 10.04 DI forced data. (0 =	Normal mode)					
	5	DI6	1 = Fo	rce DI6 to value of bit 5 of parameter 10.04 DI forced data. (0 =	Normal mode)					
	615	Reserv	ed							
	•									
	0000h	FFFF	h	Override selection for digital inputs.	1 = 1					
10.04	DI ford	ced data	1	Allows the data value of a forced digital input to be changed from 0 to 1. It is only possible to force an input that has been selected in parameter 10.03 DI force selection.	0000h					
	Bit	Name	Value							
	0	DI1	Force	Force the value of this bit to D1, if so defined in parameter 10.03 DI force selection						
	1	DI2	Force	rce the value of this bit to D3, if so defined in parameter 10.03 DI force selection						
	2	DI3	Force	orce the value of this bit to D3, if so defined in parameter 10.03 DI force selection						
	3	DI4	Force	orce the value of this bit to D4, if so defined in parameter 10.03 DI force selection						
	4	DI5	Force	orce the value of this bit to D5, if so defined in parameter 10.03 DI force select						
	5	DI6	Force	orce the value of this bit to D6, if so defined in parameter 10.03 DI force selection						
	615 Reserved									
	0000hFFFFh			Forced values of digital inputs.	1 = 1					
10.05	DI1 O	N delay		Defines the activation delay for digital input DI1.	0.00 s					
	**Dela	*DIs	tatus — tatus —		1 0 1					
	t _{Off} = 10 *Electri **Indica	ated by 1	OFF del s of digit 0.02 DI o	ay al input. Indicated by 10.01 DI status. delayed status.	Lio					
		. 3000.		Activation delay for DI1.	10 = 1 s					
10.06	DI1 OI	FF dela	/	Defines the deactivation delay for digital input DI1. See parameter 10.05 DI1 ON delay.	0.00 s					
	0.00	. 3000.	00 s	Deactivation delay for DI1.	10 = 1 s					





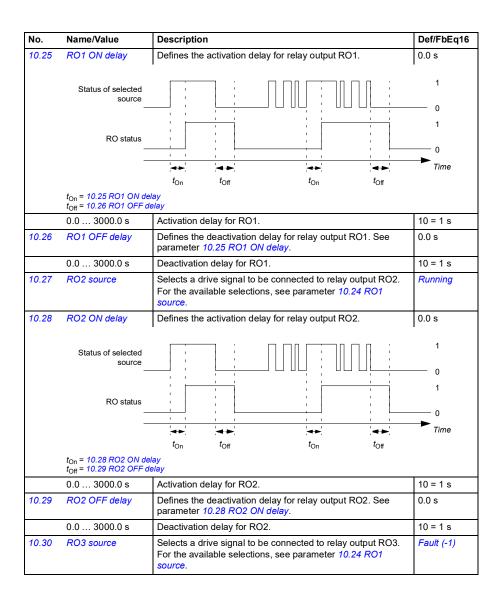
No.	Name/V	'alue	Description	Def/FbEq16			
10.15	DI6 ON	delay	Defines the activation delay for digital input DI6.	0.00 s			
		*DI status		1 0			
	**Delay	ed DI status	t _{On} t _{Off} t _{On} t _{Off}	1 0 Time			
	$t_{\text{Off}} = 10.$ *Electrica						
	0.00	3000.00 s	Activation delay for DI6.	10 = 1 s			
10.16	DI6 OF	delay	Defines the deactivation delay for digital input DI6. See parameter 10.15 DI6 ON delay.	0.00 s			
	0.00	3000.00 s	Deactivation delay for DI6.	10 = 1 s			
10.21	RO stat	us	Status of relay outputs RO3RO1.	-			
	Bit	Name	alue				
	0	RO1	1 = energized, 0 = de-energized.				
	1	RO2	1 = energized, 0 = de-energized				
	2	RO3	1 = energized, 0 = de-energized				
	315	Reserve	d				
	0000h	.FFFFh	Status of relay outputs.	1 = 1			
10.22	RO force	e selectior	The signals connected to the relay outputs can be overridden for e.g. 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 I	Name Val	ue				
			Force RO1 to value of bit 0 of parameter 10.23 RO forced data. (0 =	Normal mode)			
	1 1		Force RO2 to value of bit 1 of parameter 10.23 RO forced data. (0 =	,			
	2 I	RO3 1 =	Force RO3 to value of bit 2 of parameter 10.23 RO forced data. (0 =	Normal mode)			
	315 l						
	0000h	CCCCL	Override colorion for relay outside	1 = 1			
	JUUUII	.i ifffii	Override selection for relay outputs.	1 - 1			

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

Bit	Name	Value
0	RO1	Force the value of this bit to RO1, if so defined in parameter 10.22 RO force selection.
1	RO2	Force the value of this bit to RO2, if so defined in parameter 10.22 RO force selection.
2	RO3	Force the value of this bit to RO3, if so defined in parameter 10.22 RO force selection.
315	Reserv	/ed

	0000hFFFFh	Forced RO values.	1 = 1
0.24	RO1 source	Selects a drive signal to be connected to relay output RO1.	Ready run
	Not energized	Output is not energized.	0
	Energized	Output is energized.	1
	Ready run	Bit 1 of 06.11 Main status word (see page 190).	2
	Enabled	Bit 0 of 06.16 Drive status word 1 (see page 191).	4
	Started	Bit 5 of 06.16 Drive status word 1 (see page 191).	5
	Magnetized	Bit 1 of 06.17 Drive status word 2 (see page 191).	6
	Running	Bit 6 of 06.16 Drive status word 1 (see page 191).	7
	Ready ref	Bit 2 of 06.11 Main status word (see page 190).	8
	At setpoint	Bit 8 of 06.11 Main status word (see page 190).	9
	Reverse	Bit 2 of 06.19 Speed control status word (see page 192).	10
	Zero speed	Bit 0 of 06.19 Speed control status word (see page 192).	11
	Above limit	Bit 10 of 06.17 Drive status word 2 (see page 191).	12
	Warning	Bit 7 of 06.11 Main status word (see page 190).	13
	Fault	Bit 3 of 06.11 Main status word (see page 190).	14
	Fault (-1)	Inverted bit 3 of 06.11 Main status word (see page 190).	15
	Fault/Warning	Bit 3 of 06.11 Main status word OR bit 7 of 06.11 Main status word (see page 190).	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
	Brake command	Bit 0 of 44.01 Brake control status (see page 352).	22
	Ext2 active	Bit 11 of 06.16 Drive status word 1 (see page 191).	23
	Remote control	Bit 9 of 06.11 Main status word (see page 190).	24
	Reserved		2526

No.	Name/Value	Description	Def/FbEq16
	Timed function 1	Bit 0 of 34.01 Timed functions status (see page 307).	27
	Timed function 2	Bit 1 of 34.01 Timed functions status (see page 307).	28
	Timed function 3	Bit 2 of 34.01 Timed functions status (see page 307).	29
	Reserved		3032
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 299).	33
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 299).	34
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 299).	35
	Reserved		3638
	Start delay	Bit 13 of 06.17 Drive status word 2 (see page 191).	39
	RO/DIO control word bit0	Bit 0 of 10.99 RO/DIO control word (see page 204).	40
	RO/DIO control word bit1	Bit 1 of 10.99 RO/DIO control word (see page 204).	41
	RO/DIO control word bit2	Bit 2 of 10.99 RO/DIO control word (see page 204).	42
	Reserved		4344
	PFC1	Bit 0 of 76.01 PFC status (see page 380).	45
	PFC2	Bit 1 of 76.01 PFC status (see page 380).	46
	PFC3	Bit 2 of 76.01 PFC status (see page 380).	47
	PFC4	Bit 3 of 76.01 PFC status (see page 380).	48
	PFC5	Bit 3 of 76.01 PFC status (see page 380).	49
	PFC6	Bit 3 of 76.01 PFC status (see page 380).	50
	User load curve	Bit 3 (Outside load limit) of 37.01 ULC output status word (see page 329).	61
	RO/DIO control word	For 10.24 RO1 source: Bit 0 (RO1) of 10.99 RO/DIO control word (see page 204). For 10.27 RO2 source: Bit 1 (RO2) of 10.99 RO/DIO control word (see page 204). For 10.30 RO3 source: Bit 2 (RO3) of 10.99 RO/DIO control word (see page 204).	62
	Event word 1	Event word 1 = 1 if any bit of 04.40 Event word 1 (see page 186) is 1, that is, if any warning, fault or pure event that has been defined with parameters 04.4104.71 is on.	53
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 178).	-



No.	Name/Value	е	Descripti	on				Def/FbEq16
10.31	RO3 ON de	lay	Defines th	e activation	delay for relay	output R0	D3.	0.0 s
	Status of s	selected source	1					1
	RO	— O status						0 1
		_						0
		_	t _{On}	t _{Off}			t _{Off}	Time
	$t_{\text{On}} = 10.31 R$ $t_{\text{Off}} = 10.32 R$ $0.0 \dots 3000$	O3 OFF de	elay	delay for RO)3			10 = 1 s
10.32	RO3 OFF d		Defines th		n delay for re	lay output	RO3. See	0.0 s
	0.0 3000	.0 s	Deactivati	on delay for	RO3.			10 = 1 s
10.99	RO/DIO cor word	ntrol	through the outputs (Fassignme selection to RO/DIC	ne embedded RO) of the dri nts shown be parameter of D control wor	ve, send a co low as Modbu that particula	face. To control word us I/O data r data (58.ce selection	ontrol the relay with the bit . Set the target 10158.114) n parameter of	
	Bit Na	ame	Des	cription				
	0 R0	D1				01R03	See paramete	ers 10.24,
	4 00	20	10.2	77 and 10 30				

Bit	Name	Description
0		Source bits for relay outputs RO1RO3. See parameters 10.24,
1	RO2	10.27 and 10.30.
2	RO3	
315	Reserved	

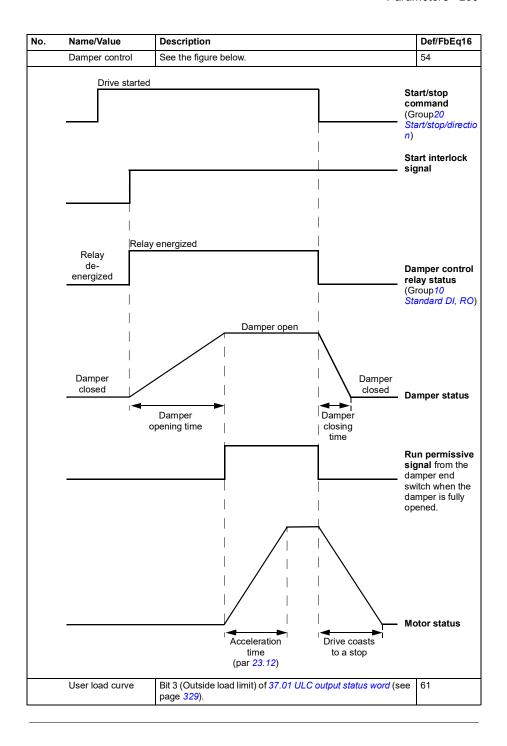
	0000hFFFFh	RO/DIO control word.	1 = 1
10.101	RO1 toggle counter	Displays the number of times relay output RO1 has changed states. Can be reset from the control panel by keeping Reset down for over 3 seconds.	-
	04294967000	State change count.	1 = 1
10.102	RO2 toggle counter	Displays the number of times relay output RO2 has changed states. Can be reset from the control panel by keeping Reset down for over 3 seconds.	-
	04294967000	State change count.	1 = 1
10.103	RO3 toggle counter	Displays the number of times relay output RO3 has changed states. Can be reset from the control panel by keeping Reset down for over 3 seconds.	-
	04294967000	State change count.	1 = 1

No.	Name/V	alue	Description		Def/FbEq16
11 Sta	ndard D	IO, FI, FO	Configuration	n of the frequency input.	
11.02	DIO delayed status		(terminal DO DIO1. Example: 00 This word is delay. When remain the soft for the new version of the new ve	status of digital or frequency output DIO1 on BIO-01). Bit 0 reflects the delayed status of 000000000000000001b = DIO1 is on. 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	DIO1		1 = Digital or frequency output DIO1 is ON.	
	115	Reserved		. , ,	
	l				
	0000h	.FFFFh	Delayed stat	tus for digital or frequency output DIO1.	1 = 1
0000hFFFh 11.03 DIO force selection		The signal or for example, force data is (terminal DO the correspo	onnected to the digital output can be overridden testing purposes. A bit in parameter 11.04 DIO provided for digital or frequency output DIO1 on BIO-01), and its value is applied whenever inding bit in this parameter is 1.	0000h	
			(parameters	10.22 and 10.23).	
	Bit	Value	I "	,	
	0	1 = Force D	I "	10.22 and 10.23). of bit 0 of parameter 11.04 DIO force data. (0 = No.	ormal mode)
			I "	,	ormal mode)
	0	1 = Force D Reserved	DIO1 to value o	,	ormal mode)
11.04	0 115	1 = Force D Reserved	Override seld Contains the (terminal DC) connected si	of bit 0 of parameter 11.04 DIO force data. (0 = No	
11.04	0 115	1 = Force D Reserved	Override seld Contains the (terminal DC) connected si	port bit 0 of parameter 11.04 DIO force data. (0 = Not be ection for digital or frequency output DIO1. Evalue of for digital or frequency output DIO1 on BIO-01) that is used instead of the ignals if selected in parameter 11.04 DIO force	1 = 1
11.04	0 115 0000h	1 = Force E Reserved FFFFh Se data Value	Override sele Contains the (terminal DC connected si data. Bit 0 is	por bit 0 of parameter 11.04 DIO force data. (0 = Note that the parameter 11.04 DIO force data. (0 = Note that the parameter 11.04 DIO force data. (0 = Note that the parameter 11.04 DIO force the forced value for DIO1.	1 = 1 0000h
11.04	0 115 0000h	1 = Force E Reserved FFFFh Se data Value	Override sele Contains the (terminal DC connected si data. Bit 0 is	port bit 0 of parameter 11.04 DIO force data. (0 = Not be ection for digital or frequency output DIO1. Evalue of for digital or frequency output DIO1 on BIO-01) that is used instead of the ignals if selected in parameter 11.04 DIO force	1 = 1 0000h
11.04	0 115 0000h DIO ford	1 = Force E Reserved FFFFh Se data Value 1 = Force tl	Override sele Contains the (terminal DC connected si data. Bit 0 is	por bit 0 of parameter 11.04 DIO force data. (0 = Note that the parameter 11.04 DIO force data. (0 = Note that the parameter 11.04 DIO force data. (0 = Note that the parameter 11.04 DIO force the forced value for DIO1.	1 = 1 0000h
11.04	0 115 0000h DIO ford	1 = Force E Reserved FFFFh The data Value 1 = Force ti Reserved	Override seld Contains the (terminal DC connected sider data. Bit 0 is the value of this	por bit 0 of parameter 11.04 DIO force data. (0 = Note that the parameter 11.04 DIO force data. (0 = Note that the parameter 11.04 DIO force data. (0 = Note that the parameter 11.04 DIO force the forced value for DIO1.	1 = 1 0000h
11.04	0 115 0000h DIO ford Bit 0 115	1 = Force E Reserved FFFFh The data Value 1 = Force ti Reserved	Override seld Contains the (terminal DC connected sider. Bit 0 is the value of this selects whether the contains the contains the value of this selects whether the contains the cont	por bit 0 of parameter 11.04 DIO force data. (0 = Not be ection for digital or frequency output DIO1. It is value of for digital or frequency output DIO1 on BIO-01) that is used instead of the ignals if selected in parameter 11.04 DIO force the forced value for DIO1.	1 = 1 0000h
	0 115 0000h DIO ford Bit 0 115	1 = Force E Reserved FFFFh The data Value 1 = Force tt Reserved FFFFh The data The data FFFFh The data	Override sele Contains the (terminal DC connected si data. Bit 0 is Forced value Selects whet used as a die	portion of parameter 11.04 DIO force data. (0 = Note that the parameter 11.04 DIO force data. (0 = Note that the parameter 11.04 DIO force data. (0 = Note that is used instead of the ignals if selected in parameter 11.04 DIO force the forced value for DIO1. Solit to DIO1, if so defined in parameter 11.04 DIO force that the parameter 11.04 DIO force the parameter 11.04 DIO force the parameter 11.04 DIO force that the parameter 11.04 DIO force the parameter 11.04 DIO	1 = 1 0000h 0 force data.
	0 115 0000h DIO force Bit 0 115 0000h DIO1 cc	1 = Force E Reserved FFFFh The data Value 1 = Force tt Reserved FFFFh The data The data FFFFh The data	Override sele Contains the (terminal DC connected si data. Bit 0 is Forced value Selects whet used as a dig	por bit 0 of parameter 11.04 DIO force data. (0 = Note that the parameter 11.04 DIO force data. (0 = Note that is used instead of the ignals if selected in parameter 11.04 DIO force the forced value for DIO1. The parameter 11.04 DIO force that is used instead of the ignals if selected in parameter 11.04 DIO force the forced value for DIO1. The parameter 11.04 DIO force that is used instead of the ignals if selected in parameter 11.04 DIO force that force the forced value for DIO1. The parameter 11.04 DIO force data. (0 = Note that is used instead of the ignal is used instead of the igna	1 = 1 0000h Diforce data. 1 = 1 Digital output
	0 115 0000h DIO force Bit 0 115 0000h DIO1 cc Digital c	1 = Force E Reserved FFFFh The data Value 1 = Force till Reserved FFFFh The data The data	Override sele Contains the (terminal DC connected si data. Bit 0 is Forced value Selects whet used as a die DIO1 is used Selects a dri (terminal DC connected si data.	por bit 0 of parameter 11.04 DIO force data. (0 = Note that the parameter 11.04 DIO force data. (0 = Note that is used instead of the ignals if selected in parameter 11.04 DIO force the forced value for DIO1. The parameter 11.04 DIO force that is used instead of the ignals if selected in parameter 11.04 DIO force the forced value for DIO1. The parameter 11.04 DIO force that is used instead of the ignals if selected in parameter 11.04 DIO force the forced value for DIO1. The parameter 11.04 DIO force data. (0 = Note that is used in the parameter DIO1 force that is used instead of the ignals is used in the parameter 11.04 DIO force that is used in the param	1 = 1 0000h D force data. 1 = 1 Digital output 0

No.	Name/Value	Description	Def/FbEq16
	Energized	Output is energized.	1
	Ready run	Bit 1 of 06.11 Main status word (see page 190).	2
	Enabled	Bit 0 of 06.16 Drive status word 1 (see page 191).	4
	Started	Bit 5 of 06.16 Drive status word 1 (see page 191).	5
	Magnetized	Bit 1 of 06.17 Drive status word 2 (see page 191).	6
	Running	Bit 6 of 06.16 Drive status word 1 (see page 191).	7
	Ready ref	Bit 2 of 06.11 Main status word (see page 190).	8
	At setpoint	Bit 8 of 06.11 Main status word (see page 190).	9
	Reverse	Bit 2 of 06.19 Speed control status word (see page 192).	10
	Zero speed	Bit 0 of 06.19 Speed control status word (see page 192).	11
	Above limit	Bit 10 of 06.17 Drive status word 2 (see page 191).	12
	Warning	Bit 7 of 06.11 Main status word (see page 190).	13
	Fault	Bit 3 of 06.11 Main status word (see page 190).	14
	Fault (-1)	Inverted bit 3 of 06.11 Main status word (see page 190).	15
	Fault/Warning	Bit 3 of 06.11 Main status word OR bit 7 of 06.11 Main status word (see page 190).	16
	Overcurrent	Fault has occurred.	17
	Overvoltage	Fault has occurred.	18
	Drive temp	Fault,,,,, or has occurred.	19
	Undervoltage	Fault has occurred.	20
	Motor temp	Fault or has occurred.	21
	Reserved		22
	Ext2 active	Bit 11 of 06.16 Drive status word 1 (see page 191).	23
	Remote control	Bit 9 of 06.11 Main status word (see page 190).	24
	Reserved		2526
	Timed function 1	Bit 0 of 34.01 Timed functions status (see page 307).	27
	Timed function 2	Bit 1 of 34.01 Timed functions status (see page 307).	28
	Timed function 3	Bit 2 of 34.01 Timed functions status (see page 307).	29
	Reserved		3032
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 299).	33
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 299).	34
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 299).	35
	Reserved		3638
	Start delay	Bit 13 of 06.17 Drive status word 2 (see page 191).	39
	RO/DIO control word bit0	Bit 0 of 10.99 RO/DIO control word (see page 204).	40
	RO/DIO control word bit1	Bit 1 of 10.99 RO/DIO control word (see page 204).	41
	RO/DIO control word bit2	Bit 2 of 10.99 RO/DIO control word (see page 204).	42
	Reserved		4344
	PFC1	Bit 0 of 76.01 PFC status (see page 380).	45

208 Parameters

No.	Name/Value	Description	Def/FbEq16
	PFC2	Bit 1 of 76.01 PFC status (see page 380).	46
	PFC3	Bit 2 of 76.01 PFC status (see page 380).	47
	PFC4	Bit 3 of 76.01 PFC status (see page 380).	48
	PFC5	Bit 4 of 76.01 PFC status (see page 380).	48
	PFC6	Bit 5 of 76.01 PFC status (see page 380).	48
	Reserved		4952
	Event word 1	Event word 1 = 1 if any bit of 04.40 Event word 1 (see page 186) is 1, that is, if any warning, fault or pure event that has been defined with parameters 04.4104.71 is on.	53



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No.	Name/Value	Description	Def/FbEq16
	RO/DIO control word	For 10.24 RO1 source: Bit 0 (RO1) of 10.99 RO/DIO control word (see page 204). For 10.27 RO2 source: Bit 1 (RO2) of 10.99 RO/DIO control word (see page 204). For 10.30 RO3 source: Bit 2 (RO3) of 10.99 RO/DIO control word (see page 204).	62
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 178).	-
11.07	DIO1 ON delay	Defines the activation delay for DO1 on BIO-01 when it is used as a digital output.	0.00 s
	0.03000.0 s	Activation delay for DO1.	10 = 1 s
11.08	DIO1 OFF delay	Defines the deactivation delay for DO1 on BIO-01 when it is used as a digital output.	0.00 s
	0.03000.0 s	Deactivation delay for DO1.	10 = 1 s
11.17	DI4 configuration	Selects how digital input 4 is used.	Digital input
	Digital input	DI4 is used as a digital input.	0
	Frequency input	DI4 is used as a frequency input 1.	1
11.21	DI5 configuration	Selects how digital input 5 is used.	Digital input
	Digital input	DI5 is used as a digital input.	0
	Frequency 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 16000 Hz	Unscaled value of frequency input 1.	1 = 1 Hz
11.39	Freq in 1 scaled value	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.	-
	-32768.000 32767.000	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: 11.39 11.45 11.45 11.44	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.	50.00
	-32768.000 32767.000	Value corresponding to maximum of frequency input 1.	1 = 1

No.	Name/V	alue	Description	Def/FbEq16
12 Standard AI			Configuration of standard analog inputs.	
12.02	Al force selection		The true readings of the analog inputs can be overridden for e.g. 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: All 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	Name	Value	
	0	Al1	1 = Force Al1 to value of parameter 12.13 Al1 forced value.	
	1	Al2	1 = Force Al2 to value of parameter 12.23 Al2 forced value.	
	215	Reserve	d	
	0000h	.FFFFh	Forced values selector for analog inputs Al1 and Al2.	1 = 1
12.03	Al super function		Selects how the drive reacts when an analog input signal moves out of the minimum and/or maximum limits specified for the input. The supervision applies a margin of 0.5 V or 1.0 mA to the limits. For example, if the maximum limit for the input is 7.000 V, the maximum limit supervision activates at 7.500 V. The inputs and the limits to be observed are selected by parameter 12.04 Al supervision selection.	No action
	No action		No action taken.	0
	Fault		Drive trips on 80A0 AI supervision.	1
	Warning		Drive generates an A8A0 AI supervision warning.	2
	Last spe	eed	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		ef 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

No.	o. Name/Value		Description	Def/FbEq16
12.04	AI supervision selection		Specifies the analog input limits to be supervised. See parameter 12.03 Al supervision function.	0000h
	Bit	Name	Description	
	0	AI1 < MIN	1 = Minimum limit supervision of Al1 active.	
	1	AI1 > MAX	1 = Maximum limit supervision of Al1 active.	
	2	AI2 < MIN	1 = Minimum limit supervision of Al2 active.	
	3	AI2 > MAX	1 = Maximum limit supervision of Al2 active.	
	415	Reserved	<u> </u>	
	0000hFFFFh Activation of analog input supervision.		1 = 1	
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 with parameter 12.15 Al1 unit selection). This parameter is read-only.	-
	0.00022.000 mA or 0.00011.000 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.	-
		.22.000 mA 011.000 V	Forced value of analog input Al1.	1000 = 1 unit
12.15	Al1 uni	t selection	Selects the unit for readings and settings related to analog input Al1.	V
	V		Volts.	2
	mA		Milliamperes.	10

No.	Name/Value	Description	Def/FbEq16
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
	0.00022.000 mA or 0.00011.000 V	Minimum value of Al1.	1000 = 1 unit
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
	0.00022.000 mA or 0.00011.000 V	Maximum value of Al1.	1000 = 1 unit

No.	Name/Value	Description	Def/FbEq16
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)	0.000
		12.17 AI _{in} (12.11)	
		12.19	
	-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 with parameter 12.25 Al2 unit selection). This parameter is read-only.	-
	0.00022.000 mA or 0.00011.000 V	Value of analog input AI2.	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 Al2.	1 = 1
12.23	Al2 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
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	Al2 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

No.	Name/Value	Description	Def/FbEq16	
12.27	Al2 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	
	0.00022.000 mA or 0.00011.000 V Minimum value of Al2.		1000 = 1 unit	
12.28	AI2 max	Defines the maximum site value for analog input Al2. Set the value actually sent to the drive when the analog signal from plant is wound to its maximum setting.	20.000 mAor 10.000 V	
	0.00022.000 mA or 0.00011.000 V	Maximum value of Al2.	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	0.000	
	-32768.000 32767.000	Real value corresponding to minimum Al2 value.	1 = 1	
12.30	AI2 scaled at AI2 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).	-	

No.	Name	/Value		Description	Def/FbEq16
13 Sta	ndard	AO		Configuration of standard analog outputs.	
13.02	AO foi	rce selecti	ion	The source signals of the analog outputs can be overridden for e.g. 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	Name	Valu	ie	
	0	AO1	1 = 1	Force AO1 to value of parameter 13.13 AO1 forced value. (0 = I	Normal mode)
	1	AO2		Force AO2 to value of parameter 13.23 AO2 forced value. (0 = I	Normal mode)
	215	Reserve	ed		
	0000h	FFFFh		Forced values selector for analog outputs AO1 and AO2.	1 = 1
13.11	AO1 a	ctual valu	ie	Displays the value of AO1 in mA or V (depending on whether the input is set to current or voltage with parameter 13.15 AO1 unit selection).	-
				This parameter is read-only.	
		22.000 \ 11.000 \		Value of AO1.	1 = 1 mA
13.12	AO1 s	ource		Selects a signal to be connected to analog output AO1.	Output frequency
	Zero			None.	0
	Motor	speed us	ed	01.01 Motor speed used (page 181).	1
	Reser	ved			2
	Outpu	t frequenc	у	01.06 Output frequency (page 181).	3
	Motor	current		01.07 Motor current (page 181).	4
		current % nominal	of	01.08 Motor current % of motor nom (page 181).	5
	Motor	torque		01.10 Motor torque (page 181).	6
	DC vo	ltage		01.11 DC voltage (page 181).	7
	Outpu	t power		01.14 Output power (page 182).	8
	Reser	ved			9
	Speed	ref ramp	in	23.01 Speed ref ramp input (page 256).	10
	Speed	ref ramp	out	23.02 Speed ref ramp output (page 256).	11
	Speed	ref used		24.01 Used speed reference (page 260).	12
	Reser	ved			13
	Freq r	ef used		28.02 Frequency ref ramp output (page 271).	14
	Reser	ved			15
	Proces	ss PID ou	t	40.01 Process PID output actual (page 332).	16
	Reser	ved			1719
	Temp excitat	sensor 1 tion		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 160).	20

No.	Name/Value	Description	Def/FbEq16
	Temp sensor 2 excitation	The output is used to feed an excitation current to the temperature sensor 2, see parameter 35.21 Temperature 2 source. See also section Motor thermal protection (page 160).	21
	Reserved		2125
	Abs motor speed used	01.61 Abs motor speed used (page 184).	26
	Abs motor speed %	01.62 Abs motor speed % (page 184).	27
	Abs output frequency	01.63 Abs output frequency (page 184).	28
	Reserved		29
	Abs motor torque	01.64 Abs motor torque (page 184).	30
	Abs output power	01.65 Abs output power (page 184).	31
	Abs motor shaft power	01.68 Abs motor shaft power (page 184).	32
	External PID1 out	71.01 External PID act value ((page 378).	33
	Reserved		3436
	AO1 data storage	13.91 AO1 data storage (page 221).	37
	AO2 data storage	13.92 AO2 data storage (page 221).	38
	Other	Source selection (see <i>Terms and abbreviations</i> on page 178).	-
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	Unfiltered signal O = I × (1 - e ^{t/T}) I = filter input (step) O = filter output t = time T = filter time constant	0.100 s
	0.000 30.000 s	Filter time constant.	1000 = 1 s

No.	Name/Value	Description	Def/FbEq16
13.17	AO1 source min	Defines the real minimum value of the signal (selected by parameter 13.12 AO1 source) that corresponds to the minimum required AO1 output value (defined by parameter 13.19 AO1 out at AO1 src min). IAO1 (mA) 13.17 13.18 Signal (real) selected by 13.12 Programming 13.17 as the maximum value and 13.18 as the minimum value inverts the output. IAO1 (mA) 13.20	0.0
		13.18 13.17 Signal (real) selected by 13.12	

о.	Nam	e/Value	Description			Def/FbEq16	
			ling. Every time the source for the AO is changed, the scaling range is User given minimum and maximum values override the automatic values.				
		13.12 AO1 so	urce,	13.17 AO1 source min,	13.18 AO1 source	ce max,	
		13.22 AO2 so	urce	13.27 AO2 source min	13.28 AO2 source	ce max	
	0	Zero		N/A (Output is constant zero.)			
	1	Motor speed ι	ised	0	46.01 Speed sca	aling	
	3	Output freque	псу	0	46.02 Frequency	scaling	
	4	Motor current		0	30.17 Maximum	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	ıp in	0	46.01 Speed sca	aling	
	11	Speed ref ram	p out	0	46.01 Speed sca	aling	
	12	Speed ref use	d	0	46.01 Speed sca	aling	
	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 actua		
	20	Temp sensor	1 excitation	N/A (Analog output is not scal	ed; it is determine	d by the	
	21	Temp sensor	2 excitation	sensor's triggering voltage.)			
	26	Abs motor spe	eed used	0	46.01 Speed sca	aling	
	27	Abs motor spe	eed %	0	46.01 Speed sca	aling	
	28	Abs output fre	quency	0	46.02 Frequency	scaling	
	30	Abs motor tore	que	0	46.03 Torque sca	aling	
	31	Abs output po	wer	0	46.04 Power sca	nling	
	32	Abs motor sha	aft power	•	46.04 Power sca	46.04 Power scaling	
	33	External PID1	out	Min. value of 71.01 External PID act value	Max. value of 71 PID act value	.01 External	
		Other		Min. value of the selected parameter	Max. value of the parameter	e selected	
						1	
	-327	68.032767.0	Real signal v value.	alue corresponding to minimum	AO1 output	1 = 1	
8	AO1	source max	parameter 13 maximum red	eal maximum value of the signa 8.12 AO1 source) that corresponduired AO1 output value (define at at AO1 src max). See parame	nds to the d by parameter	50.0	
	-327	68.032767.0	Real signal v value.	alue corresponding to maximun	n AO1 output	1 = 1	
9	AO1 min			ninimum output value for analog wing at parameter 13.17 AO1 s	, ,	0.000 mA	
		022.000 mA / 011.000 V	Minimum AO	1 output value.		1000 = 1 un	
0	AO1 max	out at AO1 src		naximum output value for analowing at parameter 13.17 AO1 s		20.000 mA	
		022.000 mA / 011.000 V	Maximum AC	01 output value.		1000 = 1 un	
						I	

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. 13.29 13.27 13.28 Signal (real) selected by 13.22 Programming 13.27 as the maximum value and 13.28 as the minimum value inverts the output. 13.30 13.29 13.29 Signal (real) selected by 13.22 Signal (real) selected by 13.29	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.	3.2
	-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.	4.000 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, for example, 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, for example, 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 e	extension module	Configuration of the I/O extension module installed in slot 2. See also section <i>Programmable I/O extensions</i> (page 120). 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 drive 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 to set the value of this parameter manually.	None
	None	Inactive.	0
	BREL	External relay option BREL-01.	5
	BAPO-01	Auxiliary power extension module option BAPO-01.	6
15.02	Detected extension module	I/O extension module detected on the drive.	None
	None	Inactive.	0
	BREL	External relay option BREL-01.	5
	BAPO-01	Auxiliary power extension module option BAPO-01.	6

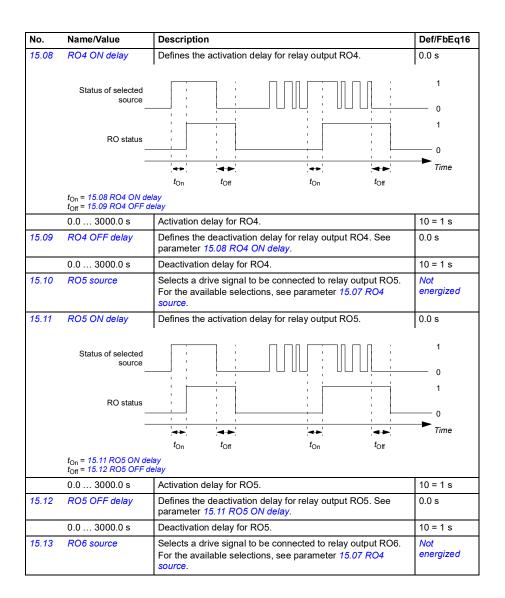
No.	Name/\	Value	Description	Def/FbEq16
15.04	RO status		Displays the status of the relay outputs RO4 and RO75 and digital output DO1 on the extension module. Bits 01 indicates the status of RO4RO7. Example: 100101b = RO4 is on, RO5 is off. This parameter is read-only.	-
	Bit	Name	Description	
	0	RO4	1 = Relay output 4 is ON.	
	1	RO5	1 = Relay output 5 is ON	
	2	RO6	1 = Relay output 6 is ON	
	3	RO7	1 = Relay output 7 is ON	
	415	Reserve	d	
5.05		FFFFh		1 = 1 0000h
5.05				
5.05	RO ford	Name	The electrical statuses of the relay/digital outputs can be overridden for e.g. testing purposes. A bit in parameter 15.06 RO 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
5.05	RO ford	Name RO4	The electrical statuses of the relay/digital outputs can be overridden for e.g. testing purposes. A bit in parameter 15.06 RO 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). Value 1 = Force RO4 to value of bit 0 of parameter 15.06 RO forced data	0000h
5.05	RO ford	Name R04 R05	The electrical statuses of the relay/digital outputs can be overridden for e.g. testing purposes. A bit in parameter 15.06 RO 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). Value 1 = Force RO4 to value of bit 0 of parameter 15.06 RO forced dat 1 = Force RO5 to value of bit 1 of parameter 15.06 RO forced dat	0000h
5.05	RO force Bit 0 1 2	Name RO4 RO5 RO6	The electrical statuses of the relay/digital outputs can be overridden for e.g. testing purposes. A bit in parameter 15.06 RO 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). Value 1 = Force RO4 to value of bit 0 of parameter 15.06 RO forced dat 1 = Force RO5 to value of bit 2 of parameter 15.06 RO forced dat 1 = Force RO6 to value of bit 2 of parameter 15.06 RO forced dat	a. a. a.
15.05	Bit 0 1 2 3	Name RO4 RO5 RO6 RO7	The electrical statuses of the relay/digital outputs can be overridden for e.g. testing purposes. A bit in parameter 15.06 RO 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). Value 1 = Force RO4 to value of bit 0 of parameter 15.06 RO forced dat 1 = Force RO5 to value of bit 2 of parameter 15.06 RO forced dat 1 = Force RO7 to value of bit 3 of parameter 15.06 RO forced dat 1 = Force RO7 to value of bit 3 of parameter 15.06 RO forced dat 1 = Force RO7 to value of bit 3 of parameter 15.06 RO forced dat	a. a. a.
5.05	RO force Bit 0 1 2	Name RO4 RO5 RO6	The electrical statuses of the relay/digital outputs can be overridden for e.g. testing purposes. A bit in parameter 15.06 RO 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). Value 1 = Force RO4 to value of bit 0 of parameter 15.06 RO forced dat 1 = Force RO5 to value of bit 2 of parameter 15.06 RO forced dat 1 = Force RO7 to value of bit 3 of parameter 15.06 RO forced dat 1 = Force RO7 to value of bit 3 of parameter 15.06 RO forced dat 1 = Force RO7 to value of bit 3 of parameter 15.06 RO forced dat	a. a. a.

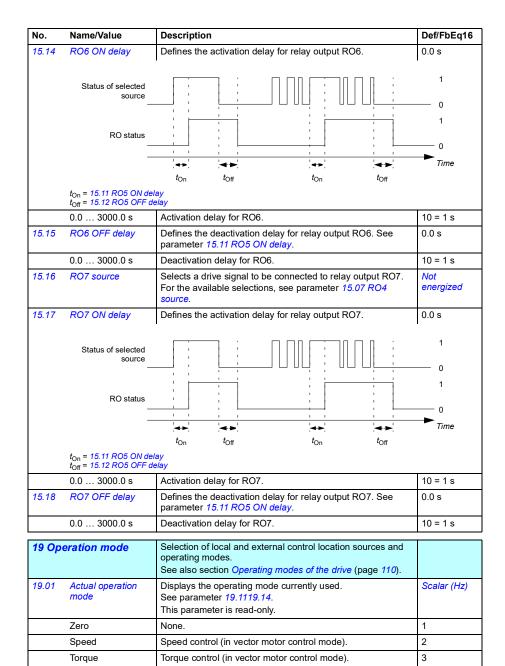
No.	Name/Value	Description	Def/FbEq16
15.06	RO forced data	Allows the data value of a forced relay or digital output to be changed from 0 to 3. It is only possible to force an output that has been selected in parameter 15.05 RO force selection. Bits 03 are the forced values for RO4RO7.	0000h

Bit	Name	Description
0	RO4	Force the value of this bit to RO4, if so defined in parameter 15.05 RO force selection.
1	RO5	Force the value of this bit to RO5, if so defined in parameter 15.05 RO force selection.
2	RO6	Force the value of this bit to RO6, if so defined in parameter 15.05 RO force selection.
3	RO7	Force the value of this bit to RO7, if so defined in parameter 15.05 RO force selection.
415	Reserved	

	0000hFFFFh	Forced values of relay/digital outputs.	1 = 1
15.07	RO4 source	Selects a drive signal to be connected to relay output RO4.	Not energized
	Not energized	Output is not energized.	0
	Energized	Output is energized.	1
	Ready run	Bit 1 of 06.11 Main status word (see page 190).	2
	Reserved		3
	Enabled	Bit 0 of 06.16 Drive status word 1 (see page 191).	4
	Started	Bit 5 of 06.16 Drive status word 1 (see page 191).	5
	Magnetized	Bit 1 of 06.17 Drive status word 2 (see page 191).	6
	Running	Bit 6 of 06.16 Drive status word 1 (see page 191).	7
	Ready ref	Bit 2 of 06.11 Main status word (see page 190).	8
	At setpoint	Bit 8 of 06.11 Main status word (see page 190).	9
	Reverse	Bit 2 of 06.19 Speed control status word (see page 192).	10
	Zero speed	Bit 0 of 06.19 Speed control status word (see page 192).	11
	Above limit	Bit 10 of 06.17 Drive status word 2 (see page 191).	12
	Warning	Bit 7 of 06.11 Main status word (see page 190).	13
	Fault	Bit 3 of 06.11 Main status word (see page 190).	14
	Fault (-1)	Inverted bit 3 of 06.11 Main status word (see page 190).	15
	Fault/Warning	Bit 3 of 06.11 Main status word OR bit 7 of 06.11 Main status word (see page 190).	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

No.	Name/Value	Description	Def/FbEq16
	Motor temp	Fault 4981 External temperature 1 or 4982 External temperature 2 has occurred.	21
	Brake command	Bit 0 of 44.01 Brake control status (see page 352).	22
	Ext2 active	Bit 11 of 06.16 Drive status word 1 (see page 191).	23
	Remote control	Bit 9 of 06.11 Main status word (see page 190).	24
	Reserved		2526
	Timed function 1	Bit 0 of 34.01 Timed functions status (see page 307).	27
	Timed function 2	Bit 1 of 34.01 Timed functions status (see page 307).	28
	Timed function 3	Bit 2 of 34.01 Timed functions status (see page 307).	29
	Reserved		3032
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 299).	33
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 299).	34
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 299).	35
	Reserved		3638
	Start delay	Bit 13 of 06.17 Drive status word 2 (see page 191).	39
	RO/DIO control word bit0	Bit 0 of 10.99 RO/DIO control word (see page 204).	40
	RO/DIO control word bit1	Bit 1 of 10.99 RO/DIO control word (see page 204).	41
	RO/DIO control word bit2	Bit 2 of 10.99 RO/DIO control word (see page 204).	42
	Reserved		4344
	PFC1	Bit 0 of 76.01 PFC status (see page 380).	45
	PFC2	Bit 1 of 76.01 PFC status (see page 380).	46
	PFC3	Bit 2 of 76.01 PFC status (see page 380).	47
	PFC4	Bit 3 of 76.01 PFC status (see page 380).	48
	PFC5	Bit 4 of 76.01 PFC status (see page 380).	49
	PFC6	Bit 5 of 76.01 PFC status (see page 380).	50
	Reserved		5152
	Event word 1	Event word 1 = 1 if any bit of 04.40 Event word 1 (see page 186) is 1, that is, if any warning, fault or pure event that has been defined with parameters 04.4104.71 is on.	53
	User load curve	Bit 3 (Outside load limit) of 37.01 ULC output status word (see page 329).	61
	RO/DIO control word	For 15.07 RO4 source: Bit 3 (RO4) of 10.99 RO/DIO control word (see page 204). For 15.10 RO5 source: Bit 4 (RO5) of 10.99 RO/DIO control word (see page 204).	62
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 178).	-





No.	Name/Value	Description	Def/FbEq16
	Min	The torque selector is comparing the output of the speed controller (25.01 Torque reference speed control) and torque reference (26.74 Torque ref ramp out) and the smaller of the two is used (in vector motor control mode).	4
	Max	The torque selector is comparing the output of the speed controller (25.01 Torque reference speed control) and torque reference (26.74 Torque ref ramp out) and the greater of the two is used (in vector motor control mode).	5
	Add	The speed controller output is added to the torque reference (in vector motor control mode).	6
	Reserved		79
	Scalar (Hz)	Frequency control 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 307).	19
	Timed function 2	Bit 1 of 34.01 Timed functions status (see page 307).	20
	Timed function 3	Bit 2 of 34.01 Timed functions status (see page 307).	21
	Reserved		2224
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 299).	25
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 299).	26
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 299).	27
	Reserved		2831
	EFB MCW bit 11	Control word bit 11 received through the embedded fieldbus interface.	32
	FBAA 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 178).	-
19.12	Ext1 control mode	Selects the operating mode for external control location EXT1 in vector motor control mode.	Speed
	Zero	None.	1

No.	Name/Value	Description	Def/FbEq16
	Speed	Speed control. The torque reference used is 25.01 Torque reference speed control (output of the speed reference chain).	2
	Torque	Torque control. The torque reference used is 26.74 Torque ref ramp out (output of the torque reference chain).	3
	Minimum	Combination of selections <i>Speed</i> and <i>Torque</i> : the torque selector compares the speed controller output (25.01 Torque reference speed control) and the torque reference (26.74 Torque ref ramp out) and selects the smaller of the two. If speed error becomes negative, the drive follows the speed controller output until speed error becomes positive again. This prevents the drive from accelerating uncontrollably if the load is lost in torque control.	4
	Maximum	Combination of selections <i>Speed</i> and <i>Torque</i> : the torque selector compares the speed controller output (25.01 Torque reference speed control) and the torque reference (26.74 Torque ref ramp out) and selects the greater of the two. If speed error becomes positive, the drive follows the speed controller output until speed error becomes negative again. This prevents the drive from accelerating uncontrollably if the load is lost in torque control.	5
19.14	Ext2 control mode	Selects the operating mode for external control location EXT2 in vector motor control mode. For the selections, see parameter 19.12 Ext1 control mode.	Speed
19.16	Local control mode	Selects the operating mode for local control in vector motor control mode.	Speed
	Speed	Speed control. The torque reference used is 25.01 Torque reference speed control (output of the speed reference chain).	0
	Torque	Torque control. The torque reference used is 26.74 Torque ref ramp out (output of the torque reference chain).	1
19.17	Local control disable	Enables/disables local control (start and stop buttons on the control panel, and the local controls on the PC tool). WARNING! Before disabling local control, ensure that the control panel is not needed for stopping the drive.	No
	No	Local control enabled.	0
	Yes	Local control disabled.	1

20 Start/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 105).	
20.01 Ext1 commands	Selects the source of start, stop and direction commands for external control location 1 (EXT1). See parameter 20.21 for the determination of the actual direction. See also parameters 20.0220.05.	In1 Start; In2 Dir
Not selected	No start or stop command sources selected.	0

No.	Name/Value	Description			Def/FbEq16		
	In1 Start	The source of the start a parameter 20.03 Ext1 in source bits are interpret	11 source. The state tra		1		
		State of source 1 (20.	.03) Command				
		0 -> 1 (20.02 = Edge 1 (20.02 = Level)	Start				
		0	Stop				
	In1 Start; In2 Dir	signal; the source select determines the direction	The source selected by 20.03 Ext1 in1 source is the start ignal; the source selected by 20.04 Ext1 in2 source etermines the direction. The state transitions of the source its are interpreted as follows:				
		State of source 1 (20.03)	State of source 2 (20.04)	Command			
		0	Any	Stop			
		0 -> 1 (20.02 = Edge)	0	Start forward			
		1 (20.02 = Level)	1	Start reverse			
	In1 Start fwd; In2 Start rev The source selected by 20.03 Ext1 in1 source is the forward start signal; the source selected by 20.04 Ext1 in2 source is the reverse start signal. The state transitions of the source bits are interpreted as follows:				3		
		State of source 1 (20.03)	State of source 2 (20.04)	Command			
		0	0	Stop			
		0 -> 1 (20.02 = Edge) 1 (20.02 = Level)	0	Start forward			
		0	0 -> 1 (20.02 = Edge) 1 (20.02 = Level)	Start reverse			
		1	1	Stop			
	In1P Start; In2 Stop	The sources of the start parameters 20.03 Ext1 The state transitions of follows:	in1 source and 20.04 E.	xt1 in2 source	4		
		State of source 1 (20.03)	State of source 2 (20.04)	Command			
		0 -> 1	1	Start			
		Any	0	Stop			
 Notes: Parameter 20.02 Ext1 start trigger type has no effect with this setting. When source 2 is 0, the Start and Stop keys on the control panel are disabled. 							

No.	Name/Value	Description				Def/FbEq16
	In1P Start; In2 Stop; In3 Dir	parameters 20. The source seledirection. The sinterpreted as f	03 Ext1 in1 sou ected by 20.05 I state transitions ollows:	erce and 20.04 in Ext1 in3 source of the source b	are selected by Ext1 in2 source. determines the bits are	5
		State of source 1 (20.03)	State of source 2 (20.04)	State of source 3 (20.05)	Command	
		0 -> 1	1	0	Start forward	
		0 -> 1	1	1	Start reverse	
		Any	0	Any	Stop	
		this setting.			s no effect with	
	In1P Start fwd; In2P Start rev; In3 Stop	The sources of the start and stop commands are selected by parameters 20.03 Ext1 in1 source, 20.04 Ext1 in2 source and 20.05 Ext1 in3 source. The source selected by 20.05 Ext1 in3 source determines the stop. The state transitions of the source bits are interpreted as follows:				6
		State of source 1 (20.03)	State of source 2 (20.04)	State of source 3 (20.05)	Command	
		0 -> 1	Any	1	Start forward	
		Any	0 -> 1	1	Start reverse	
		Any Note: Paramete with this setting		0 tart trigger type	Stop has no effect	
	Reserved					710
	Control panel	The start and si				11
	Fieldbus A	The start and st A. Note: Set also			fieldbus adapter	12
	Reserved					13
	Embedded fieldbus	The start and s fieldbus interfact Note: Set also	ce.			14
20.02	Ext1 start trigger type	Defines whether the start signal for external control location EXT1 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 20.01 Ext1 commands.			Level	
	Edge	The start signal	is edge-trigger	ed.		0
	Level	The start signal	is level-trigger	ed.		1
20.03	Ext1 in1 source	Selects source			mmands.	DI1
	Always off	Always off.				0
	Always on	Always on.				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	Digital input DI5 (10.02 DI delayed status, bit 4).			
	DI6	Digital input DI6 (10.02	Digital input DI6 (10.02 DI delayed status, bit 5).			
	Reserved					
	Timed function 1	Bit 0 of 34.01 Timed fun	octions status (see page	e 307).	18	
	Timed function 2	Bit 1 of 34.01 Timed fun	octions status (see page	e 307).	19	
	Timed function 3	Bit 2 of 34.01 Timed fun	octions status (see page	e 307).	20	
	Reserved				2123	
	Supervision 1	Bit 0 of 32.01 Supervision	on status (see page 29	9).	24	
	Supervision 2	Bit 1 of 32.01 Supervision	on status (see page 29	9).	25	
	Supervision 3	Bit 2 of 32.01 Supervision	on status (see page 29	9).	26	
	Other [bit]	Source selection (see To	erms and abbreviations	on page 178).	-	
20.04	Ext1 in2 source	·	Selects source 2 for parameter 20.01 Ext1 commands. For the available selections, see parameter 20.03 Ext1 in1 source.			
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 steexternal control location See parameter 20.21 for direction. See also para	2 (EXT2). r the determination of t		Not selected	
	Not selected	No start or stop comman	nd sources selected.		0	
	In1 Start	The source of the start a parameter 20.08 Ext2 in source bits are interpret State of source 1 (20.	n1 source. The state tra ed as follows:		1	
		0 -> 1 (20.07 = Edge	2)			
		1 (20.07 = Level)	Start			
		0	Stop			
	In1 Start; In2 Dir	The source selected by signal; the source selected determines the direction bits are interpreted as for	2			
		State of source 1 (20.08)	State of source 2 (20.09)	Command		
		0	Any	Stop		
		0 -> 1 (20.07 = Edge)	0	Start forward		
		1 (20.07 = Level)	1	Start reverse		

No.	Name/Value	Description				Def/FbEq16
	In1 Start fwd; In2 Start rev	The source selected by 20.08 Ext2 in1 source is the forward start signal; the source selected by 20.09 Ext2 in2 source is the reverse start signal. The state transitions of the source bits are interpreted as follows:				3
		State of source (20.08)	ce 1 Sta	te of source 2 (20.09)	Command	
		0		0	Stop	
		0 -> 1 (20.07 = E 1 (20.07 = Let		0	Start forward	
		0		1 (20.07 = Edge) 20.07 = Level)	Start reverse	
		1		1	Stop	
	In1P Start; In2 Stop	The sources of the start and stop commands are selected by parameters 20.08 Ext2 in1 source and 20.09 Ext2 in2 source. The state transitions of the source bits are interpreted as follows:				4
		State of source (20.08)	e 1 State	e of source 2 (20.09)	Command	
		0 -> 1		1	Start	
		Any		0	Stop	
		Notes: Parameter 20. this setting. When source 2 panel are disal	2 is 0, the Sta	trigger type has		
	In1P Start; In2 Stop; In3 Dir	The sources of the parameters 20.08. The source select direction. The statinterpreted as follows:	B Ext2 in1 souted by 20.10 te transitions	ırce and 20.09 E Ext2 in3 source	xt2 in2 source. determines the	5
		State of source 1 (20.08)	State of source 2 (20.09)	State of source 3 (20.10)	Command	
		0 -> 1	1	0	Start forward	
		0 -> 1	1	1	Start reverse	
		Any	0	Any	Stop	
		Notes: • Parameter 20.07 Ext2 start trigger type has no effect with this setting. • When source 2 is 0, the Start and Stop keys on the control panel are disabled.				

No.	Name/Value	Description				Def/FbEq16	
	In1P Start fwd; In2P Start rev; In3 Stop	parameters 20. 20.10 Ext2 in3 s source determine	The sources of the start and stop commands are selected by parameters 20.08 Ext2 in1 source, 20.09 Ext2 in2 source and 20.10 Ext2 in3 source. The source selected by 20.10 Ext2 in3 source determines the direction. The state transitions of the source bits are interpreted as follows: State of State of State of State of				
		State of source 1 (20.08)	State of source 2 (20.09)	State of source 3 (20.10)	Command		
		0 -> 1	Any	1	Start forward		
		Any	0 -> 1	1	Start reverse		
		Any	Any	0	Stop		
		Note: Paramete with this setting		tart trigger type	has no effect		
	Reserved		710				
	Control panel	The start and s panel (or PC co				11	
	Fieldbus A	A.	•		ieldbus adapter	12	
		Note: Set also	20.07 Ext2 star	t trigger type to	Level.		
	Reserved					13	
	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 EXT2 is edge-to Note: This para signal is selected parameter 20.00	riggered or leve ameter is not eff ed. See the des	l-triggered. fective if a puls criptions of the	e-type start	Level	
	Edge	The start signal	is edge-trigger	ed.		0	
	Level	The start signal	is level-trigger	ed.		1	
20.08	Ext2 in1 source	Selects source For the available source.	•			Always off	
20.09	Ext2 in2 source	Selects source For the available source.	•			Always off	
20.10	Ext2 in3 source	Selects source For the available source.				Always off	
20.11	Run enable stop mode	Selects the way signal switches The source of t 20.12 Run enal	off. he run enable s		e run enable ed by parameter	Coast	
	Coast		sts to a stop.	nical brake is u	ors of the drive.	0	
	Ramp	Stop along the group 23 Spee				1	
	Torque limit	Stop according	to torque limits	(parameters 3	0.19 and 30.20).	2	

No.	Name/Value	Description	Def/FbEq16
20.12	Run enable 1 source	Selects the source of the external run enable signal. If the run enable signal is switched off, the drive will not start. If already running, the drive will stop according to the setting of parameter 20.11 Run enable stop mode. 1 = Run enable signal on. See also parameter 20.19 Enable start command.	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 307).	18
	Timed function 2	Bit 1 of 34.01 Timed functions status (see page 307).	19
	Timed function 3	Bit 2 of 34.01 Timed functions status (see page 307).	20
	Reserved		2123
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 299).	24
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 299).	25
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 299).	26
	Reserved		2729
	FBA A MCW bit 3	Control word bit 3 received through fieldbus interface A.	30
	Reserved		31
	EFB MCW bit 3	Control word bit 3 received through the embedded fieldbus interface.	31
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 178).	-
20.19	Enable start command	Selects the source for the start enable signal. 1 = Start enable. With the signal switched off, any drive start command is inhibited. (Switching the signal off while the drive is running will not stop the drive.) See also parameter 20.12 Run enable 1 source.	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 307).	18

No.	Name/Value	•	Description			Def/FbEq16
	Timed functi	ion 2	Bit 1 of 34.01 Time	ed functions status (see page	: 307).	19
	Timed functi	ion 3	Bit 2 of 34.01 Time	ed functions status (see page	: 307).	20
	Reserved					2123
	Supervision	1	Bit 0 of 32.01 Supe	ervision status (see page 299	9).	24
	Supervision	2	Bit 1 of 32.01 Supe	ervision status (see page 299	9).	25
	Supervision	3	Bit 2 of 32.01 Supe	ervision status (see page 299	9).	26
	Other [bit]		Source selection (s	see Terms and abbreviations	on page 178).	-
20.21	Direction		rather than the sig In the table the act parameter 20.21 D	n lock. Defines the direction on of the reference, except in ual drive rotation is shown a direction and Direction commext1 commands or 20.06 Ext	some cases. s a function of and (from	Request
		Direction Forward	n command =	Direction command = Reverse	Direction comi	mand not
	Par. 20.21 Direction = Forward	Forward		Forward	Forward	
	Par. 20.21 Direction = Reverse	Reverse		Reverse	Reverse	
	Par. 20.21 Direction = Request	Consipotent Joggi refere used	rrence from tant, Motor tiometer, PID, Last, ng or Panel ence, reference	Reverse, but If reference from Constant, PID or Jogging reference, reference used as is. If reference from the network, reference, reference multiplied by -1.	Forward	
	Request		command (parame commands). If the reference co speeds/frequencie safe, Last speed re	the direction is selected by a eter 20.01 Ext1 commands of mes from Constant (constant s), Motor potentiometer, PID eference, Jogging speed or F	20.06 Ext2 t , Speed ref	0
			If the reference co if the direction cas is if the direction cas multiplied by -1.		rence is	
reference. (Negativ			reference. (Negativ	ard regardless of the sign of we reference values are repla values are used as is.)		1
	Reverse		reference. (Negativ	rse regardless of the sign of ve reference values are repla values are multiplied by -1.)		2

No.	Name/Value	Description	Def/FbEq16
20.22	Enable to rotate	Setting this parameter to 0 stops motor rotating but does not affect any other conditions for rotating. Setting the parameter back to 1 starts motor rotating again. This parameter can be used for example with a signal from some external equipment to prevent the motor rotating before the equipment is ready. When this parameter is 0 (rotating of the motor is disabled), bit 13 of parameter 06.16 Drive status word 1 is set to 0.	Selected
	Not selected	0 (always off).	0
	Selected	1 (always on).	1
	DI1	Digital input DI1 (10.02 DI delayed status, bit 0).	2
	DI2	Digital input DI2 (10.02 DI delayed status, bit 1).	3
	DI3	Digital input DI3 (10.02 DI delayed status, bit 2).	4
	DI4	Digital input DI4 (10.02 DI delayed status, bit 3).	5
	DI5	Digital input DI5 (10.02 DI delayed status, bit 4).	6
	DI6	Digital input DI6 (10.02 DI delayed status, bit 5).	7
	Reserved		817
	Timed function 1	Bit 0 of 34.01 Timed functions status (see page 307).	18
	Timed function 2	Bit 1 of 34.01 Timed functions status (see page 307).	19
	Timed function 3	Bit 2 of 34.01 Timed functions status (see page 307).	20
	Reserved		2123
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 299).	24
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 299).	25
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 299).	26
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 178).	-
20.25	Jogging enable	Selects the source for a jog enable signal. (The sources for jogging activation signals are selected by parameters 20.26 Jogging 1 start source and 20.27 Jogging 2 start source.) 1 = Jogging is enabled. 0 = Jogging is disabled. Notes: Jogging is supported in vector control mode only. Jogging can be enabled only when no start command from an external control location is active. On the other hand, if jogging is already enabled, the drive cannot be started from an external control location (apart from inching commands through fieldbus).	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

No.	Name/Value	Description	Def/FbEq16
	Timed function 1	Bit 0 of 34.01 Timed functions status (see page 307).	18
	Timed function 2	Bit 1 of 34.01 Timed functions status (see page 307).	19
	Timed function 3	Bit 2 of 34.01 Timed functions status (see page 307).	20
	Reserved		2123
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 299).	24
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 299).	25
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 299).	26
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 178).	-
20.26	Jogging 1 start source	If enabled by parameter 20.25 Jogging enable, selects the source for the activation of jogging function 1. (Jogging function 1 can also be activated through fieldbus regardless of parameter 20.25.) 1 = Jogging 1 active. Notes: Jogging is supported in vector control mode only. If both jogging 1 and 2 are activated, the one that was activated first has priority. This parameter cannot be changed while the drive is running.	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 307).	18
	Timed function 2	Bit 1 of 34.01 Timed functions status (see page 307).	19
	Timed function 3	Bit 2 of 34.01 Timed functions status (see page 307).	20
	Reserved		2123
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 299).	24
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 299).	25
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 299).	26
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 178).	-

No. Name/Value	Description	Def/FbEq16
20.27 Jogging 2 start source	If enabled by parameter 20.25 Jogging enable, selects the source for the activation of jogging function 2. (Jogging function 2 can also be activated through fieldbus regardless of parameter 20.25.) 1 = Jogging 2 active. For the selections, see parameter 20.26 Jogging 1 start source. Notes: Jogging is supported in vector control mode only. If both jogging 1 and 2 are activated, the one that was activated first has priority. This parameter cannot be changed while the drive is running.	Not selected
21 Start/stop mode	Start and stop modes; emergency stop mode and signal source selection; DC magnetization settings.	
21.01 Start mode	Selects the motor start function for the vector motor control mode, ie. when 99.04 Motor control mode is set to Vector. Notes: The start function for the scalar motor control mode is selected by parameter 21.19 Scalar start mode. Starting into a rotating motor is not possible when DC magnetizing is selected (Fast or Const time). With permanent magnet motors, Automatic start mode must be used. This parameter cannot be changed while the drive is running. See also section DC magnetization (page 146).	Automatic
Fast	The drive pre-magnetizes the motor before start. The pre- magnetizing time is determined automatically, being typically 200 ms to 2 s depending on motor size. This mode should be selected if a high break-away torque is required.	0
Const time	The drive pre-magnetizes the motor before start. The pre-magnetizing time is defined by parameter 21.02 Magnetization time. This mode should be selected if constant pre-magnetizing time is required (e.g. if the motor start must be synchronized with the release of a mechanical brake). This setting also guarantees the highest possible break-away torque when the pre-magnetizing time is set long enough. WARNING! The drive will start after the set magnetizing time has passed even if motor magnetization is not completed. In applications where a full break-away torque is essential, ensure that the constant magnetizing time is long enough to allow generation of full magnetization and torque.	1
Automatic	Automatic start guarantees optimal motor start in most cases. It includes the flying start function (starting into a rotating motor) and the automatic restart function. The drive motor control program identifies the flux as well as the mechanical state of the motor and starts the motor instantly under all conditions. Note: If parameter 99.04 Motor control mode is set to Scalar, no flying start or automatic restart is possible unless parameter 21.19 Scalar start mode is set to Automatic.	2

No.	Name/Value	Description		Def/FbEq16
21.02	Magnetization time	Defines the pre-magnetization time when parameter 21.01 Start mode is set to Const time (in vector motor control mode), or parameter 21.19 Scalar start mode is set to Const time or Torque boost (in scalar motor control mode). After the start command, the drive automatically premagnetizes the motor for the set time. To ensure full magnetizing, set this parameter to the same value as, or higher than, the rotor time constant. If not known, use the rule-of-thumb value given in the table below: Motor rated power Constant magnetizing time		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 be running.	pe changed while the drive is	
	010000 ms	Constant DC magnetizing time).	1 = 1 ms
21.03	Stop mode	Selects the way the motor is stopped when a stop command is received. Additional braking is possible by selecting flux braking (see parameter 97.05 Flux braking).		Coast
	Coast	Stop by switching off the output The motor coasts to a stop. WARNING! If a mechal safe to stop the drive by	nical brake is used, ensure it is	0
	Ramp	Stop along the active decelera group 23 Speed reference ram Frequency reference chain on	<i>p</i> on page 256 or 28	1
	Torque limit	Stop according to torque limits (This mode is only possible in v		2
21.04	Emergency stop mode	Selects the way the motor is st stop command is received. The source of the emergency s parameter 21.05 Emergency s	stop signal is selected by	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 <i>Rush control</i> [page 150]). 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. With the drive stopped: • 1 = Starting allowed. • 0 = Starting not allowed.		1

No.	Name/Value	Description	Def/FbEq16
	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 178).	-
21.06	Zero speed limit	Defines the zero speed limit. The motor is stopped along a 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.	30.00 rpm
	0.0030000.00 rpm	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.	0 ms
		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.	
		Time	
		Time	
		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. Zero speed delay can be used e.g. with the jogging function.	
		Speed	
		Speed controller remains active. Motor is decelerated to true zero speed. 21.06 Zero speed limit Delay Time	
	030000 ms	Zero speed delay.	1 = 1 ms

No.	Name/V	alue	Des	scription	Def/FbEq16
		ent control	Not app exte mag pre	tivates/deactivates the DC hold and post-magnetization ctions. See section <i>DC magnetization</i> (page 146). te: DC magnetization causes the motor to heat up. In plications where long DC magnetization times are required, emally ventilated motors should be used. If the DC gnetization period is long, DC magnetization cannot event the motor shaft from rotating if a constant load is policed to the motor.	0000Ь
	Bit	Name	,	Value	
	0	DC hold		1 = Enable DC hold. See section <i>DC hold</i> (page 147).	
	1	Post- magnetizat	ion (Note: The DC hold function has no effect if the start signal is 1 = Enable post-magnetization. See section Settings and di (page 147). Notes: Post-magnetization is only available when ramping is the stop mode (see parameter 21.03 Stop mode). 	iagnostics
				 Post-magnetization with scalar control is not supported a 	t the moment.
	2	DC brake		1 = Enable DC brake.	
	315	Reserved			
	0000b	.0011b	DC	magnetization selection.	1 = 1
21.09	DC hold	speed	par	fines the DC hold speed in speed control mode. See rameter 21.08 DC current control, and section DC hold ge 147).	5.00 rpm
	0.001	000.00 rpm	DC	hold speed.	See par. 46.01
21.10	DC curro reference		Cur DC Afte ma	fines the DC hold current in percent of the motor nominal rent. See parameter 21.08 DC current control, and section imagnetization (page 146). er 100 seconds post-magnetization time, the maximum gnetization current is limited to the magnetization current responding to the actual flux reference.	30.0%
	0.010	0.0%	DC	hold current.	1 = 1%
21.11	Post ma time	gnetization	acti def	fines the length of time for which post-magnetization is ive after stopping the motor. The magnetization current is ined by parameter 21.10 DC current reference. e parameter 21.08 DC current control.	0 s
	03000) s	Pos	st-magnetization time.	1 = 1 s
21.14	Pre-hea source	ting input	The star	ects the source for controlling pre-heating for the motor. e status of the pre-heating is shown as bit 2 of 06.21 Drive tus word 3. tes: The heating function requires that STO is not triggered. The heating function requires that the drive is not faulted.	Off
	Off		0. F	Pre-heating is always deactivated.	0
	On		1. F	Pre-heating is always activated when the drive is stopped.	1
	DI1		Dig	ital input DI1 (10.02 DI delayed status, bit 0).	2
	DI2		Dig	ital input DI2 (10.02 DI delayed status, bit 1).	3
	DI3		Dig	ital input DI3 (10.02 DI delayed status, bit 2).	4
	DI4		Dig	ital input DI4 (10.02 DI delayed status, bit 3).	5
	DI5		Dia	ital input DI5 (10.02 DI delayed status, bit 4).	6

No.	Name/Value	Description	Def/FbEq16
	DI6	Digital input DI6 (10.02 DI delayed status, bit 5).	7
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 299).	8
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 299).	9
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 299).	10
	Timed function 1	Bit 0 of 34.01 Timed functions status (see page 307).	11
	Timed function 2	Bit 1 of 34.01 Timed functions status (see page 307).	12
	Timed function 3	Bit 2 of 34.01 Timed functions status (see page 307).	13
	MCW user bit 0	Bit 12 of 06.01 Main control word (see page 189).	16
	MCW user bit 1	Bit 13 of 06.01 Main control word (see page 189).	17
	MCW user bit 2	Bit 14 of 06.01 Main control word (see page 189).	18
	MCW user bit 3	Bit 15 of 06.01 Main control word (see page 189).	19
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 178).	-
21.15	Pre-heating time delay	Defines the time delay before pre-heating starts after the drive is stopped.	60 s
	103000 s	Pre-heating time delay.	1 = 1 s
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 156). 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. See also parameter 21.34 Force auto restart. This parameter has effect only if parameter 95.04 Control board supply is set to External 24V. 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 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 146).	Normal
	Normal	Immediate start from zero speed.	0

No. N	lame/Value	Description	Def/FbEq16
C	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
А	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
Т	orque 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 40% of nominal frequency 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 pre- magnetizing time has passed even if motor magnetization is not completed. In applications where a full break-away torque is essential, ensure that the constant magnetizing time is long enough to allow generation of full magnetization and torque.	3
Δ	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
F	Flying start	The drive automatically selects the correct output frequency to start a rotating motor. If the motor is already rotating, drive will start smoothly at the current frequency. — The mode will start the motor with vector control and switch to scalar control on the fly when the motor speed has been found. Compared to the Automatic start mode, Flying start detects the motor speed faster. Flying start requires more accurate information about motor model. Therefore standstill ID run is done automatically when the drive is started for the first time after selecting Flying start. Motor plate values should be accurate. Wrong plate values may decrease the starting performance.	5
F	Flying start+boost	Flying start with torque boost. Flying start is performed first and the motor is magnetized. If the speed is found to be zero, torque boost is applied.	6

No.	Name/Value	Description	Def/FbEq16
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 147).	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. Can be used for permanent magnet synchronous motors only.	50.0%
	10.0200.0%	Value in percent of the nominal motor current.	1 = 1%
21.25	Smooth start speed	Output frequency up to which the current vector rotation is used. See parameter 21.19 Scalar start mode. 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	Defines the maximum supplied current to motor when (21.19 Scalar start mode is set to Torque boost (see page 244). Parameter value is in percent of the motor nominal current. Nominal value of the parameter is 100.0%. Torque boost is only applied at start, ending when output frequency exceeds 40% of nominal frequency or when output frequency is equal to reference. Can be used in scalar motor control mode only.	100.0%
	15.0300.0%	Value in percent of the nominal motor current.	1 = 1%
21.27	Torque boost time	Defines the minimum and maximum torque boost time. If torque boost time is less than 40% of frequency acceleration time (see parameters 28.72 and 28.74), then torque boost time is set at 40% of frequency acceleration time.	20.0 s
	0.060.0 s	Nominal motor time.	1 = 1%
		•	

No.	Name/Value	Description	Def/FbEq16
21.30	Speed compensated stop mode	Selects the method used to stop the drive. See also section. Speed compensated stop (page 153). Speed compensated stop is active only if the operation mode is not torque, and parameter 21.03 Stop mode is Ramp, or parameter 20.11 Run enable stop mode is Ramp (in case Run enable is missing).	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%
21.34	Force auto restart	Forces automatic restart. The parameter is applicable only if parameter 95.04 Control board supply is set to External 24V.	Disable
	Disable	Force auto restart disabled. Parameter 21.18 Auto restart time is in effect if its value is more than 0.0 s.	0
	Enable	Force auto restart enabled. Parameter 21.18 Auto restart time is ignored. The drive never trips on the undervoltage fault and the start signal is on forever. When he DC voltage is restored, the normal operation continues.	1
21.35	Preheating power	Defines the power used to heat the motor.	0.00
	0.0010.00 kW	Preheating power.	100 = 1 kW
21.36	Preheating unit	Defines if preheating is specified as current or power.	Current
	Current		0
	Power		1

No.	Name/Value	Description	Def/FbEq16
22 Spe selecti	eed reference ion	Speed reference selection; motor potentiometer settings. See the control chain diagrams on pages 526530.	
22.01	Speed ref unlimited	Displays the output of the speed reference selection block. See the control chain diagram on page 527. This parameter is read-only.	-
	-30000.00 30000.00 rpm	Value of the selected speed reference.	See par. 46.01
22.11	Ext1 speed ref1	Selects EXT1 speed reference source 1. Two signal sources can be defined by this parameter and 22.12 Ext1 speed ref2. A mathematical function (22.13 Ext1 speed function) applied to the two signals creates an EXT1 reference (A in the figure below). 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 parameters 22.18 Ext2 speed ref1, 22.19 Ext2 speed ref2 and 22.20 Ext2 speed function (B in the figure below).	Al1 scaled
	0 — AI — FB — Other — 0 — AI — FB — Other —	22.11 22.13 Ref1 SUB MUL EXT1 19.11 0 0 0 0 0 0 0 0 0 0 0 0	2.86
	0 — Al — FB — Other —	22.18 22.20 Ref1 SUB MUL B EXT2	
	0 — Al — FB — Other —	22.19 MIN MAX	
	Zero	None.	0
	Al1 scaled	12.12 Al1 scaled value (see page 212).	1
	Al2 scaled	12.22 Al2 scaled value (see page 214).	2
	Reserved		3

No.	Name/Value	Description	Def/FbEq16
	FB A ref1	03.05 FB A reference 1 (see page 184).	4
	FB A ref2	03.06 FB A reference 2 (see page 184).	5
	Reserved		67
	EFB ref1	03.09 EFB reference 1 (see page 185).	8
	EFB ref2	03.10 EFB reference 2 (see page 185).	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 1	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 184) saved by the control system for the location where the control returns is used as the reference. Reference * - X X - X - X - X - X - X - X - X -	18
	Control panel (ref copied)	Panel reference (03.01 Panel reference, see page 184) 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 (e.g. frequency/speed/torque/PID); otherwise, the actual signal is used as the new reference. Reference EXT1 reference EXT1 reference Active reference Inactive reference	19
	Other	Source selection (see <i>Terms and abbreviations</i> on page 178).	-
22.12	Ext1 speed ref2	Selects EXT1 speed reference source 2. For the selections, and a diagram of reference source selection, see parameter 22.11 Ext1 speed ref1.	Zero
22.13	Ext1 speed function	Selects a mathematical function between the reference sources selected by parameters 22.11 Ext1 speed ref1 and 22.12 Ext1 speed ref2. See diagram at 22.11 Ext1 speed ref1.	Ref1
	Ref1	Signal selected by 22.11 Ext1 speed ref1 is used as speed reference 1 as such (no function applied).	0
	Add (ref1 + ref2)	The sum of the reference sources is used as speed reference 1.	1
	Sub (ref1 - ref2)	The subtraction ([22.11 Ext1 speed ref1] - [22.12 Ext1 speed ref2]) of the reference sources is used as speed reference 1.	2
	Mul (ref1 × ref2)	The multiplication of the reference sources is used as speed reference 1.	3

No.	Name/Value	Description	Def/FbEq16
	Min (ref1, ref2)	The smaller of the reference sources is used as speed reference 1.	4
	Max (ref1, ref2)	The greater of the reference sources is used as speed reference 1.	5
22.18	Ext2 speed ref1	Selects EXT2 speed reference source 1. Two signal sources can be defined by this parameter and 22.19 Ext2 speed ref2. A mathematical function (22.20 Ext2 speed function) applied to the two signals creates an EXT2 reference. See diagram at 28.11 Ext1 frequency ref1.	Zero
	Zero	None.	0
	Al1 scaled	12.12 Al1 scaled value (see page 212).	1
	Al2 scaled	12.22 Al2 scaled value (see page 214).	2
	Reserved		3
	FB A ref1	03.05 FB A reference 1 (see page 184).	4
	FB A ref2	03.06 FB A reference 2 (see page 184).	5
	Reserved		67
	EFB ref1	03.09 EFB reference 1 (see page 185).	8
	EFB ref2	03.10 EFB reference 2 (see page 185).	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 184) 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 184) 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 (e.g. 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 178).	-

	Name/	/Value Description Def/Fb		Def/FbEq16
22.19	Ext2 sp	peed ref2	Selects EXT2 speed reference source 2. For the selections, and a diagram of reference sou selection, see parameter 22.18 Ext2 speed ref1.	<i>Zero</i>
22.20	Ext2 s _i	peed function	Selects a mathematical function between the refere sources selected by parameters 22.18 Ext2 speed 22.19 Ext2 speed ref2. See diagram at 22.18 Ext2 ref1.	ref1 and
	Ref1		Signal selected by <i>Ext2 speed ref1</i> is used as speed reference 1 as such (no function applied).	ed 0
	Add (re	ef1 + ref2)	The sum of the reference sources is used as speed 1.	reference 1
	Sub (re	ef1 - ref2)	The subtraction ([22.11 Ext1 speed ref1] - [22.12 Exterior of the reference sources is used as speed ref1].	
	Mul (re	f1 × ref2)	The multiplication of the reference sources is used reference 1.	as speed 3
	Min (re	f1, ref2)	The smaller of the reference sources is used as speeference 1.	eed 4
	Max (re	ef1, ref2)	The greater of the reference sources is used as speeference 1.	eed 5
22.21	function th		Determines how constant speeds are selected, and he rotation direction signal is considered or not whapplying a constant speed.	
	Bit	Name	Information	
	0	Constant sp mode	ed 1 = Packed: 7 constant speeds are selectable of defined by parameters 22.22, 22.23 and 22.24	
			0 = Separate: Constant speeds 1, 2 and 3 are the sources defined by parameters 22.22, 22.2 In case of conflict, the constant speed with the priority.	3 and 22.24 respectively.
	1		y-	
		Direction enable	1 = Start dir: To determine running direction for sign of the constant speed setting (parameters multiplied by the direction signal (forward: +1, r effectively allows the drive to have 14 (7 forward speeds if all values in 22.2622.32 are positively allows the direction signal is reversed to constant speed is negative, the drive will direction.	22.2622.32) is reverse: -1). This rd, 7 reverse) constant e. erse and the active
			1 = Start dir: To determine running direction for sign of the constant speed setting (parameters multiplied by the direction signal (forward: +1, r effectively allows the drive to have 14 (7 forwar speeds if all values in 22.2622.32 are positived warming. If the direction signal is reviced to set the drive with the d	22.2622.32) is reverse: -1). This rd, 7 reverse) constant e. erse and the active run in the forward
	215		1 = Start dir: To determine running direction for sign of the constant speed setting (parameters multiplied by the direction signal (forward: +1, r effectively allows the drive to have 14 (7 forwards speeds if all values in 22.2622.32 are positively allows the direction signal is revisional to the constant speed is negative, the drive with direction. 0 = Accord Par: The running direction for the condetermined by the sign of the constant speed is	22.2622.32) is reverse: -1). This rd, 7 reverse) constant e. erse and the active run in the forward
	215	enable	1 = Start dir: To determine running direction for sign of the constant speed setting (parameters multiplied by the direction signal (forward: +1, r effectively allows the drive to have 14 (7 forwards speeds if all values in 22.2622.32 are positively allows the direction signal is revisional to the constant speed is negative, the drive with direction. 0 = Accord Par: The running direction for the condetermined by the sign of the constant speed is	22.2622.32) is reverse: -1). This rd, 7 reverse) constant e. erse and the active fill run in the forward

No.	Name/	Value	Description	escription			
22.22	sel1 (Se Wh (Pe spo		When bit 0 of parameter 22.21 Constant speed function is 0 (Separate), selects a source that activates constant speed 1. When bit 0 of parameter 22.21 Constant speed function is 1 (Packed), this parameter and parameters 22.23 Constant speed sel2 and 22.24 Constant speed sel3 select three sources whose states activate constant speeds as follows:			DI3	
		Source defir		Source defined by par. 22.24	Constant speed ac	active	
		0	0	0	None		
		1	0	0	Constant speed		
		0	1	0	Constant speed		
		1	1	0	Constant speed		
		0	0	1	Constant speed		
		0	0	1	Constant speed Constant speed		
		1	1	1	Constant speed		
					Combiant opera	<u>·</u>	
	Always off		Always off.			0	
	Always on		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 (10.0	02 DI delayed statu	s, bit 3).	5	
	DI5 Di		Digital input DI5 (10.02 DI delayed status, bit 4).			6	
	DI6 D		Digital input DI6 (10.02 DI delayed status, bit 5).			7	
	Reserved					817	
	Timed function 1 B		Bit 0 of 34.01 Timed functions status (see page 307).			18	
	Timed function 2 Bit		Bit 1 of 34.01 Timed functions status (see page 307).			19	
	Timed function 3 Bit		Bit 2 of 34.01 Timed functions status (see page 307).			20	
	Reserved					2123	
	Supervision 1 Bit (Bit 0 of 32.01 Supervision status (see page 299).			24	
	Supervision 2 Bit		Bit 1 of 32.01 Supervision status (see page 299).			25	
	Supervision 3 Bit		Bit 2 of 32.01 Supervision status (see page 299).			26	
	Other [bit]		Source selection (see <i>Terms and abbreviations</i> on page 178).			-	
22.23	Consta sel2	nt speed	When bit 0 of parame (Separate), selects a When bit 0 of parame (Packed), this parame speed sel1 and 22.24 cas at parameter 22.22 C For the selections, selections	DI4			

No.	Name/Value	Description	Def/FbEq16
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.	Always off
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
22.41	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
	-30000.00 30000.00 rpm	Safe speed reference.	See par. 46.01
22.42	Jogging 1 ref	Defines the speed reference for jogging function 1. For more information on jogging, see page 150.	0.00 rpm
	-30000.00 30000.00 rpm	Speed reference for jogging function 1.	See par. 46.01
22.43	Jogging 2 ref	Defines the speed reference for jogging function 2. For more information on jogging, see page 150.	0.00 rpm
	-30000.00 30000.00 rpm	Speed reference for jogging function 2.	See par. 46.01

No.	Name/\	/alue	Description	Def/FbEq16
22.51	Critical 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 123).	0000Ь
	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 tak account. 0 = Absolute: Parameters 22.5222.57 are handled as absolute.	
			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.		Low limit for critical speed 1.	See par. 46.01
22.53	Critical 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.		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.		Low limit for critical speed 2.	See par. 46.01
22.55	Critical 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.		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.		Low limit for critical speed 3.	See par. 46.01
22.57	Critical high	speed 3	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
	-30000.0		High limit for critical speed 3.	See par. 46.01
22.71	Motor potention		Activates and selects the mode of the motor potentiometer. See section <i>Speed compensated stop</i> (page 153).	Disabled
	Disable	d	Motor potentiometer is disabled and its value set to 0.	0

No.	Name/Value	Description	Def/FbEq16
	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.) Note: Motor potentiometer function up/down source control speed or frequency from zero to maximum speed or frequency. The running direction can be changed with parameter 20.04 Ext1 in2 source. See the figure in section Motor potentiometer on page 135.	Not used
	Not used	0.	0
	Not used	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 307).	18
	Timed function 2	Bit 1 of 34.01 Timed functions status (see page 307).	19
	Timed function 3	Bit 2 of 34.01 Timed functions status (see page 307).	20
	Reserved		2123
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 299).	24
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 299).	25
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 299).	26
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 178).	-

No.	Name/Value	Description	Def/FbEq16
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.) Note: Motor potentiometer function up/down source control speed or frequency from zero to maximum speed or frequency. The running direction can be changed with parameter 20.04 Ext1 in 2 source. See the figure in section Motor potentiometer on page 135. For the selections, see parameter 22.73 Motor potentiometer up source.	Not used
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 526. 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 527. The value is received from 22.86 Speed reference act 6 unless overridden by • any constant speed • a jogging reference • 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 528.	
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 <i>528</i> . 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 528. This parameter is read-only.	-
	-30000.00 30000.00 rpm	Speed reference after ramping and shaping.	See par. 46.01
23.11	Ramp set selection	Selects the source that switches between the two sets of acceleration/deceleration ramp times defined by parameters 23.1223.15. 0 = Acceleration time 1 and deceleration time 1 are active 1 = Acceleration time 2 and deceleration time 2 are active	DI5
	Acc/Dec time 1	0.	0
	Acc/Dec time 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
	Reserved		817
	FBA A	For Transparent16 and Transparent32 profiles only. DCU control word bit 10 received through the fieldbus adapter A.	18
	Reserved		19
	EFB DCU CW bit 10	Only for the DCU profile. DCU control word bit 10 received through the embedded fieldbus interface.	20
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 178).	-
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

No.	Name/Value	Description	Def/FbEq16
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, 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
23.14	Acceleration time 2	Defines acceleration time 2. See parameter 23.12 Acceleration time 1.	60.000 s
	0.0001800.000 s	Acceleration time 2.	10 = 1 s
23.15	Deceleration time 2	Defines deceleration time 2. See parameter 23.13 Deceleration time 1.	60.000 s
	0.0001800.000 s	Deceleration time 2.	10 = 1 s
23.20	Acc time jogging	Defines the acceleration time for the jogging function ie. the time required for the speed to change from zero to the speed value defined by parameter 46.01 Speed scaling. See section Settings and diagnostics (page 150).	60.000 s
	0.0001800.000 s	Acceleration time for jogging.	10 = 1 s
23.21	Dec time jogging	Defines the deceleration time for the jogging function ie. the time required for the speed to change from the speed value defined by parameter 46.01 Speed scaling to zero. See section Settings and diagnostics (page 150).	60.000 s
	0.0001800.000 s	Deceleration time for jogging.	10 = 1 s
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 23.1123.15. • The same parameter value is also used in frequency control mode (ramp parameters 28.7128.75).	3.000 s
	0.0001800.000 s	Emergency stop Off3 deceleration time.	10 = 1 s

No.	Name/Value	Description	Def/FbEq16
23.28	Variable slope enable	Activates the variable slope function, which controls the slope of the speed ramp during a speed reference change. This allows for a constantly variable ramp rate to be generated, instead of just the standard two ramps normally available. If the update interval of the signal from an external control system and the variable slope rate (23.29 Variable slope rate) are equal, speed reference (23.02 Speed ref ramp output) is a straight line. Speed reference	Off
		23.02 Speed ref ramp output	
		t = update interval of signal from an external control system A = speed reference change during t This function is only active in remote control.	
	Off	Variable slope disabled.	0
	On	Variable slope enabled (not available in local control).	1
23.29	Variable slope rate	Defines the rate of the speed reference change when variable slope is enabled by parameter 23.28 Variable slope enable. For the best result, enter the reference update interval into this parameter.	50 ms
	230000 ms	Variable slope rate.	1 = 1 ms

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	0.000 s
		S-curve ramp: 23.32 > 0 s Time Deceleration: Speed	
		S-curve ramp: 23.32 > 0 s Linear ramp: 23.32 > 0 s S-curve ramp: 23.32 > 0 s Linear ramp: 23.32 > 0 s	
	0.0001800.000 s	Ramp shape at start and end of acceleration and deceleration.	10 = 1 s
23.33	Shape time 2	Defines the shape of the acceleration and deceleration ramps used with the set 2. See parameter 23.32 Shape time 1.	0.000 s
	0.0001800.000 s	Ramp shape at start and end of acceleration and deceleration.	10 = 1 s

No.	Name/Value	Description	Def/FbEq16
	eed reference ioning	Speed error calculation; speed error window control configuration; speed error step. See the control chain diagram on page 529.	
24.01	Used speed reference	Displays the ramped and corrected speed reference (before speed error calculation). See the control chain diagram on page 529. This parameter is read-only.	-
	-30000.00 30000.00 rpm	Speed reference used for speed error calculation.	See par. 46.01
24.02	Used speed feedback	Displays the speed feedback used for speed error calculation. See the control chain diagram on page 529. This parameter is read-only.	-
	-30000.00 30000.00 rpm	Speed feedback used for speed error calculation.	See par. 46.01
24.03	Speed error filtered	Displays the filtered speed error. See the control chain diagram on page 529. 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 529. This parameter is read-only.	-
	-30000.0 30000.0 rpm	Inverted speed error.	See par. 46.01
24.11	Speed correction	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 529.	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 Sp	eed control	Speed controller settings. See the control chain diagram on page 529.	
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 529. 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.	5.00
	Ġ	Gain = $K_p = 1$ $T_1 = Integration time = 0$ $T_D = Derivation time = 0$	
		Error value	
	Controller output = K _p × e	Controller output e =	Error value ne
		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. Controller output Gain = $K_p = 1$ $T_1 = \text{Integration time} > 1$ $T_2 = \text{Derivation time} > 1$ $T_3 = \text{Derivation time} > 1$ $T_4 = \text{Derivation time} > 1$ $T_5 = \text{Derivation time} > 1$ And the proportional gain first, then return the integration time	2.50 s
0.001000.00 s	Integration time for speed controller.	10 = 1 s

No.	Name/Value	Description	Def/FbEq16
25.04	Speed derivation time	Defines the derivation time of the speed controller. Derivative action boosts the controller output if the error value changes. The longer the derivation time, the more the speed controller output is boosted during the change. If the derivation time is set to zero, the controller works as a Pl 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
	$K_{p} \times T_{D} \times \frac{\Delta e}{T_{s}} \begin{cases} K_{p} & K_{p} \end{cases}$	Controller output × e Error value • e = Error v Time	alue
	$egin{array}{c} T_{I} & & & & & & & & & & & & & & & & & & $	ain = K _p = 1 = 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	Defines the derivation filter time constant. See parameter 25.04 Speed derivation time.	8 ms
	010000 ms	Derivation filter time constant.	1 = 1 ms

No.	Name/Value	Description	Def/FbEq16
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
	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
	1.00250.00	Proportional gain upon an emergency stop.	100 = 1

No.	Name/Value	Description	Def/FbEq16
25.33	Speed controller autotune	Activates (or selects a source that activates) the speed controller autotune function. See section Speed controller autotune (page 124). The autotune will automatically set parameters 25.02 Speed proportional gain, 25.03 Speed integration time and 25.37 Mechanical time constant. The prerequisites for performing the autotune routine are: • the motor identification run (ID run) has been successfully completed • the speed and torque limits (parameter group 30 Limits) have been set • speed feedback filtering (parameter group 90 Feedback selection), speed error filtering (24 Speed reference conditioning) and zero speed (21 Start/stop mode) have been set, and • the drive has been started and is running in speed control mode. WARNING: The motor and machinery will run against the torque and speed limits during the autotune routine. MAKE SURE IT IS SAFE TO ACTIVATE THE AUTOTUNE FUNCTION! The autotune routine can be aborted by stopping the drive. 0?1 = Activate speed controller autotune Note: The value does not revert to 0 automatically	Off
	Off	0	0
	On	1	1
25.34	Speed controller autotune mode	Defines a control preset for the speed controller autotune function. The setting affects the way the torque reference will respond to a speed reference step.	Normal
	Smooth	Slow but robust response.	0
	Normal	Medium setting.	1
	Tight	Fast response. May produce too high a gain value for some applications.	2
25.37	Mechanical time constant	Mechanical time constant of the drive and the machinery as determined by the speed controller autotune function. The value can be adjusted manually.	0.00
	0.001000.00 s	Mechanical time constant.	100 = 1 s
25.38	Autotune torque step	Defines an added torque value used by the autotune function. This value is scaled to motor nominal torque. Note that the torque used by the autotune function can also be limited by the torque limits (in parameter group 30 Limits) and nominal motor torque.	10.00
	0.00100.00%	Autotune torque step.	100 = 1%
25.39	Autotune speed step	Defines a speed value added to the initial speed for the autotune routine. The initial speed (speed used when autotune is activated) plus the value of this parameter is the calculated maximum speed used by the autotune routine. The maximum speed can also be limited by the speed limits (in parameter group 30 Limits) and nominal motor speed. The value is scaled to motor nominal speed. Note: The motor will exceed the calculated maximum speed slightly at the end of each acceleration stage.	10.00

No.	Name/Value	Description	Def/FbEq16
	0.00100.00%	Autotune speed step.	100 = 1%
25.40	Autotune repeat times	Determines how many acceleration/deceleration cycles are performed during the autotune routine. Increasing the value will improve the accuracy of the autotune function, and allow the use of smaller torque or speed step values.	10
	110		1 = 1
25.53	Torque prop reference	Displays the output of the proportional (P) part of the speed controller. See the control chain diagram on page 529. 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 529. 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 529. 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 529. This parameter is read-only.	-
	-30000.0 30000.0%	Output of acceleration compensation function.	See par. 46.03
26 Toro	que reference chain	Settings for the torque reference chain. See the control chain diagrams on pages 531 and 532.	
26.01	Torque reference to TC	Displays the final torque reference given to the torque controller in percent. This reference is then acted upon by various final limiters, like power, torque, load etc. See the control chain diagrams on pages 531 and 532. This parameter is read-only.	-
	-1600.01600.0%	Torque reference for torque control in percent of motor nominal torque (99.12).	See par. 46.03
26.02	Torque reference used	Displays the final torque reference (in percent of motor nominal torque) given to the torque controller, and comes after frequency, voltage and torque limitation. See the control chain diagram on page 533. This parameter is read-only.	-
	-1600.01600.0%	Torque reference for torque control in percent of motor nominal torque (99.12).	See par. 46.03
26.08	Minimum torque ref	Defines the minimum torque reference. Allows for local limiting of the torque reference before it is passed on to the torque ramp controller. For absolute torque limiting, refer to parameter 30.19 Minimum torque 1.	-300.0%
	-1000.00.0%	Minimum torque reference in percent of motor nominal torque (99.12).	See par. 46.03

No.	Name/Value	Description	Def/FbEq16
26.09	Maximum torque ref	Defines the maximum torque reference. Allows for local limiting of the torque reference before it is passed on to the torque ramp controller. For absolute torque limiting, refer to parameter 30.20 Maximum torque 1.	300.0%
	0.01000.0%	Maximum torque reference in percent of motor nominal torque (99.12).	See par. 46.03
26.11	Torque ref1 source	Selects torque reference source 1. Two signal sources can be defined by this parameter and 26.12 Torque ref2 source. A digital source selected by 26.14 Torque ref1/2 selection can be used to switch between the two sources, or a mathematical function (26.13 Torque ref1 function) applied to the two signals to create the reference.	Zero
	0 — 26.1 FB — Other — 26.1	26.70 SUB 0 26.14 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	26.72)
	Zero	None.	0
	Al1 scaled	12.12 Al1 scaled value (see page 212).	1
	Al2 scaled	12.22 Al2 scaled value (see page 214).	2
	Reserved		3
	FB A ref1	03.05 FB A reference 1 (see page 184).	4
	FB A ref2	03.06 FB A reference 2 (see page 184).	5
	Reserved	· · · · ·	67
	EFB ref1	03.09 EFB reference 1 (see page 185).	8
	EFB ref2	03.10 EFB reference 2 (see page 185).	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
		controller).	

No.	Name/Value	Description	Def/FbEq16
	Control panel (ref saved)	Panel reference (03.01 Panel reference, see page 184) 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 184) 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 (e.g. 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 178).	-
26.12	Torque ref2 source	Selects torque reference source 2. For the selections, and a diagram of reference source selection, see parameter 26.11 Torque ref1 source.	Zero
26.13	Torque ref1 function	Selects a mathematical function between the reference sources selected by parameters 26.11 Torque ref1 source and 26.12 Torque ref2 source. See diagram at 26.11 Torque ref1 source.	Ref1
	Ref1	Signal selected by 26.11 Torque ref1 source is used as torque reference 1 as such (no function applied).	0
	Add (ref1 + ref2)	The sum of the reference sources is used as torque reference 1.	1
	Sub (ref1 - ref2)	The subtraction ([26.11 Torque ref1 source] - [26.12 Torque ref2 source]) of the reference sources is used as torque reference 1.	2
	Mul (ref1 × ref2)	The multiplication of the reference sources is used as torque reference 1.	3
	Min (ref1, ref2)	The smaller of the reference sources is used as torque reference 1.	4
	Max (ref1, ref2)	The greater of the reference sources is used as torque reference 1.	5
26.14	Torque ref1/2 selection	Configures the selection between torque references 1 and 2. See diagram at 26.11 Torque ref1 source. 0 = Torque reference 1 1 = Torque reference 2	Torque reference 1
	Torque reference 1	0.	0
	Torque reference 2	1.	1

No.	Name/Value	Description	Def/FbEq16
	Follow Ext1/Ext2 selection	Torque reference 1 is used when external control location EXT1 is active. Torque reference 2 is used when external control location EXT2 is active. See also parameter 19.11 Ext1/Ext2 selection.	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 178).	-
26.17	Torque ref filter time	Defines a low-pass filter time constant for the torque reference.	0.000 s
	0.00030.000 s	Filter time constant for torque reference.	1000 = 1 s
26.18	Torque ramp up time	Defines the torque reference ramp-up time, ie. the time for the reference to increase from zero to nominal motor torque.	0.000 s
	0.00060.000 s	Torque reference ramp-up time.	100 = 1 s
26.19	Torque ramp down time	Defines the torque reference ramp-down time, ie. the time for the reference to decrease from nominal motor torque to zero.	0.000 s
	0.00060.000 s	Torque reference ramp-down time.	100 = 1 s
26.20	Torque reversal	Selects the source of torque reversal function.	Always off
	Always off	Torque reversal function is disabled.	0
	Always on	Torque reversal function is enabled.	1
	DI1	Digital input DI1 (10.02 DI delayed status, bit 0).	2
	DI2	Digital input DI2 (10.02 DI delayed status, bit 1).	3
	DI3	Digital input DI3 (10.02 DI delayed status, bit 2).	4
	DI4	Digital input DI4 (10.02 DI delayed status, bit 3).	5
	DI5	Digital input DI5 (10.02 DI delayed status, bit 4).	6
	DI6	Digital input DI6 (10.02 DI delayed status, bit 5).	7
	Timed function 1	Bit 0 of 34.01 Timed functions status (see page 307).	8
	Timed function 2	Bit 1 of 34.01 Timed functions status (see page 307).	9
	Timed function 3	Bit 2 of 34.01 Timed functions status (see page 307).	10
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 299).	11
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 299).	12
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 299).	13
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 178).	-
26.21	Torque sel torque in	Selects the source for 26.74 Torque ref ramp out.	Torque ref torq ctrl
	Not selected	None.	0
	Torque ref torq ctrl	Torque reference from the torque chain.	1
	Other	Source selection (see <i>Terms and abbreviations</i> on page 178).	-
26.22	Torque sel speed in	Selects the source for 25.01 Torque reference speed control.	Torque ref speed ctrl
	Not selected	None.	0

No.	Name/Value	Description	Def/FbEq16
	Torque ref speed ctrl	Torque reference from the speed chain.	1
	Other	Source selection (see <i>Terms and abbreviations</i> on page 178).	-
26.70	Torque reference act 1	Displays the value of torque reference source 1 (selected by parameter 26.11 Torque ref1 source). See the control chain diagram on page 531. This parameter is read-only.	-
	-1600.01600.0%	Value of torque reference source 1.	See par. 46.03
26.71	Torque reference act 2	Displays the value of torque reference source 2 (selected by parameter 26.12 Torque ref2 source). See the control chain diagram on page 531. This parameter is read-only.	-
	-1600.01600.0%	Value of torque reference source 2.	See par. 46.03
26.72	Torque reference act 3	Displays the torque reference after the function applied by parameter 26.13 Torque ref1 function (if any), and after selection (26.14 Torque ref1/2 selection). See the control chain diagram on page 531. This parameter is read-only.	-
	-1600.01600.0%	Torque reference after selection.	See par. 46.03
26.73	Torque reference act 4	Displays the torque reference after application of reference additive 1. See the control chain diagram on page 531. This parameter is read-only.	-
	-1600.01600.0%	Torque reference after application of reference additive 1.	See par. 46.03
26.74	Torque ref ramp out	Displays the torque reference after limiting and ramping. See the control chain diagram on page 531. This parameter is read-only.	-
	-1600.01600.0%	Torque reference after limiting and ramping.	See par. 46.03
26.75	Torque reference act 5	Displays the torque reference after control mode selection. See the control chain diagram on page 532. This parameter is read-only.	-
	-1600.01600.0%	Torque reference after control mode selection.	See par. 46.03
26.81	Rush control gain	Rush controller gain term. See section <i>Rush control</i> (page 150).	5.0
	0.010000.0	Rush controller gain.	1 = 1
26.82	Rush control integration time	Rush controller integration time term.	2.0
	0.010.0	Rush controller integration time.	1 = 1 s

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No.	Name/Value	Description	Def/FbEq16
28 Fre	quency reference	Settings for the frequency reference chain. See the control chain diagrams on pages 524 and 525.	
28.01	Frequency ref ramp input	Displays the used frequency reference before ramping. See the control chain diagram on page 524. 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 524. This parameter is read-only.	-
	-500.00500.00 Hz	Final frequency reference.	See par. 46.02

No.	Name/Value	Description	Def/FbEq16
28.11	Ext1 frequency ref1	Selects EXT1 frequency reference source 1. Two signal sources can be defined by this parameter and 28.12 Ext1 frequency ref2. A mathematical function (28.13 Ext1 frequency function) applied to the two signals creates an EXT1 reference (A in the figure below). 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 parameters 28.15 Ext2 frequency ref1, 28.16 Ext2 frequency ref2 and 28.17 Ext2 frequency function (B in the figure below).	Al1 scaled
	0 — AI — FB — Other — Other —	28.13 Ref1 ADD MUL MIN MAX ADD ADD MUL MIN MAX ADD The state of the sta	9.92
	Zero	None.	0
	Al1 scaled	12.12 Al1 scaled value (see page 212).	1
	Al2 scaled	12.22 Al2 scaled value (see page 214).	2
	Reserved		3
	FB A ref1	03.05 FB A reference 1 (see page 184).	4
	FB A ref2	03.06 FB A reference 2 (see page 184).	5
	Reserved		67
	EFB ref1	03.09 EFB reference 1 (see page 185).	8
	EFB ref2	03.10 EFB reference 2 (see page 185).	9
	Reserved		1014

No.	Name/Value	Description	Def/FbEq16
	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 1	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 184) 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 184) 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 (e.g. 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 178).	-
28.12	Ext1 frequency ref2	Selects EXT1 frequency reference source 2. For the selections, and a diagram of reference source selection, see parameter 28.11 Ext1 frequency ref1.	Zero
28.13	Ext1 frequency function	Selects a mathematical function between the reference sources selected by parameters 28.11 Ext1 frequency ref1 and 28.12 Ext1 frequency ref2. See diagram at 28.11 Ext1 frequency ref1.	Ref1
	Ref1	Signal selected by 28.11 Ext1 frequency ref1 is used as frequency reference 1 as such (no function applied).	0
	Add (ref1 + ref2)	The sum of the reference sources is used as frequency reference 1.	1
	Sub (ref1 - ref2)	The subtraction ([28.11 Ext1 frequency ref1] - [28.12 Ext1 frequency ref2]) of the reference sources is used as frequency reference 1.	2
	Mul (ref1 × ref2)	The multiplication of the reference sources is used as frequency reference 1.	3
	Min (ref1, ref2)	The smaller of the reference sources is used as frequency reference 1.	4
	Max (ref1, ref2)	The greater of the reference sources is used as frequency reference 1.	5

No.	Name/Value	Description	Def/FbEq16
28.15	Ext2 frequency ref1	Selects EXT2 frequency reference source 1. Two signal sources can be defined by this parameter and 28.16 Ext2 frequency ref2. A mathematical function (28.17 Ext2 frequency function) applied to the two signals creates an EXT2 reference. See diagram at 28.11 Ext1 frequency ref1.	Zero
	Zero	None.	0
	Al1 scaled	12.12 Al1 scaled value (see page 212).	1
	Al2 scaled	12.22 Al2 scaled value (see page 214).	2
	Reserved		3
	FB A ref1	03.05 FB A reference 1 (see page 184).	4
	FB A ref2	03.06 FB A reference 2 (see page 184).	5
	Reserved		67
	EFB ref1	03.09 EFB reference 1 (see page 185).	8
	EFB ref2	03.10 EFB reference 2 (see page 185).	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 1	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 184) 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 184) 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 (e.g. frequency/speed/torque/PID); otherwise, the actual signal is used as the new reference. Reference EXT1 reference EXT1 reference CALTY reference Active reference Inactive reference	19
	Other	Source selection (see <i>Terms and abbreviations</i> on page 178).	-
28.16	Ext2 frequency ref2	Selects EXT2 frequency reference source 2. For the selections, and a diagram of reference source selection, see parameter 28.15 Ext2 frequency ref1.	Zero

No.	Name/	Value	Description	Def/FbEq16
28.17	Ext2 fre function	equency n	Selects a mathematical function between the reference sources selected by parameters 28.15 Ext2 frequency ref1 and 28.16 Ext2 frequency ref2. See diagram at 28.15 Ext2 frequency ref1.	Ref1
	Ref1		Signal selected by 28.15 Ext2 frequency ref1 is used as frequency reference 1 as such (no function applied).	0
	Add (re	ef1 + ref2)	The sum of the reference sources is used as frequency reference 1.	1
	Sub (re	ef1 - ref2)	The subtraction ([28.15 Ext2 frequency ref1] - [28.16 Ext2 frequency ref2]) of the reference sources is used as frequency reference 1.	2
	Mul (re	f1 × ref2)	The multiplication of the reference sources is used as frequency reference 1.	3
	Min (re	f1, ref2)	The smaller of the reference sources is used as frequency reference 1.	4
	Max (re	ef1, ref2)	The greater of the reference sources is used as frequency reference 1.	5
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.	0b0001
	Bit	Name	Information	
	0	Const freq mode	1 = Packed: 7 constant frequencies are selectable using sources defined by parameters 28.22, 28.23 and 28.24.	the three
			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 w	28.24
	1	Direction enable	by the sources defined by parameters 28.22, 28.23 and 2	28.24 ith the smaller t speed, the 2.32) is). This se) constant ne active e forward eed is

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

	Always off	Always off.	0
	Always on	Always on.	1
	DI1	Digital input DI1 (10.02 DI delayed status, bit 0).	2
	DI2	Digital input DI2 (10.02 DI delayed status, bit 1).	3
	DI3	Digital input DI3 (10.02 DI delayed status, bit 2).	4
	DI4	Digital input DI4 (10.02 DI delayed status, bit 3).	5
	DI5	Digital input DI5 (10.02 DI delayed status, bit 4).	6
	DI6	Digital input DI6 (10.02 DI delayed status, bit 5).	7
	Reserved		817
	Timed function 1	Bit 0 of 34.01 Timed functions status (see page 307).	18
	Timed function 2	Bit 1 of 34.01 Timed functions status (see page 307).	19
	Timed function 3	Bit 2 of 34.01 Timed functions status (see page 307).	20
	Reserved		2123
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 299).	24
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 299).	25
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 299).	26
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 178).	-
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.	Always off
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	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
28.42	Jogging 1 frequency ref	Defines the frequency reference for jogging function 1 in scalar control mode.	0.00 Hz
	-500.00500.00 Hz	Jogging 1 frequency reference.	See par. 46.02
28.43	Jogging 2 frequency ref	Defines the frequency reference for jogging function 2 in scalar control mode.	0.00 Hz

No.	Name/\	/alue	Description	Def/FbEq16
	-500.00 Hz	500.00	Jogging 2 frequency reference.	See par. 46.02
28.51	Critical function	frequency 1	Enables/disables the critical frequencies function. Also determines whether the specified ranges are effective in both rotating directions or not. See also section <i>Critical speeds/frequencies</i> (page 123).	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. into account.	
			0 = Absolute: Parameters 28.5228.57 are handled as abs Each range is effective in both directions of rotation.	solute values.
	0000b.	0011b	Critical frequencies configuration word.	1 = 1
28.52	2 Critical frequency 1 low		Defines the low limit for critical frequency 1. Note: This value must be less than or equal to the value of 28.53 Critical frequency 1 high.	0.00 Hz
	-500.00 Hz	500.00	Low limit for critical frequency 1.	See par. 46.02
28.53	Critical frequency 1 high		Defines the high limit for critical frequency 1. Note: This value must be greater than or equal to the value of 28.52 Critical frequency 1 low.	0.00 Hz
	-500.00500.00 Hz		High limit for critical frequency 1.	See par. 46.02
28.54	Critical low	frequency 2	Defines the low limit for critical frequency 2. Note: This value must be less than or equal to the value of 28.55 Critical frequency 2 high.	0.00 Hz
	-500.00 Hz	500.00	Low limit for critical frequency 2.	See par. 46.02
28.55	Critical high	frequency 2	Defines the high limit for critical frequency 2. Note: This value must be greater than or equal to the value of 28.54 Critical frequency 2 low.	0.00 Hz
	-500.00 Hz	500.00	High limit for critical frequency 2.	See par. 46.02
28.56	Critical low	frequency 3	Defines the low limit for critical frequency 3. Note: This value must be less than or equal to the value of 28.57 Critical frequency 3 high.	0.00 Hz
	-500.00 Hz	500.00	Low limit for critical frequency 3.	See par. 46.02
28.57	Critical high	frequency 3	Defines the high limit for critical frequency 3. Note: This value must be greater than or equal to the value of 28.56 Critical frequency 3 low.	0.00 Hz
	-500.00 Hz	500.00	High limit for critical frequency 3.	See par. 46.02

No.	Name/Value	Description	Def/FbEq16
28.71	Freq ramp set selection	Selects a source that switches between the two sets of acceleration/deceleration times defined by parameters 28.7228.75. 0 = Acceleration time 1 and deceleration time 1 are in force 1 = Acceleration time 2 and deceleration time 2 are in force	DI5
	Acc/Dec time 1	0.	0
	Acc/Dec time 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
	Reserved		817
	FBAA	For Transparent16 and Transparent32 profiles only. DCU control word bit 10 received through the fieldbus adapter.	18
	Reserved		19
	EFB DCU CW bit 10	Only for the DCU profile. DCU control word bit 10 received through the embedded fieldbus interface.	20
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 178).	-
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
28.74	Freq acceleration time 2	Defines acceleration time 2. See parameter 28.72 Freq acceleration time 1.	60.000 s
	0.0001800.000 s	Acceleration time 2.	10 = 1 s
28.75	Freq deceleration time 2	Defines deceleration time 2. See parameter 28.73 Freq deceleration time 1.	60.000 s
	0.0001800.000 s	Deceleration time 2.	10 = 1 s

No.	Name/Value	Description	Def/FbEq16
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 178).	-

No.	Name/Value	Description	Def/FbEq16
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	0.000 s
		S-curve ramp: 28.82 > 0 s	
		Deceleration:	
		S-curve ramp: 28.82 > 0 s Linear ramp: 28.82 > 0 s S-curve ramp: 28.82 > 0 s Time	
	0.0001800.000 s	Ramp shape at start and end of acceleration and deceleration.	10 = 1 s
28.83	Shape time 2	Defines the shape of the acceleration and deceleration ramps used with the set 2. See parameter 28.82 Shape time 1.	0.000 s
	0.0001800.000 s	Ramp shape at start and end of acceleration and deceleration.	10 = 1 s

1 = 1

No.	Name/Value	Description	Def/FbEq16
28.92	Frequency ref act 3	Displays the frequency reference after the function applied by parameter 28.13 Ext1 frequency function (if any), and after selection (19.11 Ext1/Ext2 selection). See the control chain diagram on page 524. This parameter is read-only.	-
	-500.00500.00 Hz	Frequency reference after selection.	See par. 46.02
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 524. 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 525. This parameter is read-only.	-
	-500.00500.00 Hz	Frequency reference before ramping and limiting.	See par. 46.02

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

Bit	Name	Description	
0	Torq lim	1 = 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	I = Torque reference ramp input is being limited by 26.09 Maximum orque ref, 30.20 Maximum torque 1, 30.26 Power motoring limit or 80.27 Power generating limit. See the diagram on page 533.	
4	Torq ref min	1 = Torque reference ramp input is being limited by 26.08 Minimum torque ref, 30.19 Minimum torque 1, 30.26 Power motoring limit or 30.27 Power generating limit. See the diagram on page 533.	
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	I = 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		

0000h...FFFFh

Limit word 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	
12	IGBT overtemperature	*1 = Output current is being limited because of estimated IGBT temperature	
13	IGBT overload	*1 = Output current is being limited because of IGBT junction to case temperature	
1415	Reserved		
*Only on	e 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 simultaneously. The bit typically indicates the limit that is exceeded first.

0000h...FFFFh Torque limitation status word. 1 = 1

No.	Name/Value	Description	Def/FbEq16
30.11	Minimum speed	Defines together with 30.12 Maximum speed the allowed speed range. See the figure below. A positive or zero minimum speed value defines two ranges, one positive and one negative. A negative minimum speed value defines one range. WARNING! The absolute value of 30.11 Minimum speed must not be higher than the absolute value of 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
	Speed	30.11 value < 0 Speed 20.21 value 30.11 value 30.11	
	Speed range	e allowed 30.11 Speed range allowed	
	0	Time 0	Time
	30.11	-(30.11) -(30.12) Speed range allowed	
		30.12 30.11 Speed range allowed	
		0 -(30.11)	Time
		-(30.12)	
	-30000.00 30000.00 rpm	Minimum allowed speed.	See par. 46.01
30.12	Maximum speed	Defines together with 30.11 Minimum speed the allowed speed range. See parameter 30.11 Minimum speed. Note: This parameter does not affect the speed acceleration and deceleration ramp times. See parameter 46.01 Speed scaling.	1500.00 rpm
	-30000.00 30000.00 rpm	Maximum speed.	See par. 46.01

00.10	Name/Value	Description	Def/FbEq16
30.13	Minimum frequency	Defines together with 30.14 Maximum frequency the allowed frequency range. See the figure. A positive or zero minimum frequency value defines two ranges, one positive and one negative. A negative minimum frequency value defines one range. WARNING! The absolute value of 30.13 Minimum frequency must not be higher than the absolute value of 30.14 Maximum frequency. WARNING! in frequency control mode only.	-50.00 Hz
	Frequency	Frequency	- D
	A .	30.13 value < 0 20.21 value 30.13 value	•
	30.14	30.14	_
	Frequency ra	nge allowed 30.13 Frequency range allowed	
	0	Time 0	Time
	22.42	-(30.13) Frequency range allowed	
	30.13	-(30.14) -(30.14)	
		30.14 30.13 0 -(30.13)	
		-(30.14)	Time
	-500.00500.00 Hz	, ,	Time See par. 46.02
30.14		-(30.14)	See par.
30.14	Hz <i>Maximum</i>	-(30.14) Minimum frequency. Defines together with 30.13 Minimum frequency the allowed frequency range. See parameter 30.13 Minimum frequency. Note: This parameter does not affect the frequency acceleration and deceleration ramp times. See parameter	See par. 46.02
30.14	Hz Maximum frequency -500.00500.00	-(30.14) Minimum frequency. Defines together with 30.13 Minimum frequency the allowed frequency range. See parameter 30.13 Minimum frequency. Note: This parameter does not affect the frequency acceleration and deceleration ramp times. See parameter 46.02 Frequency scaling.	See par. 46.02 50.00 Hz

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 0 Al1 Al2 PID 30.23 Other 30.19 User-defined minimum torque limit	
		30.22 Al1 Al2 PID 30.24 Other 30.20 User-defined maximum torque limit	
		Note: In addition to the user-defined limits, torque may be limited for other reasons (such as power limitation).	
	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	1 (minimum torque limit selected by 30.21 and maximum torque limit defined by 30.22 are active).	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		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 178).	-

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.	-300.0%
	-1600.00.0%	Minimum torque limit 1.	See par. 46.03
30.20	Maximum torque 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.	300.0%
	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 212).	1
	Al2 scaled	12.22 Al2 scaled value (see page 214).	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 178).	-
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 212).	1
	Al2 scaled	12.22 Al2 scaled value (see page 214).	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 178).	-

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	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.	300.0%
	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. Note: If your application, like a pump or a fan, requires that the motor must rotate in one direction only, use speed/ frequency limit (30.11 Minimum speed/30.13 Minimum frequency), or direction limit (20.21 Direction) to achieve this. Do not set parameter 30.19 Minimum torque 1 or 30.27 Power generating limit to 0%, as the drive is then not able to stop correctly.	-300.00%
	-600.000.00%	Maximum generating power.	1 = 1%
30.30	<u> </u>		
	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
30.35	Thermal current limitation	Enables/disables temperature-based output current limitation. The limitation should only be disabled if required by the application.	Enable
	Disable	Thermal current limitation disabled.	0
	Enable	Thermal current limitation enabled.	1
30.36	Speed limit selection	Selects a source that switches between two different predefined adjustable speed limit sets. 0 = minimum speed limit defined by 30.11 and maximum speed limit defined by 30.12 are active 1 = minimum speed limit selected by 30.37 and maximum speed limit defined by 30.38 are active The user can define two sets of speed limits, and switch between the sets using a binary source such as a digital input. The first set of limits is defined by parameters 30.11 Minimum speed and 30.12 Maximum speed. The second set has selector parameters for both the minimum (30.37) and maximum (30.38) limits that allows the use of a selectable analog source (such as an analog input). 30.37 O Al1 Al2 Minimum speed Other 30.11 30.36 1 User-defined minimum speed limit User-defined minimum speed limit	Not selected
	Not selected	Adjustable speed limits are disabled. (Minimum speed limit defined by 30.11 Minimum speed and maximum speed limit defined by 30.12 Maximum speed are active).	0
	Selected	Adjustable speed limits are enabled. (Minimum speed limit defined by 30.37 Minimum speed source and maximum speed limit defined by 30.38 Maximum speed source are active).	1
	Ext1 active	Adjustable speed limits are enabled if EXT1 is active.	2
	Ext2 active	Adjustable speed limits are enabled if EXT2 is active.	3
	Torque control	Adjustable speed limits are enabled if Torque control mode (vector motor control) is active.	4
	DI1	Digital input DI1 (10.02 DI delayed status, bit 0).	5
	DI2	Digital input DI2 (10.02 DI delayed status, bit 1).	6
	DI3	Digital input DI3 (10.02 DI delayed status, bit 2).	7

No.	o. Name/Value Description			
	DI4	Digital input DI4 (10.02 DI delayed status, bit 3).	8	
	DI5	Digital input DI5 (10.02 DI delayed status, bit 4).	9	
	DI6	Digital input DI6 (10.02 DI delayed status, bit 5).	10	
	Reserved		11	
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 178).	-	
30.37	Minimum speed source	Defines the source of a minimum speed limit for the drive when the source is selected by 30.36 Speed limit selection. Note: In vector motor control mode only. In scalar motor control mode, use frequency limits 30.13 and 30.14.	Minimum speed	
	Zero	None.	0	
	Al1 scaled	12.12 Al1 scaled value (see page 212).	1	
	Al2 scaled	12.22 Al2 scaled value (see page 214).	2	
	Reserved		310	
	Minimum speed	30.11 Minimum speed.	11	
	Other	Source selection (see <i>Terms and abbreviations</i> on page 178).	-	
30.38	38 Maximum speed source Defines the source of a maximum speed limit for the drive when the source is selected by 30.36 Speed limit selection. Note: In vector motor control mode only. In scalar motor control mode, use frequency limits 30.13 and 30.14.		Maximum speed	
	Zero	None.	0	
	Al1 scaled	12.12 Al1 scaled value (see page 212).	1	
	Al2 scaled	12.22 Al2 scaled value (see page 214).	2	
	Reserved		311	
	Maximum speed	30.12 Maximum speed.	12	
	Other	Source selection (see <i>Terms and abbreviations</i> on page 178).	-	

31 Fau	ult functions	Configuration of external events; selection of behavior of the drive upon fault situations.	
31.01			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 178).	-
31.02	External event 1 type	Selects the type of external event 1.	Fault
	Fault	The external event generates a fault.	0

No.	Name/Value	Description	Def/FbEq16	
	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	
31.09	External event 5 source	Defines the source of external event 5. See also parameter 31.10 External event 5 type. For the selections, see parameter 31.01 External event 1 source.	Inactive (true)	
31.10	External event 5 type	Selects the type of external event 5.	Fault	
	Fault	The external event generates a fault.	0	
	Warning	The external event generates a warning.	1	
31.11	Fault reset selection	Selects the source of an external fault reset signal. The signal resets the drive after a fault trip if the cause of the fault no longer exists. 0 -> 1 = Reset Note: A fault reset from the fieldbus interface is always observed regardless of this parameter.	Not used	
	Not used	0.	0	
	Not used	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	

No.	Name/Value	Description	Def/FbEq16
	Timed function 1	Bit 0 of 34.01 Timed functions status (see page 307).	18
	Timed function 2	Bit 1 of 34.01 Timed functions status (see page 307).	19
	Timed function 3	Bit 2 of 34.01 Timed functions status (see page 307).	20
	Reserved		2123
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 299).	24
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 299).	25
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 299).	26
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 178).	-
31.12	Autoreset 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:	000h

Bit	Fault
0	Overcurrent
1	Overvoltage
2	Undervoltage
3	Al supervision fault
49	Reserved
10	Selectable fault (see parameter 31.13 Selectable fault)
11	External fault 1 (from source selected by parameter 31.01 External event 1 source)
12	External fault 2 (from source selected by parameter 31.03 External event 2 source)
13	External fault 3 (from source selected by parameter 31.05 External event 3 source)
14	External fault 4 (from source selected by parameter 31.07 External event 4 source)
15	External fault 5 (from source selected by parameter 31.09 External event 5 source)

	0000hFFFFh	Automatic reset configuration word.	1 = 1
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 464).	0000h
	0000hFFFFh	Fault code.	10 = 1
31.14	Number 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

No.	o. Name/Value Description			
31.15	Total trials time	Defines a time window for automatic fault resets. The maximum number of attempts made during any period of this length is defined by 31.14 Number of trials. Note: If the fault condition remains and cannot be reset, each reset attempt will generate an event and start a new time window. In practice, if the specified number of resets (31.14) at specified intervals (31.16) take longer than the value of 31.15, the drive will continue to attempt resetting the fault until the cause is eventually removed.	30.0 s	
	1.0600.0 s	Time for automatic resets.	10 = 1 s	
31.16	Defines the time that the drive will wait after a fault before attempting an automatic reset. See parameter 31.12 Autoreset selection.			
	0.0120.0 s	Autoreset delay.	10 = 1 s	
31.19	9 Motor phase loss Selects how the drive reacts when a motor phase loss is detected. In scalar motor control mode: • The supervision activates above 10% of the motor nominal frequency. If any of the phase currents stays very small for a certain time limit, the output phase loss fault is given. • If the motor nominal current is below 1/6 of the drive nominal current or there is no motor connected, ABB recommends to disable the motor output phase loss function.		Fault	
	No action	No action taken.	0	
	Fault	The drive trips on fault 3381 Output phase loss.	1	
31.21	Supply phase loss	Selects how the drive reacts when a supply phase loss is detected.	Fault	
	No action	No action taken.	0	
	Fault	The drive trips on fault 3130 Input phase loss.	1	

No.	Name/Value	Descri	ption			Def/FbEq16
31.22	STO indication run/stop	Selects torque indicat stoppe The tal genera When control giving Notes: This func the rem both The as it	Fault/Fault			
	Fault/Fault	torque	off fun	ction in the Hardware m	anual of the drive.	0
	, add, add	Inp IN1 0 0 1				
	Fault/Warning					1
			uts		ation	
		IN1	IN2 0	Running Fault 5091 Safe torque	Stopped Warning A5A0 Safe	
		0				
		0	1			
		1				
		1	1	(Normal o	operation)	

No.	Name/Value	Descri	Def/FbEq16			
	Fault/Event					2
		Inp	uts	Indic	ation	
		IN1	IN2	Running	Stopped	
		0	0	Fault 5091 Safe torque off	Event B5A0 Safe torque off	
		0	1	Faults 5091 Safe torque off and FA81 Safe torque off 1	Event B5A0 Safe torque off and fault FA81 Safe torque off 1	
		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	operation)	
	Warning/Warning					3
		Inp	uts	Indiantian (·:	1
		IN1	IN2	indication (runr	ning or stopped)	
		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)	
	Event/Event					4
		Inp	uts	Indication (runn	ning or stopped)	
		IN1	IN2	•	,	
		0	0	Event B5A0	STO event	
		0	1		nt and fault FA81 Safe e off 1	
		1	0		nt and fault FA82 Safe e off 2	
		1	1	(Normal o	operation)	
	No indication/No indication					5
	maioation		uts	Indication (runr	ning or stopped)]
		IN1	IN2		,]
		0	0		ne]
		0	1		afe torque off 1]
		1	0		nfe torque 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

No.	Name/Value	Description	Def/FbEq16
31.24	Stall function	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
	No action	None (stall supervision disabled).	0
	Warning	The drive generates an A780 Motor stall warning.	1
	Fault	The drive trips on fault 7121 Motor stall.	2
31.25	Stall current limit	Stall current limit in percent of the nominal current of the motor. See parameter 31.24 Stall function.	200.0%
	0.01600.0%	Stall current limit.	-
31.26	Stall speed limit	Stall speed limit in rpm. See parameter 31.24 Stall function.	150.00 rpm
	0.0010000.00 rpm	Stall speed limit.	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.	15.00 Hz
	0.001000.00 Hz	Stall frequency limit.	See par. 46.02
31.28	Stall time	Stall time. See parameter 31.24 Stall function.	20 s
	03600 s	Stall time.	-

No.	Name/Value	Description	Def/FbEq16
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 Overspeed trip level	500.00 rpm
	0.0010000.00 rpm	Overspeed trip margin.	See par. 46.01

No.	Name/Value	Description	Def/FbEq16
31.31	Frequency trip margin	Defines, together with 30.13 Minimum frequency and 30.14 Maximum frequency, the maximum allowed frequency of the motor (overfrequency protection). The absolute value of this overfrequency trip level is calculated by adding the value of this parameter to the higher of the absolute values of 30.13 Minimum frequency and 30.14 Maximum frequency. If the output frequency (01.06 Output frequency) exceeds the overfrequency trip level (ie. the absolute value of the output frequency exceeds the absolute value of the overfrequency trip level), the drive trips on the 73F0 Overfrequency fault. Frequency Overfrequency trip level 31.31 ABS(30.14) Time 30.13 31.31 Overfrequency trip level	15.00 Hz
	0.0010000.00 Hz	Overfrequency trip margin.	1 = 1 Hz
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 23.1123.15 (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 7380 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%
	0300%	Maximum deviation from expected deceleration rate.	1 = 1%

No.	Name/V	alue/	Description		Def/FbEq16
31.33		ncy ramp sion delay	If parameter 3 this parameter (mode Off1 or stopped when Emergency ra 2, and coasts If 31.32 is set defines a delar command and recommends t change rate to	0 s	
	0100	s	Maximum ram	p-down time, or supervision activation delay.	1 = 1 s
31.35	Main fai function		Selects how the drive reacts when a main cooling fan fault is detected. Note: With an inverter unit consisting of one or more frame R8i inverter modules with speed-controlled fans, it may be possible to continue operation even if one main fan of a module stops. When fan failure is detected, the control program will automatically.		Warning
	Fault		Triggers fault v	when the speed is below ID-run result or I value.	0
	Warning	1	Triggers warni predetermined	ng when the speed is below ID-run result or I value.	1
	No actio	n	No action take	n.	2
32 Sup 32.01	32 Supervision 32.01 Supervision status		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 168). Signal supervision status word. Indicates whether the values monitored by the signal supervision functions are within or outside their respective		0000ь
				rd is independent of the drive actions defined 32.06, 32.16, 32.26, 32.36, 32.46 and 32.56.	
	Bit	Name		Description	
	0	Supervision	1 active	1 = Signal selected by 32.07 is outside its limits	i
	1	Supervision	2 active	1 = Signal selected by 32.17 is outside its limits	i.
	2	Supervision	3 active	1 = Signal selected by 32.27 is outside its limits	i.
	3	Supervision	4 active	1 = Signal selected by 32.37 is outside its limits	i
	4	Supervision	5 active	1 = Signal selected by 32.47 is outside its limits	i.
	5	Supervision	6 active	1 = Signal selected by 32.27 is outside its limits	i
	615	Reserved			
	00000)111b	Signal supervi	sion status word.	1 = 1
32.05	5 Supervision 1 function		how the monito	ode of signal supervision function 1. Determines ored signal (see parameter 32.07) is compared d upper limits (32.09 and 32.10 respectively). Detaken when the condition is fulfilled is 2.06.	Disabled
	Disable	d	Signal supervi	sion 1 not in use.	0

No.	Name/Value	Description	Def/FbEq16
	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
	Hysteresis	Action is taken whenever the signal rises above the value defined by the upper limit + 0.5 · hysteresis range (32.11 Supervision 1 hysteresis). The action is deactivated when the signal falls below the value defined by the lower limit - 0.5 · hysteresis range.	7
32.06	Supervision 1 action	Selects whether the drive generates a fault, warning or neither when the value monitored by signal supervision 1 exceeds its limits. Note: This parameter does not affect the status indicated by 32.01 Supervision status.	No action
	No action	No warning or fault generated.	0
	Warning	Warning A8B0 ABB 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 181).	1
	Reserved		2
	Frequency	01.06 Output frequency (page 181).	3
	Current	01.07 Motor current (page 181).	4
	Reserved		5
	Torque	01.10 Motor torque (page 181).	6
	DC voltage	01.11 DC voltage (page 181).	7
	Output power	01.14 Output power (page 182).	8
	Al1	12.11 Al1 actual value (page 212).	9
	Al2	12.21 Al2 actual value (page 214).	10
	Reserved		1117
	Speed ref ramp in	23.01 Speed ref ramp input (page 256).	18
	Speed ref ramp out	23.02 Speed ref ramp output (page 256).	19
	Speed ref used	24.01 Used speed reference (page 260).	20
	Torque ref used	ue ref used 26.02 Torque reference used (page 266).	
	Freq ref used	28.02 Frequency ref ramp output (page 271).	22

No.	Name/Value	Description	Def/FbEq16	
	Inverter temperature	05.11 Inverter temperature (page 187).	23	
	Process PID output	40.01 Process PID output actual (page 332).	24	
	Process PID feedback	40.02 Process PID feedback actual (page 332).	25	
	Process PID setpoint	40.03 Process PID setpoint actual (page 332).	26	
	Process PID deviation	40.04 Process PID deviation actual (page 333).	27	
	Other	Source selection (see <i>Terms and abbreviations</i> on page 178).	-	
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	Supervision 1 hysteresis	Defines the hysteresis for the signal monitored by signal supervision 1. This parameter applies to all selections for parameter 32.05 Supervision 1 function, not just Hysteresis (7). Action is taken whenever the signal rises above the value defined by the upper limit + 0.5 · hysteresis. The action is deactivated when the signal falls below the value defined by the lower limit - 0.5 · hysteresis.	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	

No.	Name/Value	Description	Def/FbEq16	
	Hysteresis Action is taken whenever the signal rises above the value defined by the upper limit + 0.5 · hysteresis range (32.21 Supervision 2 hysteresis). The action is deactivated when the signal falls below the value defined by the lower limit - 0.5 · hysteresis range.			
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 ABB Signal supervision 2 is generated.	1	
	Fault	Drive trips on fault 80B1 Signal supervision 2.	2	
	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	2 low Defines the lower limit for signal supervision 2.		
	-21474836.00 21474836.00	Low limit.	-	
32.20	Supervision 2 high	Defines the upper limit for signal supervision 2.	0.00	
	-21474836.00 21474836.00	Upper limit.	-	
32.21	Supervision 2 hysteresis	Defines the hysteresis for the signal monitored by signal supervision 2. This parameter applies to all selections for parameter 32.15 Supervision 2 function, not just Hysteresis (7). Action is taken whenever the signal rises above the value defined by the upper limit + 0.5 · hysteresis. The action is deactivated when the signal falls below the value defined by the lower limit - 0.5 · hysteresis.	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.	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	

No. Name/Value		Description	Def/FbEq16
	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
	Hysteresis	Action is taken whenever the signal rises above the value defined by the upper limit + 0.5 · hysteresis range (32.31 Supervision 3 hysteresis). The action is deactivated when the signal falls below the value defined by the lower limit - 0.5 · hysteresis range.	7
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 ABB Signal supervision 3 is generated.	1
	Fault	Drive trips on fault 80B2 Signal supervision 3.	2
	Fault if running	If running, the drive trips on fault 80B0 Signal supervision 1.	3
32.27	Supervision 3 signal	Selects the signal to be monitored by signal supervision function 3. For the available selections, see parameter 32.07 Supervision 1 signal.	Torque
32.28	Supervision 3 filter time	Defines a filter time constant for the signal monitored by signal supervision 3.	0.000 s
	0.000 30.000 s	Signal filter time.	1000 = 1 s
32.29	Supervision 3 low	Defines the lower limit for signal supervision 3.	0.00
	-21474836.00 21474836.00	Low limit.	-
32.30	Supervision 3 high	Defines the upper limit for signal supervision 3.	0.00
	-21474836.00 21474836.00	Upper limit.	-
32.31	2.31 Supervision 3 hysteresis Defines the hysteresis for the signal monitored by signal supervision 3. This parameter applies to all selections for parameter 32.25 Supervision 3 function, not just Hysteresis (7). Action is taken whenever the signal rises above the value defined by the upper limit + 0.5 · hysteresis. The action is deactivated when the signal falls below the value defined by the lower limit - 0.5 · hysteresis.		0.00
	0.00100000.00	Hysteresis.	-
32.35	2.35 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

No.	Name/Value	Description	Def/FbEq16
	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
	Hysteresis	Action is taken whenever the signal rises above the value defined by the upper limit + 0.5 · hysteresis range (32.41 Supervision 4 hysteresis). The action is deactivated when the signal falls below the value defined by the lower limit - 0.5 · hysteresis range.	7
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 ABB Signal supervision 4 is generated.	1
	Fault	Drive trips on fault 80B3 Signal supervision 4.	2
	Fault if running	Drive trips on fault 80B0 Signal supervision 1 if the motor is running.	3
32.37	Supervision 4 signal	Selects the signal to be monitored by signal supervision function 4. For the available selections, see parameter 32.07 Supervision 1 signal.	Zero
32.38	Supervision 4 filter time	Defines a filter time constant for the signal monitored by signal supervision 4.	0.000 s
	0.000 30.000 s	Signal filter time.	1000 = 1 s
32.39	Supervision 4 low	Defines the lower limit for signal supervision 4.	0.00
	-21474836.00 21474836.00	Low limit.	-
32.40	Supervision 4 high	Defines the upper limit for signal supervision 4.	0.00
	-21474836.00 21474836.00	Upper limit.	-
32.41	Supervision 4 hysteresis	Defines the hysteresis for the signal monitored by signal supervision 4.This parameter applies to all selections for parameter 32.35 Supervision 4 function, not just Hysteresis (7). Action is taken whenever the signal rises above the value defined by the upper limit + 0.5 · hysteresis. The action is deactivated when the signal falls below the value defined by the lower limit - 0.5 · hysteresis.	0.00
	0.00100000.00	Hysteresis.	-

No.	Name/Value	Description	Def/FbEq16
32.45	Supervision 5 function	Selects the mode of signal supervision function 5. Determines how the monitored signal (see parameter 32.47) is compared to its lower and upper limits (32.49 and 32.40 respectively). The action to be taken when the condition is fulfilled is selected by 32.46.	Disabled
	Disabled	Signal supervision 5 not in use.	0
	Low	Action is taken whenever 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
	Hysteresis	Action is taken whenever the signal rises above the value defined by the upper limit + 0.5 · hysteresis range (32.51 Supervision 5 hysteresis). The action is deactivated when the signal falls below the value defined by the lower limit - 0.5 · hysteresis range.	7
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 ABB 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.	-
32.50	Supervision 5 high	Defines the upper limit for signal supervision 5.	0.00
	-21474836.00 21474836.00	Upper limit.	-

No. Name/Value		Description	Def/FbEq16
32.51	Supervision 5 hysteresis	Defines the hysteresis for the signal monitored by signal supervision 5. This parameter applies to all selections for parameter 32.45 Supervision 5 function, not just Hysteresis (7). Action is taken whenever the signal rises above the value defined by the upper limit + 0.5 · hysteresis. The action is deactivated when the signal falls below the value defined by the lower limit - 0.5 · hysteresis.	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
	Hysteresis	Action is taken whenever the signal rises above the value defined by the upper limit + 0.5 · hysteresis range (32.61 Supervision 6 hysteresis). The action is deactivated when the signal falls below the value defined by the lower limit - 0.5 · hysteresis range.	7
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 ABB 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

No.	Name/\	/alue	Description		Def/FbEq16	
32.59	Superv	ision 6 low	Defines the lo	wer limit for signal supervision 6.	0.00	
	-214748 214748	336.00 36.00	Low limit.		-	
32.60	Superv	ision 6 high	Defines the up	oper limit for signal supervision 6.	0.00	
	-214748 214748	336.00 36.00	Upper limit.		-	
32.61	Supervision 6 hysteresis		supervision 6. parameter 32. (7). Action is taker defined by the	Action is taken whenever the signal rises above the value defined by the upper limit $+$ 0.5 \cdot hysteresis. The action is deactivated when the signal falls below the value defined by		
	0.001	00.0000	Hysteresis.		-	
34 Timed functions 34.01 Timed functions status		See also section Status of the continuous timer is the log	Configuration of the timed functions. See also section <i>Timed functions</i> (page <i>134</i>). Status of the combined timers. The status of a combined timer is the logical OR of all timers connected to it. This parameter is read-only.			
	Bit Name			Description		
	0	Timed function 1		1 = Active.		
	1	Timed fund	tion 2	1 = Active.		
	2	Timed function 3		1 = Active.		
	315	Reserved		,		
	0000h0FFFFh		Status of combined timers 13.		1 = 1	
34.02	Timer s	tatus	Status of times This paramete		-	
	Bit	Name		Description		
	0	Timer 1		1 = Active.		
	1	Timer 2		1 = Active.		
	2	Timer 3		1 = Active.		
	3	Timer 4	1 = Active.			
	4	Timer 5		1 = Active.		
	5	Timer 6		1 = Active.		
	6	Timer 7		1 = Active.		
	7	Timer 8		1 = Active.		
	8	Timer 9		1 = Active.		
	9	Timer 10		1 = Active.		
	10	Timer 11		1 = Active.		
	11	Timer 12		1 = Active.		
	1215			7.0070.		
	1213	i vesei ved				
l	0000hFFFFh		Timer status.		1 = 1	

No.	Name/\	Name/Value Description			Def/FbEq16
34.04	Season/exception day status		holiday. Only o	sons 13, exception weekday and exception one season can be active at a time. A day can and a holiday at the same time. er 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 workday		1 = Active.	
	11	Exception holiday		1 = Active.	
	1215 Reserved				
	0000h.	FFFFh	Status of the s	seasons and exception weekday and holiday.	1 = 1
34.10	Timed i enable	functions	Selects the so 0 = Disabled. 1 = Enabled.	urce for the timed functions enable signal.	Disabled
	Disabled		0.		0
	Enable	d	1.		1
	DI1		Digital input D	I1 (10.02 DI delayed status, bit 0).	2
			Digital input D	I2 (10.02 DI delayed status, bit 1).	3
			Digital input D	l3 (10.02 DI delayed status, bit 2).	4
	DI4		Digital input DI4 (10.02 DI delayed status, bit 3).		5
	DI5		Digital input D	l5 (10.02 DI delayed status, bit 4).	6
	DI6		Digital input D	l6 (10.02 DI delayed status, bit 5).	7

Source selection (see *Terms and abbreviations* on page 178).

Other [bit]

310 Parameters

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

No. Name/Value Description Def/FbEq16

Bit	Name	Description
0	Monday	1 = Monday is an active start day.
1	Tuesday	1 = Tuesday is an active start day.
2	Wednesday	1 = Wednesday is an active start day.
3	Thursday	1 = Thursday is an active start day.
4	Friday	1 = Friday is an active start day.
5	Saturday	1 = Saturday is an active start day.
6	Sunday	1 = Sunday is an active start day.
7	Season 1	1 = Timer is active in season 1.
8	Season 2	1 = Timer is active in season 2.
9	Season 3	1 = Timer is active in season 3.
10	Season 4	1 = Timer is active in season 4.
11	Exceptions	0 = Exceptions days are disabled. The timer follows only weekday and season settings (bits 010 in the timer configuration) and the start time and duration of the timer (see 34.12 and 34.13). Exception day settings, parameters 34.7034.90, do not have any effect on this timer. 1 = Exception days are enabled. The timer is active during the weekdays and seasons defined with bits 010 and the times defined by 34.12 and 34.13. In addition, the timer is active during the exception days defined with bit 12, bit 13 and parameters 34.7034.90. If bit 12 and bit 13 are both zero, the timer is inactive during the exception days.
12	Holidays	0 = Timer is inactive on exception days configured as "Holiday". 1 = Timer is active on exception days configured as "Holiday". This bit has no effect unless bit 11 = 1 (Exceptions days are enabled). When bits 11 and 12 are both 1, the timer is active during the weekdays and seasons defined with bits 010 and times defined by parameters 34.12 and 34.13. In addition, the timer is active when the ongoing day is defined as Exception day Holiday by parameters 34.7034.90 and the current time matches with the time range defined by 34.12 and 34.13. During Exception days, weekday and season bits are ignored.
13	Workdays	0 = Timer is inactive on exception days configured as "Workday". 1 = Timer is active on exception days configured as "Workday". This bit has no effect unless bit 11 = 1 (Exceptions enabled). When bits 11 and 13 are both 1, the Timer is active during the weekdays and seasons defined with bits 010 and the times defined by parameters 34.12 and 34.13.
141	5 Reserved	

No.	Na	me	/Va	alu				De	esc	rip	tio	n				Def/FbEq16
						ow	the						atio	n d	efines when the Timer is active are shown	-
	Bit	s o	f pa	ara	me	ter										
	34	.11	Tir	nei	1	cor	ifigi	ura	tior	1		1				
	Monday	Tuesday	Wednesday	Fhursday	Friday	Saturday	Sunday	Season1	Season2	Season3	Season4	Exceptions	Holidays	Workdays		
	1	1	1	1	1	1	1	1	1	1	1	0	0	0	Example 1: Timer is active during the tim defined by other parameters every Weekd Season. Exception day settings (34.7034.90) do	ay and every
															effect on the Timer.	
	1	1	1	1	1	0	0	1	1	1	1	0	0	0	Example 2: Timer is active during the tim defined by other parameters from Mon to Season. Exception day settings (34.7034.90) do effect on the Timer.	Fri, every
	1	1	1	1	1	0	0	0	0	1	0	0	0	0	Example 3: Timer is active during the tim defined by other parameters from Mon to during Season 3 (can be configured as e. Exception day settings (34.7034.90) do effect on the Timer.	Fri, <u>only</u> g. summer).
	1	1	1	1	1	0	0	1	1	1	1	1	1	0	Example 4: Timer is active during the tim defined by other parameters from Mon to Season. In addition, the Timer is active every Excelled Holidays, regardless what is the day or see	Fri, every ption day
	1	0	1	0	1	0	1	1	1	0	0	1	0	1	· · · · · · · · · · · · · · · · · · ·	es of the day d, Fri and ption day
	1	1	1	1	1	1	1	1	1	1	1	1	0	0	Example 6: Timer is active during the tim defined by other parameters every Weekd Season. The Timer is <u>inactive during all Exception</u>	es of the day ay and every
	00	00h	1 I	FFI	Fŀ	<u> </u>		Co	onfi	auı	ratio	on	of t	ime	er 1	1 = 1
34.12	changed in second The timer can be sta For example, if the t the active session st						es geo ime xar ctiv	the I in er c mpl	e da se an le, i	cor be if th	sta nd s sta ne t	art time of timer 1. The time can be	00:00:00			
	00	:00	:00	2	23:5	59:5	59					_	÷			1 = 1
34.13	in minute steps. The duration can ext exception day becon midnight. In the same day stays active only							mine of ocception of the community of th	dura otio ighi itay ion ratio	e si atio on c t. Ir s a is l	tep lay th ctiv long	s. be e s ve o ger	ex cor am	of timer 1. The duration can be changed tend over the change of the day but if an mes active, the period is interrupted at e way the period started on an exception y until the end of the day, even if the ne timer will continue after a break if there	00 00:00	
	υÜ	UU:	.00	()/():U:(JU	111	me	al	ıraı	uor	١.			1 = 1

No.	Name/Value	Description	Def/FbEq16
34.14	Timer 2 configuration	See 34.11 Timer 1 configuration.	0111 1000 0000b
34.15	Timer 2 start time	See 34.12 Timer 1 start time.	00:00:00
34.16	Timer 2 duration	See 34.13 Timer 1 duration.	00 00:00
34.17	Timer 3 configuration	See 34.11 Timer 1 configuration.	0111 1000 0000b
34.18	Timer 3 start time	See 34.12 Timer 1 start time.	00:00:00
34.19	Timer 3 duration	See 34.13 Timer 1 duration.	00 00:00
34.20	Timer 4 configuration	See 34.11 Timer 1 configuration.	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

No.	Name/	Value	Description		Def/FbEq16	
34.60	Seasoi	n 1 start date	is the number The season ch at a time. Time are not inside The season st order to use al the season is n in increasing of	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 I 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 d	ate.		
34.61	Seaso	n 2 start date		art date of season 2. ason 1 start date.	01.01.	
34.62	Seaso	n 3 start date		art date of season 3. ason 1 start date.	01.01.	
34.63	Seaso	n 4 start date		art date of season 4. ason 1 start date.	01.01.	
34.70	Numbe except	er of active ions	Defines how method last active Exceptions 1 exceptions 4 Example: If the exceptions 5	3		
	016		Number of act	ive exception periods or days.	-	
34.71	Except	ion types	Defines the typ Exceptions 1 exceptions 4	0000b		
	Bit	Name		Description		
	0	Exception 1		0 = Workday. 1 = Holiday		
	1	Exception 2	2	0 = Workday. 1 = Holiday		
	2	Exception 3		0 = Workday. 1 = Holiday		
	3	Exception 4	,	0 = Workday. 1 = Holiday		
	4	Exception 5	5	0 = Workday. 1 = Holiday		
	5	Exception 6	3	0 = Workday. 1 = Holiday		
	6	Exception 7	,	0 = Workday. 1 = Holiday		
	7	Exception 8	3	0 = Workday. 1 = Holiday		
	8	Exception 9)	0 = Workday. 1 = Holiday		
	9	Exception 1		0 = Workday. 1 = Holiday		
	10	Exception 1	1	0 = Workday. 1 = Holiday		
	11 Exception 12 12 Exception 13		2	0 = Workday. 1 = Holiday		
			3	0 = Workday. 1 = Holiday		
	13	Exception 1	4	0 = Workday. 1 = Holiday		
		Exception 1	5	0 = Workday. 1 = Holiday		
			6	0 = Workday. 1 = Holiday		
	15	Exception 1	О	o Workday. I Honday		
	15	Exception	10	io violiday. I Holiday		

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/\	/alue	Description		Def/FbEq16	
34.100	Timed f	unction 1	Defines which 0 = Not connecte 1 = Connecte See 34.01 Tin	0000ь		
	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 f	unction 2		Defines which timers are connected to combined timer 2. 0000b See 34.01 Timed functions status.		
34.102	Timed f	unction 3	Defines which See 34.01 Til	0000b		
34.110	Boost ti	me function	Defines which connected to extra time fun	0000b		
	Bit	Name		Description		
	0	Timed func	tion 1			
	1	Timed func	tion 2			
	2	Timed fund	tion 3	0 = Inactive. 1 = Active.		
	315	Reserved				
	0000h	.FFFFh	Combined tim	ners including the extra timer.	1 = 1	
34.111	Boost til	me on source	Selects the set 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	DI4 (10.02 DI delayed status, bit 3).	5	
	DI5		Digital input D	DI5 (10.02 DI delayed status, bit 4).	6	
	DI6		Digital input D	DI6 (10.02 DI delayed status, bit 5).	7	

No.	Name/Value	Description	Def/FbEq16
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 178).	-
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 00:0007 00:00	Extra time duration.	1 = 1

35 Mor	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 <i>160</i>).	
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.	-
		This parameter is read-only.	
	-605000 °C or -769032 °F, 05000 ohm or [35.12] ohm	Measured temperature 1. Note: With a PTC sensor, the unit is ohms. If the measured temperature source selection (35.11) is PTC analog I/O or PTC Al/DI Voltage divider tree, the motor thermal protection function converts the analog input signal (35.14) to PTC resistance value (ohms), and shows it in this parameter. This is the case even the parameter name and unit refer to motor temperature (°C or °F). You cannot change the unit to ohm by the time being (96.16).	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. This parameter is read-only.	-
	-605000 °C or -769032 °F, 05000 ohm or [35.22] ohm	Measured temperature 2. Note: With a PTC sensor, the unit is ohms. If the measured temperature source selection (35.21) is PTC analog I/O or PTC AI/DI Voltage divider tree, the motor thermal protection function converts the analog input signal (35.24) to PTC resistance value (ohms), and shows it in this parameter. This is the case even the parameter name and unit refer to motor temperature (°C or °F). You cannot change the unit to ohm by the time being (96.16).	1 = 1 unit
35.05	Motor overload level	Shows the motor overload level as a percent of the motor overload fault limit. See section <i>Motor overload protection</i> (page 165).	0.0
	0.0300.0%	Motor overload level. 0.0% No motor overloading 88.0% Motor overloaded to warning level 100.0% Motor overloaded to fault level	10 = 1%

No.	Name/Value	Description	Def/FbEq16
35.11	Temperature 1 source	Selects the source from which measured temperature 1 is read. Usually this source is from a sensor connected to the motor controlled by the drive, but it could be used to measure and monitor a temperature from other parts of the process as long as a suitable sensor is used as per the selection list. Note: Depending on this parameter selection the control program hides the non-relevant parameters in this group.	Estimated temperature
	Disabled	None. Temperature monitoring function 1 is disabled.	0
	Estimated temperature	Estimated motor temperature (see parameter 35.01 Motor estimated temperature). The temperature is estimated from an internal drive calculation. It is important to set up the ambient temperature of the motor in 35.50 Motor ambient temperature.	1
	KTY84 analog I/O	KTY84 sensor connected to the analog input selected by parameter 35.14 Temperature 1 AI source and an analog output. The following settings are required: Set the appropriate analog input unit selection parameter in group 12 Standard AI to V (volt). In parameter group 13 Standard AO, set the source selection parameter of the analog output to Temp sensor 1 excitation. The analog output feeds a constant current through the sensor. As the resistance of the sensor increases along with its temperature, the voltage over the sensor increases. The voltage is read by the analog input and converted into degrees.	2
	Reserved		34
	1 × Pt100 analog I/O	Pt100 sensor connected to a standard analog input selected by parameter 35.14 Temperature 1 Al source and an analog output. The following settings are required: • 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
	Reserved		910
	Direct temperature	The temperature is taken from the source selected by parameter 35.14 Temperature 1 Al source. The value of the source is assumed to be in the unit of temperature specified by parameter 96.16 Unit selection.	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 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.	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 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.	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.	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.	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 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.	16
	Reserved		1718
	PTC analog I/O	PTC sensor connected to analog input selected by parameter 35.14 Temperature 1 Al source and an analog output. The required settings are the same as with selection KTY84 analog I/O. Note: With this selection, the control program converts the analog signal to PTC resistance value in ohms and shows it in parameter 35.02. The parameter name and unit still refer to temperature.	20

No.	Name/Value	Description	Def/FbEq16
	PTC AI/DI Voltage Divider tree	PTC sensor connected to the analog input selected by parameter 35.14 Temperature 1 Al source. A special voltage divider connection must be in use instead of the normal PTC connection. The voltage divider connection uses the terminals +10 V, digital input and analog input. See the drive hardware manual for the actual connection. This selection makes it possible to connect the PTC when no analog output is available. The required settings are same as with selection KTY84 analog I/O. Note: Make sure that the digital input that you connect to this voltage divider circuit is not used for any other purpose in the control program. With this selection, the parameter 35.02 shows PTC resistance in ohms, not motor temperature even the parameter name and unit still refer to temperature.	23
35.12	Temperature 1 fault limit	Defines the fault limit for temperature supervision function 1. When measured temperature 1 exceeds the limit, the drive trips on fault 4981 External temperature 1. The unit is selected by parameter 96.16 Unit selection.	130 °C or 266 °F or 4500 ohm
	-605000 °C or -769032 °F or 05000 ohm	Fault limit for temperature monitoring function 1. Note: If the measured temperature source selection (35.11) is PTC analog I/O or PTC AI/DI Voltage divider tree, the motor thermal protection function converts the analog input signal (35.14) to PTC resistance value (ohms). Also this limit is then a resistance value even the parameter name and unit refer to motor temperature (°C or °F). You cannot change the unit to ohm by the time being (96.16).	1 = 1 °
35.13	Temperature 1 warning limit	Defines the warning limit for temperature supervision function 1. When measured temperature 1 exceeds the limit, warning A491 External temperature 1 is generated. The unit is selected by parameter 96.16 Unit selection.	110 °C or 230 °F or 4000 ohm
	-605000 °C or -769032 °F or 05000 ohm	Warning limit for temperature monitoring function 1. Note: If the measured temperature source selection (35.11) is PTC analog I/O or PTC AI/DI Voltage divider tree, the motor thermal protection function converts the analog input signal (35.14) to PTC resistance value (ohms). Also this limit is then a resistance value even the parameter name and unit refer to motor temperature (°C or °F). You cannot change the unit to ohm by the time being (96.16).	1=1°
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 178).	-

No.	Name/Value	Description	Def/FbEq16
35.21	Temperature 2 source	Selects the source from which measured temperature 2 is read. See parameter 35.11.	Estimated temperature
	Disabled	None. Temperature monitoring function 2 is disabled.	0
	Estimated temperature	Estimated motor temperature (see parameter 35.01 Motor estimated temperature). The temperature is estimated from an internal drive calculation. It is important to set up the ambient temperature of the motor in 35.50 Motor ambient temperature.	1
	KTY84 analog I/O	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 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.	2
	Reserved		34
	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 appropriate analog input unit selection parameter in group 12 Standard AI to V (volt). In parameter group 13 Standard AO, set the source selection parameter of the analog output to Temp sensor 2 excitation. The analog output feeds a constant current through the sensor. As the resistance of the sensor increases along with its temperature, the voltage over the sensor increases. The voltage is read by the analog input and converted into degrees.	5
	2 × Pt100 analog I/O	As selection 1 × Pt100 analog I/O, but with two sensors connected in series. Using multiple sensors improves measurement accuracy significantly.	6
	3 × Pt100 analog I/O	As selection 1 × Pt100 analog I/O, but with three sensors connected in series. Using multiple sensors improves measurement accuracy significantly.	7
	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 in the unit of temperature specified by parameter 96.16 Unit selection.	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 Al source and an analog output. The following settings are required: Set the appropriate analog input unit selection parameter in group 12 Standard Al to V (volt).	12
		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.	
	1 × Pt1000 analog I/O	Pt1000 sensor connected to a standard analog input selected by parameter 35.14 Temperature 1 Al source and an analog output. The following settings are required: Set the appropriate analog input unit selection parameter	13
		 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.	
	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.	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.	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 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.	16
	Reserved		1718
	PTC analog I/O	PTC sensor connected to analog input selected by parameter 35.24 Temperature 2 AI source and an analog output. The required settings are the same as with selection KTY84 analog I/O. Note: With this selection, the control program converts the analog signal to PTC resistance value in ohms and shows it	20
		in parameter 35.03. The parameter name and unit still refer to temperature.	

No.	Name/Value	Description	Def/FbEq16
	PTC AI/DI Voltage Divider tree	PTC sensor connected to the analog input selected by parameter 35.24 Temperature 2 AI source. A special voltage divider connection must be in use instead of the normal PTC connection. The voltage divider connection uses the terminals +10 V, digital input and analog input. See the drive hardware manual for the actual connection. This selection makes it possible to connect the PTC when no analog output is available. The required settings are same as with selection KTY84 analog I/O. Note: Make sure that the digital input that you connect to this voltage divider circuit is not used for any other purpose in the control program. With this selection, the parameter 35.03 shows PTC resistance in ohms, not motor temperature even the parameter name and unit still refer to temperature.	
35.22	Temperature 2 fault limit	Defines the fault limit for temperature supervision function 2. When measured temperature 1 exceeds the limit, the drive trips on fault 4982 External temperature 2. The unit is selected by parameter 96.16 Unit selection.	130 °C or 266 °F or 4500 ohm
	-605000 °C or -769032 °F or 05000 ohm	Fault limit for temperature monitoring function 2. Note : If the measured temperature source selection (35.21) is PTC analog I/O or PTC AI/DI Voltage divider tree, the motor thermal protection function converts the analog input signal (35.24) to PTC resistance value (ohms). Also this limit is then a resistance value even the parameter name and unit refer to motor temperature (°C or °F). You cannot change the unit to ohm by the time being (96.16).	1 = 1 °
35.23	Temperature 2 warning limit	Defines the warning limit for temperature supervision function 2. When measured temperature 1 exceeds the limit, warning A492 External temperature 2 is generated. The unit is selected by parameter 96.16 Unit selection.	110 °C or 230 °F or 4000 ohm
	-605000 °C or -769032 °F or 05000 ohm	Warning limit for temperature monitoring function 2. Note: If the measured temperature source selection (35.21) is PTC analog I/O or PTC AI/DI Voltage divider tree, the motor thermal protection function converts the analog input signal (35.24) to PTC resistance value (ohms). Also this limit is then a resistance value even the parameter name and unit refer to motor temperature (°C or °F). You cannot change the unit to ohm by the time being (96.16).	1 = 1°
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 Terms and abbreviations on page 178).	-

No.	Name/Value	Description	Def/FbEq16
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°
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.	110%
	// _N		!
	(%)	I = Motor currentI_N = Nominal motor current	
	150 —		
	100	35.51	
	35.52 S		
		35.53 Drive outp. frequency	ut
	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.	70%
	25150%	Zero speed load for the motor load curve.	1 = 1%

No.	Name/Value	Description	Def/FbEq16
35.53	Break point	Defines the motor load curve together with parameters 35.51 Motor load curve and 35.52 Zero speed load. Defines the break point frequency of the load curve ie. the point at which the motor load curve begins to decrease from the value of parameter 35.51 Motor load curve towards the value of parameter 35.52 Zero speed load. See parameter 35.51 Motor load curve.	45.00 Hz
	1.00500.00 Hz	Break point for the motor load curve.	See par. 46.02
35.54	Motor nominal temperature rise Motor nom temperature		80 °C or 176 °F
	0300 °C or 32572 °F	Temperature rise.	1 = 1°

No.	Name/Value	Description	Def/FbEq16
35.55	Motor thermal time constant	Defines the thermal time constant for use with the motor thermal protection model, defined as the time to reach 63% of the nominal motor temperature. See the motor manufacturer's recommendations. For thermal protection according to UL requirements for NEMA class motors, use the rule of thumb: Motor thermal time equals 35 times t6, where t6 (in seconds) is specified by the motor manufacturer as the time that the motor can safely operate at six time its rated current. The thermal time for Class 10 trip curve is 350 s, for Class 20 trip curve 700 s and for Class 30 trip curve 1050 s. Motor current 100% 63% Motor thermal time Time	256 s
	10010000 s	Motor thermal time constant.	1 = 1 s
35.56	Motor overload action	Selects the action taken when motor overload is detected. See section <i>Motor overload protection</i> (page 165).	Warning and fault
	No action	No action taken.	0
	Warning only	Drive generates warning A783 Motor overload when the motor is overloaded to the warning level, that is, parameter 35.05 Motor overload level reaches value 88.0%.	1
	Warning and fault	Drive generates warning A783 Motor overload when the motor is overloaded to the warning level, that is, parameter 35.05 Motor overload level reaches value 88.0%. Drive trips on fault 7122 Motor overload when the motor is overloaded to the fault level, that is, parameter 35.05 Motor overload level reaches value 100.0%.	2
35.57	Motor overload class	Defines the motor overload class to be used. The class of protection is specified by the user as the time for tripping at 7.2 times (IEC 60947-4-1) or 6 times (NEMA ICS) the tripping level current. See section <i>Motor overload protection</i> (page 165).	Class 20
	Class 5	Motor overload class 5.	0
	Class 10	Motor overload class 10.	1
	Class 20	Motor overload class 20.	2

No.	Name/Value	Description	Def/FbEq16
	Class 30	Motor overload class 30.	3
	Class 40	Motor overload class 40.	4

36 Load analyzer		Peak value and amplitude logger settings. See also section <i>Load analyzer</i> (page <i>169</i>).	
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 181).	1
	Reserved		2
	Output frequency	01.06 Output frequency (page 181).	3
	Motor current	01.07 Motor current (page 181).	4
	Reserved		5
	Motor torque	01.10 Motor torque (page 181).	6
	DC voltage	01.11 DC voltage (page 181).	7
	Output power	01.14 Output power (page 182).	8
	Reserved		9
	Speed ref ramp in	23.01 Speed ref ramp input (page 256).	10
	Speed ref ramp out	23.02 Speed ref ramp output (page 256).	11
	Speed ref used	24.01 Used speed reference (page 260).	12
	Torque ref used	26.02 Torque reference used (page 266).	13
	Freq ref used	28.02 Frequency ref ramp output (page 271).	14
	Reserved		15
	Process PID out	40.01 Process PID output actual (page 332).	16
	Other	Source selection (see <i>Terms and abbreviations</i> on page 178).	-
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

No.	Name/Value	Description	Def/FbEq16
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
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.	00:00:00
	-	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.	00:00:00
	-	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 $I_{\rm max}$ 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/\	/alue	Description		Def/FbEq16
36.50	AL2 res	set date	The date on w	The date on which amplitude logger 2 was last reset.	
	-		Last reset date	Last reset date of amplitude logger 2.	
36.51	AL2 reset time		The time at wh	nich amplitude logger 2 was last reset.	00:00:00
	-		Last reset time	e of amplitude logger 2.	-
37 Us	er load (curve	Settings for us See also section	ser load curve. on <i>User load curve</i> (page 127).	
37.01	ULC output status word		shown only whindependent o	tatus of the monitored signal. The status is nile the drive is running. (The status word is if the actions and delays selected by 7.03, 37.04, 37.41 and 37.42.) or is read-only.	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	d curve.
	2	Overload lii	mit	1 = Signal higher than the overload curve.	
	3	Outside loa	d limit	1 = Signal lower than the underload curve or hi overload curve.	gher than the
	415	Reserved			
	0000h.	FFFFh	Status of the n	nonitored signal.	1 = 1
37.02	ULC supervision signal			gnal to be monitored. The function compares alue of the signal against the load curve.	Motor torque %
	Not selected		No signal sele	cted (monitoring disabled).	0
	Motor speed %		01.03 Motor s	peed % (page 181).	1
	Motor current %		01.08 Motor ca	urrent % of motor nom (page 181).	2
	Motor torque %		01.10 Motor to	orque (page 181).	3
	Output power % of motor nominal		01.15 Output µ	power % of motor nom (page 182).	4
	Output power % of drive nominal		01.16 Output µ	power % of drive nom (page 182).	5
	Other		Source selecti	on (see Terms and abbreviations on page 178).	-
37.03	ULC ov actions		monitored sign	ne drive reacts if the absolute value of the nal stays continuously above the overload curve in the value of 37.41 ULC overload timer.	Disabled
	Disable	d	No action take	en.	0
	Warnin	g	The drive gene warning).	erates a warning (A8BE ULC overload	1
	Fault		The drive trips	on 8002 ULC overload fault.	2
	Warnin	g/Fault	The drive gene if the signal standard of the time timer. The drive trips continuously a	erates a warning (A8BE ULC overload warning) ays continuously above the overload curve for a defined by parameter 37.41 ULC overload on 8002 ULC overload fault if the signal stays above the overload curve for a time defined by 41 ULC overload timer.	3

No.	Name/Value	Description	Def/FbEq16
37.04	ULC underload actions	Selects how the drive reacts if the absolute value of the monitored signal stays continuously above the overload curve for longer than the value of 37.42 ULC underload timer.	Disabled
	Disabled	No action taken.	0
	Warning	The drive generates a warning (A8BF ULC underload warning).	1
	Fault	The drive trips on 8001 ULC underload fault.	2
	Warning/Fault	The drive generates a warning (A8BF ULC underload warning) if the signal stays continuously below the underload curve for half of the time defined by parameter 37.41 ULC overload timer. The drive trips on 8001 ULC underload fault if the signal stays continuously above 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. Speed points are used if parameter 99.04 Motor control mode is set to Vector or if 99.04 Motor control mode is set to Vector or if 99.04 Motor control mode is set to Scalar and the reference unit is rpm. The five points must be in order from lowest to highest. The points are defined as positive values, but the range is symmetrically effective also in the negative direction. The monitoring is not active outside these two areas.	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. Frequency points are used if parameter 99.04 Motor control mode is set to Scalar and the reference unit is Hz. The five points must be in order from lowest to highest. The points are defined as positive values, but the range is symmetrically effective also in the negative direction. The monitoring is not active outside these two areas.	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. Each point of the underload curve must have a lower value than the corresponding overload point.	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. Each point of the overload curve must have a higher value than the corresponding underload point.	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%
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%

No.	Name/Value	Description	Def/FbEq16
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 for which the monitored signal must continuously stay above the overload curve before the drive takes the action selected by 37.03 ULC overload actions.	20.0 s
	0.010000.0 s	Overload timer.	1 = 1 s
37.42	ULC underload timer	Defines the time for which the monitored signal must continuously stay below the underload curve before the drive takes the action selected by 37.04 ULC underload actions.	20.0 s
	0.010000.0 s	Underload timer.	1 = 1 s

40 Pro	ocess 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 40.0740.90 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 534 and 535. 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 535. This parameter is read-only.	-
	-200000.00 200000.00	Process PID controller output.	1 = 1
40.02	Process PID feedback actual	Displays the value of process feedback after source selection, mathematical function (parameter 40.10 Set 1 feedback function), and filtering. See the control chain diagram on page 534. This parameter is read-only.	-
	-200000.00 200000.00 PID customer units	Process feedback.	1 = 1 PID customer unit
40.03	Process PID setpoint actual	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 diagram on page 534. This parameter is read-only.	-
	-200000.00 200000.00 PID customer units	Setpoint for process PID controller.	1 = 1 PID customer unit

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 535. This parameter is read-only.	-
	-200000.00 200000.00 PID customer units	PID deviation.	1 = 1 PID customer unit
40.05	Process PID trim output act	Displays the process PID trimmed reference output. This parameter is read-only.	-
	-3276832768	Process PID trimmed reference.	1 = 1
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	Trim mode	
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	Deadband active	1 = Deadband active (see par. 40.39)
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. 40.1640.23)
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 Local control vs. external control (page 105).	Off
	Off	Process PID control inactive.	0
	On	Process PID control active.	1
	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 534.	Al2 percent
	Not selected	None.	0
	Al1 scaled	12.12 Al1 scaled value (see page 212).	1
	Al2 scaled	12.22 Al2 scaled value (see page 214).	2
	Freq in scaled	11.39 Freq in 1 scaled value (see page 209).	3
	Reserved		47
	Al1 percent	12.101 Al1 percent value (see page 215).	8

No.	Name/Value	Description	Def/FbEq16
	Al2 percent	12.102 Al2 percent value (see page 215).	9
	Feedback data storage	40.91 Feedback data storage (see page 347).	10
	Other	Source selection (see <i>Terms and abbreviations</i> on page 178).	-
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. The result of the function (for any selection) is multiplied by parameter 40.90 Set 1 feedback multiplier.	In1
	ln1	Source 1.	0
	ln1+ln2	Sum of sources 1 and 2.	1
	ln1-ln2	Source 2 subtracted from source 1.	2
	ln1*ln2	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
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
40.14	Set 1 setpoint scaling	Defines, together with parameter 40.15 Set 1 output scaling, a general scaling factor for the process PID control chain. If the parameter is set to zero, automatic setpoint scaling is activated, where suitable setpoint scale is calculated according to selected setpoint source. Actual setpoint scale is shown in parameter 40.61 Setpoint scaling actual. The scaling can be utilized when, for example, the process setpoint is input in Hz, and the output of the PID controller is used as an rpm value in speed control. In this case, this parameter might be set to 50, and parameter 40.15 to the nominal motor speed at 50 Hz. In effect, the output of the PID controller = [40.15] when deviation (setpoint - feedback) = [40.14] and [40.32] = 1. Note: The scaling is based on the ratio between 40.14 and 40.15. For example, the values 50 and 1500 would produce the same scaling as 1 and 30.	0.00
	-200000.00 200000.00	Scaling.	1 = 1

No.	Name/Value	Description		Def/FbEq16
40.15	Set 1 output scaling	See parameter 40.14 Set 1 set If the parameter is set to zero,		0.00
		Operation mode (see par. 19.01) Speed control	Scaling 46.01 Speed scaling	
		Frequency control	46.02 Frequency scaling	
		Torque control	100%	
		· · · · · · · · · · · · · · · · · · ·		
	-200000.00 200000.00	Process PID controller output t		1 = 1
40.16	Set 1 setpoint 1 source	Selects the primary source of p control chain diagram on page		Al1 percent
	Not selected	None.		0
	Reserved			1
	Internal setpoint	Internal setpoint. See paramete sel1.	er 40.19 Set 1 internal setpoint	2
	Al1 scaled	12.12 Al1 scaled value (see page	nge 212).	3
	Al2 scaled	12.22 Al2 scaled value (see pa	nge 214).	4
	Reserved			57
	Motor potentiometer	22.80 Motor potentiometer ref potentiometer).	act (output of the motor	8
	Reserved		9	
	Freq in scaled	11.39 Freq in 1 scaled value (s	10	
	Al1 percent	12.101 Al1 percent value (see	page 215)	11
	Al2 percent	12.102 Al2 percent value (see	page 215)	12
	Control panel (ref saved)	Panel reference (03.01 Panel I saved by the control system for returns is used as the reference (Selection not available for par source.) Reference	the location where the control e. ameter 71.16 Setpoint 1 EXT1 reference X EXT2 reference Active reference Inactive reference	13
	Control panel (ref copied)	Panel reference (03.01 Panel I) the previous control location is the control location changes il locations are of the same type frequency/speed/torque/PID); used as the new reference. Reference	used as the reference when the references for the two (e.g.	14

No.	Name/Value	Description			Def/FbEq16
	FB A ref1	03.05 FB A referen	nce 1 (see page 18	34).	15
	FB A ref2	03.06 FB A referen	nce 2 (see page 18	34).	16
	Reserved				1718
	EFB ref1	03.09 EFB referen	ce 1 (see page 18	25).	19
	EFB ref2	03.10 EFB referen	ce 2 (see page 18	25).	20
	Reserved				2123
	Setpoint data storage	40.92 Setpoint data (Selection not ava source.)	- , , ,	ge 347). er 71.16 Setpoint 1	24
	Other	Source selection (see <i>Terms and abl</i>	breviations on page 178).	-
40.17	Set 1 setpoint 2 source	source is used onl inputs.	y if the setpoint fur	s setpoint. The second nction requires two 0.16 Set 1 setpoint 1	Not selected
40.18	Set 1 setpoint function	parameters 40.16 setpoint 2 source.	Set 1 setpoint 1 so unction (for any se	oint sources selected by ource and 40.17 Set 1 lection) is multiplied by plier.	In1
	In1	Source 1.			0
	ln1+ln2	Sum of sources 1	and 2.		1
	ln1-ln2	Source 2 subtracte	ed from source 1.		2
	In1*In2	Source 1 multiplie	d by source 2.		3
	ln1/ln2	Source 1 divided b	y 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 sou	irce 1.		8
	sqrt(In1-In2)	Square root of (so	urce 1 - source 2).		9
	sqrt(In1+In2)	Square root of (so	urce 1 + source 2)		10
	sqrt(In1)+sqrt(In2)	Square root of sou	irce 1 + square roo	ot of source 2.	11
40.19	Set 1 internal setpoint sel1	internal setpoint of 40.2140.24. Note: Parameters	ut of the presets de 40.16 Set 1 setpo	ernal setpoint sel2 the efined by parameters int 1 source and 40.17 to Internal setpoint.	Not selected
		Source defined by par. 40.19	Source defined by par. 40.20	Setpoint preset active	
		0	0	0 (par. 40.24)	
		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
	23,000,00				l .

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
	Reserved		817
	Timed function 1	Bit 0 of 34.01 Timed functions status (see page 307).	18
	Timed function 2	Bit 1 of 34.01 Timed functions status (see page 307).	19
	Timed function 3	Bit 2 of 34.01 Timed functions status (see page 307).	20
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 299).	21
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 299).	22
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 299).	23
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 178).	-
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 (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 307).	18
	Timed function 2	Bit 1 of 34.01 Timed functions status (see page 307).	19
	Timed function 3	Bit 2 of 34.01 Timed functions status (see page 307).	20
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 299).	21
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 299).	22
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 299).	23
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 178).	-
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
	-200000.00 200000.00 PID customer units	Internal process setpoint 1.	1 = 1 PID customer unit

No.	Name/Value	Description	Def/FbEq16
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
	-200000.00 200000.00PID 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
	-200000.00 200000.00 PID customer units	Internal process setpoint 3.	1 = 1 PID customer unit
40.24	Set 1 internal setpoint 0	Internal process setpoint 0. See parameter 40.19 Set 1 internal setpoint sel1.	0.00 PID customer units
	-200000.00 200000.00 PID customer units	Internal process setpoint 0.	1 = 1 PID customer unit
40.26	Set 1 setpoint min	Defines a minimum limit for the process PID controller setpoint.	0.00
	-200000.00 200000.00 PID customer units	Minimum limit for process PID controller setpoint.	1 = 1 PID customer unit
40.27	Set 1 setpoint max	Defines a maximum limit for the process PID controller setpoint.	200000.00
	-200000.00 200000.00 PID customer units	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 enable.	Not selected
	Not selected	Process PID controller setpoint not frozen.	0
	Selected	Process PID controller setpoint frozen.	1
	DI1	Digital input DI1 (10.02 DI delayed status, bit 0).	2
	DI2	Digital input DI2 (10.02 DI delayed status, bit 1).	3
	DI3	Digital input DI3 (10.02 DI delayed status, bit 2).	4
	DI4	Digital input DI4 (10.02 DI delayed status, bit 3).	5
	DI5	Digital input DI5 (10.02 DI delayed status, bit 4).	6
	DI6	Digital input DI6 (10.02 DI delayed status, bit 5).	7
	Reserved		817

No.	Name/Value	Description	Def/FbEq16
	Timed function 1	Bit 0 of 34.01 Timed functions status (see page 307).	18
	Timed function 2	Bit 1 of 34.01 Timed functions status (see page 307).	19
	Timed function 3	Bit 2 of 34.01 Timed functions status (see page 307).	20
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 299).	21
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 299).	22
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 299).	23
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 178).	-
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 130).	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 178).	-
40.32	Set 1 gain	Defines the gain for the process PID controller. See parameter 40.33 Set 1 integration time.	1.00
	0.01100.00	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.	1=1s
40.34	Set 1 derivation time	Integration 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

No.	Name/Value	Description	Def/FbEq16
40.35	Set 1 derivation filter time	Defines the time constant of the 1-pole filter used to smooth the derivative component of the process PID controller.	0.0 s
		Unfiltered signal	
		Filtered signal	
		O = I × (1 - e ^{-t/T})	
		I = filter input (step) O = filter output t = time T = filter time constant	
	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.	0.00
	-200000.00 200000.00	Minimum limit for process PID controller output.	1 = 1
40.37	Set 1 output max	Defines the maximum limit for the process PID controller output. See parameter 40.36 Set 1 output min.	100.00
	-200000.00 200000.00	Maximum limit for process PID controller output.	1 = 1
40.38	Set 1 output freeze enable	Freezes (or defines a source that can be used to freeze) the output of the process PID controller, keeping the output at the value it was before freeze was enabled. This feature can be used when, for example, a sensor providing process feedback must to be serviced without stopping the process. 1 = Process PID controller output frozen See also parameter 40.30 Set 1 setpoint freeze enable.	Not selected
	Not selected	Process PID controller output not frozen.	0
	Selected	Process PID controller output frozen.	1
	DI1	Digital input DI1 (10.02 DI delayed status, bit 0).	2
	DI2	Digital input DI2 (10.02 DI delayed status, bit 1).	3
	DI3	Digital input DI3 (10.02 DI delayed status, bit 2).	4
	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 307).	18
	Timed function 2	Bit 1 of 34.01 Timed functions status (see page 307).	19
	Timed function 3	Bit 2 of 34.01 Timed functions status (see page 307).	20

No.	Name/Value	Description	Def/FbEq16
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 299).	21
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 299).	22
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 299).	23
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 178).	-
40.39	Set 1 deadband range	Defines a deadband around the setpoint. Whenever process feedback enters the deadband, a delay timer starts. If the feedback remains within the deadband longer than the delay (40.40 Set 1 deadband delay), the PID controller output is frozen. Normal operation resumes after the feedback value leaves the deadband.	0.0
	40.39 Set 1 deadband range Setp Feedb	oint	
	515		
	PID contro ou	PID co output	
		PID co output	
		PID co output	frozen
10.40	ou	PID co output 40.40 Set 1 deadband delay	frozen Time
40.40	0200000.0 Set 1 deadband	Deadband range. Delay for the deadband. See parameter 40.39 Set 1	Time
	0200000.0 Set 1 deadband delay	Deadband range. Delay for the deadband. See parameter 40.39 Set 1 deadband range.	Time 1 = 1 0.0 s
	0200000.0 Set 1 deadband delay 0.0 3600.0 s	Deadband range. Delay for the deadband. See parameter 40.39 Set 1 deadband range. Delay for deadband area. Delines 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	Time 1 = 1 0.0 s 1 = 1 s
40.43	0200000.0 Set 1 deadband delay 0.0 3600.0 s Set 1 sleep level	Deadband range. Delay for the deadband. See parameter 40.39 Set 1 deadband range. Delay for deadband area. Delines 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.	Time 1 = 1 0.0 s 1 = 1 s 0.0
40.43	0200000.0 Set 1 deadband delay 0.0 3600.0 s Set 1 sleep level	Deadband range. Delay for the deadband. See parameter 40.39 Set 1 deadband range. Delay for deadband area. 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. Sleep start level. 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	Time 1 = 1 0.0 s 1 = 1 s 0.0
40.40	0200000.0 Set 1 deadband delay 0.0 3600.0 s Set 1 sleep level 0.0200000.0 Set 1 sleep delay	Deadband range. Delay for the deadband. See parameter 40.39 Set 1 deadband range. Delay for deadband area. Delines 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. Sleep start level. 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.	Time 1 = 1 0.0 s 1 = 1 s 0.0 1 = 1 s 0.0

No.	Name/Value	Description	Def/FbEq16
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
	0.0200000.0 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
	-200000.00 200000.00 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
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 132). 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 307).	18
	Timed function 2	Bit 1 of 34.01 Timed functions status (see page 307).	19
	Timed function 3	Bit 2 of 34.01 Timed functions status (see page 307).	20
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 299).	21
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 299).	22
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 299).	23
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 178).	-
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 212).	1
	Al2 scaled	12.22 Al2 scaled value (see page 214).	2

No.	Name/Value	Description	Def/FbEq16
	FB A ref1	03.05 FB A reference 1 (see page 184).	3
	FB A ref2	03.06 FB A reference 2 (see page 184).	4
	Other	Source selection (see <i>Terms and abbreviations</i> on page 178).	-
40.51	Set 1 trim mode	Activates the trim function and selects between direct and proportional trimming (or a combination of both). With trimming, it is possible to apply a corrective factor to the drive reference (setpoint). The output after trimming is available as parameter 40.05 Process PID trim output act. See the control chain diagram on page 535.	Off
	Off	The trim function is inactive.	0
	Direct	The trim function is active. The trimming factor is relative to the maximum speed, torque or frequency; the selection between these is made by parameter 40.52 Set 1 trim selection.	1
	Proportional	The trim function is active. The trimming factor is relative to the reference selected by parameter 40.53 Set 1 trimmed ref pointer.	2
	Combined	The trim function is active. The trimming factor is a combination of both <i>Direct</i> and <i>Proportional</i> modes; the proportions of each are defined by parameter 40.54 Set 1 trim mix.	3
40.52	Set 1 trim selection	Selects whether trimming is used for correcting the speed, torque or frequency reference.	Torque
	Torque	Torque reference trimming.	1
	Speed	Speed reference trimming.	2
	Frequency	Frequency reference trimming.	3
40.53	Set 1 trimmed ref pointer	Selects the signal source for the trim reference.	Not selected
	Not selected	None.	0
	Al1 scaled	12.12 Al1 scaled value (see page 212).	1
	Al2 scaled	12.22 Al2 scaled value (see page 214).	2
	FB A ref1	03.05 FB A reference 1 (see page 184).	3
	FB A ref2	03.06 FB A reference 2 (see page 184).	4
	Other	Source selection (see <i>Terms and abbreviations</i> on page 178).	-
40.54	Set 1 trim mix	When parameter 40.51 Set 1 trim mode is set to Combined, defines the effect of direct and proportional trim sources in the final trimming factor. 0.000 = 100% proportional 0.500 = 50% proportional, 50% direct 1.000 = 100% direct	0.000
	0.000 1.000	Trim mix.	1 = 1
40.55	Set 1 trim adjust	Defines a multiplier for the trimming factor. This value is multiplied by the result of parameter 40.51 Set 1 trim mode. Consequently, the result of the multiplication is used to multiply the result of parameter 40.56 Set 1 trim source.	1.000
	-100.000 100.000	Multiplier for trimming factor.	1 = 1
40.56	Set 1 trim source	Selects the reference to be trimmed.	PID ref
	PID ref	PID setpoint.	1

No.	Name/Value	Description	Def/FbEq16
	PID output	PID controller output.	2
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 307).	18
	Timed function 2	Bit 1 of 34.01 Timed functions status (see page 307).	19
	Timed function 3	Bit 2 of 34.01 Timed functions status (see page 307).	20
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 299).	21
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 299).	22
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 299).	23
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 178).	-
40.58	Set 1 increase prevention	Activates and defines the type of the 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 178).	-
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

No.	Name/Value	Description	Def/FbEq16
	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
40.60	Set 1 PID activation source	Selects a source that enables/disables process PID control. See also parameter 40.07 Process PID operation mode. 0 = Process PID control disabled. 1 = Process PID control enabled.	On
	Off	0.	0
	On	1.	1
	Follow Ext1/Ext2 selection	Process PID control is disabled when external control location EXT1 is active, and enabled when external control location EXT2 is active.	2
	DI1	See also parameter 19.11 Ext1/Ext2 selection.	3
	DI2	Digital input DI1 (10.02 DI delayed status, bit 0).	4
		Digital input DI2 (10.02 DI delayed status, bit 1).	
	DI3	Digital input DI3 (10.02 DI delayed status, bit 2).	5
	DI4	Digital input DI4 (10.02 DI delayed status, bit 3).	6
	DI5	Digital input DI5 (10.02 DI delayed status, bit 4).	7
	DI6	Digital input DI6 (10.02 DI delayed status, bit 5).	8
	DIO1	Digital input/output DIO1.	9
	DIO2	Digital input/output DIO2.	10
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 178).	-
40.61	Setpoint scaling actual	Actual setpoint scaling. See parameter 40.14 Set 1 setpoint scaling.	-
	-200000.00 200000.00	Scaling.	1 = 1
40.62	PID internal setpoint actual	Displays the value of the internal setpoint. See the control chain diagram on page 534. This parameter is read-only.	-
	-200000.00 200000.00 PID customer units	Process PID internal setpoint.	1 = 1 PID customer unit
40.79	Set 1 units	Unit used for PID set 1.	°C
	User text	User editable text. User text default is "PID unit 1".	0
	%		
	bar		
	kPa		
	Pa		
	psi		
	CFM		
	inH ₂ O		
	°C		
	°F		
	mbar		
	m ³ /h		

No.	Name/Value	Description	Def/FbEq16
	dm ³ /h		
	I/s		
	l/min		
	l/h		
	m ³ /s		
	m ³ /min		
	km ³ /h		
	gal/s		
	ft ³ /s		
	ft ³ /min		
	ft ³ /h		
	ppm		
	inHg		
	kCFM		
	inWC		
	gpm		
	gal/min		
	in wg		
	MPa		
	ftWC		
	%		4
	bar		74
	kPa		75
	Pa		77
	psi		76
	CFM		26
	inH ₂ O		58
	°C		150
	°F		151
	mbar		44
	m ³ /h		78
	dm ³ /h		21
	I/s		79
	I/min		37
	l/h		38
	m³/s		88
	m ³ /min		40
	km ³ /h		131
	gal/s		47
	ft ³ /s		50
	ft ³ /min		51

No.	Name/Value	Description	Def/FbEq16
	ft ³ /h		52
	ppm		34
	inHg		29
	kCFM		126
	inWC		65
	gpm		80
	gal/min		48
	in wg		59
	MPa		94
	ftWC		125
40.80	Set 1 PID output min source	Selects the source for set 1 PID output minimum.	Set1 output min
	Not selected	None.	0
	Set1 output min	40.36 Set 1 output min.	1
40.81	Set 1 PID output max source	Selects the source for set 1 PID output minimum.	Set1 output max
	Not selected	None.	0
	Set1 output max	40.37 Set 1 output max	1
40.89	Set 1 setpoint multiplier	Defines the multiplier with which the result of the function specified by parameter 40.18 Set 1 setpoint function is multiplied.	1.00
	-200000.00 200000.00	Multiplier.	1 = 1
40.90	Set 1 feedback multiplier	Defines the multiplier with which the result of the function specified by parameter 40.10 Set 1 feedback function is multiplied.	1.00
	-200000.00 200000.00	Multiplier.	1 = 1
40.91	Feedback data storage	Storage parameter for receiving a process feedback value e.g. 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 e.g. 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
40.96	Process PID output %	Percentage scaled signal of parameter 40.01 Process PID feedback actual.	0.00%
	-100.00100.00%	Percentage.	100 = 1%

No.	Name/Value	Description	Def/FbEq16
40.97	Process PID feedback %	Percentage scaled signal of parameter 40.02 Process PID feedback actual.	0.00%
	-100.00100.00%	Percentage.	100 = 1%
40.98	Process PID setpoint %	Percentage scaled signal of parameter 40.03 Process PID setpoint actual.	0.00%
	-100.00100.00%	Percentage.	100 = 1%
40.99	Process PID deviation %	Percentage scaled signal of parameter 40.04 Process PID deviation actual.	0.00%
	-100.00100.00%	.Percentage.	100 = 1%

41 Process 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 534 and 535.	
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
41.14	Set 2 setpoint scaling	See parameter 40.14 Set 1 setpoint scaling.	0.00
41.15	Set 2 output scaling	See parameter 40.15 Set 1 output scaling.	0.00
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
41.24	Set 2 internal setpoint 0	40.24 Set 1 internal setpoint 0.	0.00 PID customer units
41.26	Set 2 setpoint min	See parameter 40.26 Set 1 setpoint min.	0.00

No.	Name/Value	Description	Def/FbEq16
41.27	Set 2 setpoint max	See parameter 40.27 Set 1 setpoint max.	200000.00
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.	0.00
41.37	Set 2 output max	See parameter 40.37 Set 1 output max.	100.00
41.38	Set 2 output freeze enable	See parameter 40.38 Set 1 output freeze enable.	Not selected
41.39	Set 2 deadband range	See parameter 40.39 Set 1 deadband range.	0.0
41.40	Set 2 deadband delay	See parameter 40.40 Set 1 deadband delay.	0.0 s
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
41.51	Set 2 trim mode	See parameter 40.51 Set 1 trim mode.	Off
41.52	Set 2 trim selection	See parameter 40.52 Set 1 trim selection.	Torque
41.53	Set 2 trimmed ref pointer	See parameter 40.53 Set 1 trimmed ref pointer.	Not selected
41.54	Set 2 trim mix	See parameter 40.54 Set 1 trim mix.	-
41.55	Set 2 trim adjust	See parameter 40.55 Set 1 trim adjust.	1.000
41.56	Set 2 trim source	See parameter 40.56 Set 1 trim source.	PID ref

No.	Name/Value	Description	Def/FbEq16
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
41.60	Set 2 PID activation source	See parameter 40.60 Set 1 PID activation source.	On
41.79	Set 2 units	See parameter 40.79 Set 1 units.	°C
41.80	Set 2 PID output min source	See parameter 40.80 Set 1 PID output min source.	Set1 output min
41.81	Set 2 PID output max source	See parameter 40.81 Set 1 PID output max source.	Set1 output max
41.89	Set 2 setpoint multiplier	See parameter 40.89 Set 1 setpoint multiplier.	1.00
41.90	Set 2 feedback multiplier	Defines the multiplier k used in formulas of parameter 41.10 Set 2 feedback function. See parameter 40.90 Set 1 feedback multiplier.	1.00
43 Bra	ke chopper	Settings for the internal brake chopper. Note: These parameters apply to internal brake chopper only. When using external brake, you must disable brake chopper function by setting parameter 43.06 Brake chopper function to value Disabled.	
43.01	Braking resistor temperature	Displays the estimated temperature of the brake resistor, or how close the brake resistor is to being too hot. The value is given in percent where 100% is the eventual temperature the resistor would reach when loaded long enough with its rated maximum load capacity (43.09 Brake resistor Pmax cont). The temperature calculation is based on the values of parameters 43.08, 43.09 and 43.10, and on the assumption that the resistor is installed as instructed by the manufacturer (ie it cools down as expected). This parameter is read-only.	-
	0.0120.0%	Estimated brake resistor temperature.	1 = 1%
43.06	Brake chopper function	Enables brake chopper control and selects the brake resistor overload protection method (calculation or measurement). Note: Before enabling brake chopper control, ensure that a brake resistor is connected overvoltage control is switched off (parameter 30.30 Overvoltage control) the supply voltage range (parameter 95.01 Supply voltage) has been selected correctly. Note: When using external brake chopper, set this parameter to value Disabled.	Disabled
	Disabled	Brake chopper control disabled.	0
	Enabled with thermal model	Brake chopper control enabled with brake resistor protection based on the thermal model. If you select this, you must also specify the values needed by the model, ie. parameters 43.08 43.12. See the resistor data sheet.	1

No.	Name/Value	Description	Def/FbEq16
	Enabled without thermal model	Brake chopper control enabled without resistor overload protection based on the thermal model. This setting can be used, for example, if the resistor is equipped with a thermal switch that is wired to open the main contactor of the drive if the resistor overheats. For more information, see chapter Resistor braking in the Hardware manual.	2
	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
43.07	Brake chopper run enable	Selects the source for quick brake chopper on/off control. 0 = Brake chopper IGBT pulses are cut off 1 = Normal brake chopper IGBT modulation allowed.	On
	Off	0.	0
	On	1.	1
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 178).	-
43.08	Brake resistor thermal tc	Defines the thermal time constant for the brake resistor thermal model.	0 s
	010000 s	Brake resistor thermal time constant, ie the rated time to achieve 63% temperature.	1 = 1 s
43.09	Brake resistor Pmax cont	Defines the maximum continuous load of the brake resistor that will eventually raise the resistor temperature to the maximum allowed value (= continuous heat dissipation capacity of the resistor in kW) but not above it. The value is used in the resistor overload protection based on the thermal model. See parameter 43.06 Brake chopper function and the data sheet of the brake resistor used.	0.00 kW
	0.00 10000.00 kW	Maximum continuous load of the brake resistor.	1 = 1 kW
43.10	Brake resistance	Defines the resistance value of the brake resistor. The value is used for the brake resistor protection based on the thermal model. See parameter 43.06 Brake chopper function.	0.0 ohm
	0.01000.0 ohm	Brake resistor resistance value.	1 = 1 ohm
43.11	Brake resistor fault limit	Selects the fault limit for the brake resistor protection based on the thermal model. See parameter 43.06 Brake chopper function. When the limit is exceeded, the drive trips on fault 7183 BR excess temperature. The value is given in percent of the temperature the resistor reaches when loaded with the power defined by parameter	105%
		43.09 Brake resistor Pmax cont.	

No.	Name/Value	Description	Def/FbEq16
43.12	Brake resistor warning limit	Selects the warning limit for the brake resistor protection based on the thermal model. See parameter 43.06 Brake chopper function. When the limit is exceeded, the drive generates a A793 BR excess temperature warning. The value is given in percent of the temperature the resistor reaches when loaded with the power defined by parameter 43.09 Brake resistor Pmax cont.	95%
	0150%	Brake resistor temperature warning limit.	1 = 1%

	Configuration of mechanical brake control. See also section <i>Mechanical brake control</i> (page 136).	
44.01 Brake control status	Displays the mechanical brake control status word. This parameter is read-only.	-

Bit	Name	Information
0	Open command	Close/open command to brake actuator (0 = close, 1 = open). Connect this bit to desired output.
1	Opening torque request	1 = Opening torque requested from drive logic.
2	Hold stopped request	1 = Hold requested from drive logic
3	Ramp to stopped	1 = Ramping down to zero speed requested from drive logic
4	Enabled	1 = Brake control is enabled
5	Closed	1 = Brake control logic in BRAKE CLOSED state
6	Opening	1 = Brake control logic in BRAKE OPENING state
7	Open	1 = Brake control logic in BRAKE OPEN state
8	Closing	1 = Brake control logic in BRAKE CLOSING state
915	Reserved	

	0000hFFFFh	Mechanical brake control status word.	1 = 1
44.06	Brake control enable	Activates/deactivates (or selects a source that activates/deactivates) the mechanical brake control logic. 0 = Brake control inactive 1 = Brake control active	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 307).	18
	Timed function 2	Bit 1 of 34.01 Timed functions status (see page 307).	19
	Timed function 3	Bit 2 of 34.01 Timed functions status (see page 307).	20
	Reserved		2123
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 299).	24

No.	Name/Value	Description	Def/FbEq16
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 299).	25
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 299).	26
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 178).	-
44.08	Brake open delay	Defines the brake open delay, ie. the delay between the internal open brake command and the release of motor speed control. The delay timer starts when the drive has magnetized the motor. Simultaneously with the timer start, the brake control logic energizes the brake control output and the brake starts to open. Set this parameter to the value of mechanical opening delay specified by the brake manufacturer.	0.00 s
	0.005.00 s	Brake open delay.	100 = 1 s
44.13	Brake close delay	Specifies a delay between a close command (that is, when the brake control output is de-energized) and when the drive stops modulating. This is to keep the motor live and under control until the brake actually closes. Set this parameter equal to the value specified by the brake manufacturer as the mechanical wake-up time of the brake.	0.00 s
	0.0060.00 s	Brake close delay.	100 = 1 s
44.14	Brake close level	Defines the brake close speed as an absolute value. After motor speed has decelerated to this level, a close command is given.	100.00 rpm
	0.001000.00 rpm	Brake close speed.	See par. 46.01

45 Ene	ergy efficiency	Settings for the energy saving calculators as well as peak and energy loggers. See also section <i>Energy saving calculators</i> (page <i>168</i>).	
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

No.	Name/Value	Description	Def/FbEq16
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).	-
	0.0214748368.0 kWh	Energy savings in kWh.	1 = 1 kWh
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. You can define the currency during the first start up or from primary settings (Main menu - Primary settings - Clock, region display - Units - Currency). This parameter is read-only (see parameter 45.21 Energy calculations reset).	-
	04294967295 thousands	Monetary savings in thousands of units.	1 = 1 unit
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. You can define the currency during the first start up or from primary settings (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). You can define the currency during the first start up or from primary settings (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

No.	Name/Value	Description	Def/FbEq16
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 kilotons	Reduction in CO ₂ emissions in metric kilotons.	1 = 1 metric kiloton
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 CO ₂ conversion factor (by default, 0.5 metric tons/MWh). When this parameter rolls over, parameter 45.08 CO ₂ 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 CO ₂ conversion factor (by default, 0.5 metric tons/MWh). This parameter is read-only (see parameter 45.21 Energy calculations reset).	-
	0.0214748304.0 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 and a synchronous reluctance motor, energy optimization is always enabled regardless of this parameter. Note: Do no use energy optimizer in multimotor systems.	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. You can define the currency during the first start up or from primary settings (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.	-

No.	Name/Value	Description	Def/FbEq16
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
45.18	CO2 conversion factor	Defines a factor for conversion of saved energy into CO ₂ emissions (kg/kWh or tn/MWh). Example: 45.10 Total saved CO2 = 45.02 Saved MW hours × 45.18 CO2 conversion factor (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
45.19	Comparison power	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
45.24	Hourly peak power value	Value of the peak power during the last hour, that is, the most recent 60 minutes after the drive has been powered up. The parameter is updated once every 10 minutes unless the hourly peak is found in the most recent 10 minutes. In that case, the values is shown immediately.	0.00 kW
	-3000.00 3000.00 kW	Peak power value.	10 = 1 kW
45.25	Hourly peak power time	Time of the peak power value during the last hour.	00:00:00
		Time.	N/A
45.26	Hourly total energy (resettable)	Total energy consumption during the last hour, that is, the most recent 60 minutes. You can reset the value by setting it to zero.	0.00 kWh
	-3000.00 3000.00 kWh	Total energy.	10 = 1 kWh

No.	Name/Value	Description	Def/FbEq16
45.27	Daily peak power value (resettable)	Value of the peak power since midnight of the present day. You can reset the value by setting it to zero.	0.00 kW
	-3000.00 3000.00 kW	Peak power value.	10 = 1 kW
45.28	Daily peak power time	Time of the peak power since midnight of the present day.	00:00:00
		Time.	N/A
45.29	Daily total energy (resettable)	Total energy consumption since midnight of the present day. You can reset the value by setting it to zero.	0.00 kWh
	-30000.00 30000.00 kWh	Total energy.	1 = 1 kWh
45.30	Last day total energy	Total energy consumption during the previous day, that is, between midnight of the previous day and midnight of the present day	0.00 kWh
	-30000.00 30000.00 kWh	Total energy.	1 = 1 kWh
45.31	Monthly peak power value (resettable)	Value of the peak power during the present month, that is, since midnight of the first day of the present month. You can reset the value by setting it to zero.	0.00 kW
	-3000.00 3000.00 kW	Peak power value.	10 = 1 kW
45.32	Monthly peak power date	Date of the peak power during the present month.	1.1.1980
		Date.	N/A
45.33	Monthly peak power time	Time of the peak power during the present month.	00:00:00
		Time.	N/A
45.34	Monthly total energy (resettable)	Total energy consumption from the beginning of the present month. You can reset the value by setting it to zero.	0.00 kWh
	-1000000.00 1000000.00 kWh	Total energy.	0.01 = 1 kWh
45.35	Last month total energy	Total energy consumption during the previous month, that is, between midnight of the first day or the previous month and midnight of the first day of the present month.	0.00 kWh
	-1000000.00 1000000.00 kWh		0.01 = 1 kWh
45.36	Lifetime peak power value	Value of the peak power over the drive lifetime.	0.00 kW
	-3000.00 3000.00 kW	Peak power value.	10 = 1 kW
45.37	Lifetime peak power date	Date of the peak power over the drive lifetime.	1.1.1980
		Date.	N/A
45.38	Lifetime peak power time	Time of the peak power over the drive lifetime.	00:00:00
		Time.	N/A

No.	Name/Value	Description	Def/FbEq16
46 Mo	nitoring/scaling gs	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 e.g. 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 e.g. 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 e.g. fieldbus communication.	100.0%
	0.11000.0%	Torque corresponding to 10000 on fieldbus.	10 = 1%
46.04	Power scaling	Defines the 16-bit scaling of power parameters. The value of this parameter corresponds to 10000 in the fieldbus communication. The unit is selected by parameter 96.16 Unit selection. For 32-bit scaling see 46.43 Power decimals.	100.00
	0.10 30000.00 kW or 0.10 40214.48 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. For 32-bit scaling see 46.44 Current decimals.	10000 A
	030000 A		
46.06	Speed ref zero scaling	Defines a speed corresponding to a zero reference received from fieldbus (either the embedded fieldbus interface, or interface FBA A). For example, with a setting of 500, the fieldbus reference range of 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

No.	Name/Value	Description	Def/FbEq16
46.07	Frequency ref zero scaling	Defines a frequency corresponding to a zero reference received from fieldbus (either the embedded fieldbus interface, or interface FBA). For example, with a setting of 30, the fieldbus reference range of 020000 would correspond to a speed of 30[46.02] Hz. Note: This parameter is effective only with the ABB Drives communication profile.	0.00 Hz
	0.00 1000.00 Hz	Frequency corresponding to minimum fieldbus reference.	10 = 1 Hz
46.11	Filter time motor speed	Defines a filter time for signals 01.01 Motor speed used and 01.02 Motor speed estimated.	500 ms
	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) 22.87 + 46.21 (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. 01.06 (Hz) Drive at setpoint (06.11 bit 8 = 1) Drive at setpoint (28.96 + 46.22 (Hz)) 28.96 - 46.22 (Hz)	2.00 Hz
		0 Hz	
	0.001000.00 Hz	Limit for "at setpoint" indication in frequency control.	See par. 46.02
46.23	At torque hysteresis	Defines the "at setpoint" limits for torque control of the drive. When the absolute difference between reference (26.73 Torque reference act 4) and actual torque (01.10 Motor torque) is smaller than 46.23 At torque hysteresis, the drive is considered to be "at setpoint". This is indicated by bit 8 of 06.11 Main status word. 01.10 (%)	5.0%
		Drive at setpoint (06.11 bit 8 = 1) 26.73 + 46.23 (%) 26.73 - 46.23 (%) 26.73 - 46.23 (%)	
	0.0300.0%	Limit for "at setpoint" indication in torque control.	See par. 46.03
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

No.	Name/Value	Description	Def/FbEq16
46.41	kWh pulse scaling	Defines the trigger level for the "kWh pulse" on for 50 ms. The output of the pulse is bit 9 of 05.22 Diagnostic word 3.	1.000 kWh
	0.001 1000.000 kWh	"kWh pulse" on trigger level.	1 = 1 kWh
46.43	Power decimals	Defines the number of display decimals places and 32-bit scaling of power-related parameters. The value of this parameter corresponds to the number of decimals assumed in the 32-bit integer fieldbus communication (for 16-bit scaling see 46.04 Power scaling).	2
	03	Number of decimals.	1 = 1
46.44	Current decimals	Defines the number of display decimals places and 32-bit scaling of current-related parameters. The value of this parameter corresponds to the number of decimals assumed in the 32-bit integer fieldbus communication (for 16-bit scaling see 46.05 Current scaling).	2
	03	Number of decimals.	1 = 1

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 Data storage parameters (page 174).	
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.	-
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.	-

No.	Name/Value	Description	Def/FbEq16
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

49 Panel port communication		Communication settings for the control panel port on the drive.	
49.01	Node ID number	Defines the node ID of the drive. All devices connected to the network must have a unique node ID. Note: For networked drives, it is advisable to reserve ID 1 for spare/replacement drives.	1
	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
	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

No.	Name/Value	Description	Def/FbEq16
	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
49.19	Basic panel home view 1	Selects the parameters that are shown in Home view 1 of the integrated or Basic panel (ACS-BP-S).	Auto
	Auto	Shows the factory default parameters.	
	Motor speed used	01.01 Motor speed used	
	Output frequency	01.06 Output frequency	
	Motor current	01.07 Motor current	
	Motor current % of motor nominal	01.08 Motor current % of motor nom	
	Motor torque	01.10 Motor torque	
	DC voltage	01.11 DC voltage	
	Output power	01.14 Output power	
	Speed ref ramp in	23.01 Speed ref ramp input	
	Speed ref ramp out	23.02 Speed ref ramp output	
	Speed ref used	24.01 Used speed reference	
	Freq ref used	28.02 Frequency ref ramp output	
	Process PID out	40.01 Process PID output actual	
	Temp sensor 1 excitation	The output is used to feed an excitation current to the temperature sensor 1, see parameter 35.11 Temperature 1 source. See also section Motor thermal protection (page 160).	
	Temp sensor 2 excitation	The output is used to feed an excitation current to the temperature sensor 2, see parameter 35.21 Temperature 2 source. See also section Motor thermal protection (page 160).	
	Abs motor speed used	01.61 Abs motor speed used	
	Abs motor speed %	01.62 Abs motor speed %	
	Abs output frequency	01.63 Abs output frequency	
	Abs motor torque	01.64 Abs motor torque	
	Abs output power	01.65 Abs output power	
	Abs motor shaft power	01.68 Abs motor shaft power	
	External PID1 out	71.01 External PID act value	
	AO1 data storage	13.91 AO1 data storage	

No.	Name/Value	Description	Def/FbEq16
	AO2 data storage	13.92 AO2 data storage	
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 178).	-
49.20	Basic panel home view 2	Selects the parameters that are shown in Home view 2 of the integrated or Basic panel (ACS-BP-S). For the selections, see parameter 49.19 Basic panel home view 1.	Auto
49.21	Basic panel home view 3	Selects the parameters that are shown in Home view 3 of the integrated or Basic panel (ACS-BP-S). For the selections, see parameter 49.19 Basic panel home view 1.	Auto
49.219	Basic panel home view 4	Selects the parameters that are shown in Home view 4 of the integrated or Basic panel (ACS-BP-S). For the selections, see parameter 49.19 Basic panel home view 1.	Auto
49.220	Basic panel home view 5	Selects the parameters that are shown in Home view 5 of the integrated or Basic panel (ACS-BP-S). For the selections, see parameter 49.19 Basic panel home view 1.	Auto
49.221	Basic panel home view 6	Selects the parameters that are shown in Home view 6 of the integrated or Basic panel (ACS-BP-S). For the selections, see parameter 49.19 Basic panel home view 1.	Auto

50 Fieldbus adapter (FBA)		Fieldbus communication configuration. See also chapter <i>Fieldbus control through a fieldbus adapter</i> (page <i>505</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.	Enable
	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	Drive trips on 7510 FBA A communication. This only occurs if control is expected from the fieldbus (FBA A selected as source of start/stop/reference in the currently active control location).	1
	Last speed	Drive generates a warning (A7C1 FBA A communication) and freezes the speed to the level the drive was operating at. This only occurs if control is expected from the fieldbus. 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

No.	Name/Value	Description		Def/FbEq16
	Speed ref safe	Drive generates a warning (A7 sets the speed to the value det Speed ref safe (in speed control (in frequency control). This onl from the fieldbus. WARNING! Make sure operation in case of a control of the sure operation in case of a control of the sure operation in case of a control of the sure operation in case of a control of the sure operation in case of a control of the sure operation in case of a control of the sure operation in case of a control of the sure operation in case of a control of the sure operation in case of a control of the sure operation in case of a control of the sure operation in case of a control of the sure operation in case of a control of the sure operation in case of a control of the sure operation in case of a control of the sure operation in case of a control of the sure operation in case of a control of the sure operation in case of a control of the sure operation in case of a control of the sure operation in case of a control of the sure operation in case of a control operatio	3	
	Fault always	Drive trips on 7510 FBA A communication through no control is expected to		4
	Warning	Drive generates an A7C1 FBA This only occurs if control is ex WARNING! Make sure operation in case of a co	pected from the fieldbus. that it is safe to continue	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. Note: There is a 60-second boot-up delay immediately after power-up. During the delay, the communication break monitoring is disabled (but communication itself can be active).		0.3 s
	0.36553.5 s	Time delay.		1 = 1 s
50.04	FBA A ref1 type	Selects the type and scaling of reference 1 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
	Speed or frequency	Type and scaling is chosen automatically according to the currently active operation mode as follows:		0
		Operation mode (see par. 19.01)	Reference 1 type	
		Speed control	Speed	
		Torque control	Speed	
		Frequency control	Frequency	
	Transparent	No scaling is applied (the 16-b	it scaling is 1 = 1 unit).	1
	General	Generic reference with a 16-bi and two decimals).	t scaling of 100 = 1 (ie. integer	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 parar	meter 46.02 Frequency scaling.	5
50.05	FBA A ref2 type	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
	Speed or frequency	Type and scaling is chosen automatically according to the currently active operation mode as follows:		0
		Operation mode (see par. 19.01)	Reference 2 type	
		Speed control	Torque	
		Torque control	Torque	
		Frequency control	Torque	

No.	Name/Value	Description		Def/FbEq16
	Transparent	No scaling is applied(the 16-bit	t scaling is 1 = 1 unit).	1
	General	Generic reference with a 16-bit and two decimals).	t scaling of 100 = 1 (ie. integer	2
	Torque	The scaling is defined by parar	3	
	Speed	The scaling is defined by parar	meter 46.01 Speed scaling.	4
	Frequency	The scaling is defined by parar	meter 46.02 Frequency scaling.	5
50.06	FBA A SW sel	Selects the source of the Statu fieldbus network through fieldb		Auto
	Auto	Source of the Status word is ch	nosen automatically.	0
	Transparent mode	The source selected by parametransparent source is transmitt fieldbus network through fieldb	ed as the Status word to the	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 paral depending on which actual val- parameter.	eldbus adapter A. The scaling meters 46.0146.04,	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 1 type	
		Speed control	Speed	
		Torque control	Speed	
		Frequency control	Frequency	
	Transparent	The value selected by parameter 50.10 FBA A act1 transparent source is sent as actual value 1. No scaling is applied (the 16-bit scaling is 1 = 1 unit).		1
	General	The value selected by parameter transparent source is sent as a scaling of 100 = 1 unit (ie. integrated)	actual value 1 with a 16-bit	2
	Torque	01.10 Motor torque is sent as a defined by parameter 46.03 To		3
	Speed	01.01 Motor speed used is sent is defined by parameter 46.01		4
	Frequency	01.06 Output frequency is sent is defined by parameter 46.02		5
50.08	FBA A actual 2 type	Selects the type and scaling of actual value 2 transmitted to the fieldbus network through fieldbus adapter A. The scaling of the value is defined by parameters 46.0146.04, depending on which actual value type is selected by this parameter.		Speed or frequency
	Speed or frequency	Type and scaling is chosen automatically according to the currently active operation mode as follows:		0
		Operation mode (see par. 19.01)	Actual value 2 type	
		Speed control	Torque	
		Torque control	Torque	
		Frequency control	Torque	1

No.	Name/Value	Description	Def/FbEq16
	Transparent	The value selected by parameter 50.11 FBA A act2 transparent source is sent as actual value 1. No scaling is applied (the 16-bit scaling is 1 = 1 unit).	1
	General	The value selected by parameter 50.11 FBA A act2 transparent source is sent as actual value 1 with a 16-bit scaling of 100 = 1 unit (ie. integer and two decimals).	2
	Torque	01.10 Motor torque is sent as actual value 1. The scaling is defined by parameter 46.03 Torque scaling.	3
	Speed	01.01 Motor speed used is sent as actual value 1. The scaling is defined by parameter 46.01 Speed scaling.	4
	Frequency	01.06 Output frequency is sent as actual value 1. The scaling is defined by parameter 46.02 Frequency scaling.	5
50.09	FBA A SW transparent source	Selects the source of the fieldbus status word when parameter 50.06 FBA A SW sel is set to Transparent mode.	Not selected
	Not selected	No source selected.	-
	Other	Source selection (see <i>Terms and abbreviations</i> on page 178).	-
50.10	FBA A act1 transparent source	When parameter 50.07 FBA A actual 1 type is set to Transparent, this parameter selects the source of actual value 1 transmitted to the fieldbus network through fieldbus adapter A.	Not selected
	Not selected	No source selected.	-
	Other	Source selection (see <i>Terms and abbreviations</i> on page 178).	-
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 <i>Terms and abbreviations</i> on page 178).	-
50.12	FBA A debug mode	This parameter enables debug mode. Displays raw (unmodified) data received from and sent to fieldbus adapter 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.	-
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.	-

No.	Name/Value	Description	Def/FbEq16
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 FB.	A A settings	Fieldbus adapter A configuration.	
51.01	FBA A type	Displays the type of the connected fieldbus adapter module. If value is 0 = None, module is not found or is not properly connected, or is disabled by parameter 50.01 FBA A enable. 1 = PROFIBUS-DP 32 = CANopen 37 = DeviceNet 128 = Ethernet 132 = PROFInet IO 135 = EtherCAT 136 = ETH Pwrlink 485 = RS-485 comm 101 = ControlNet 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.	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 running.	Done
	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
	Other	Source selection (see <i>Terms and abbreviations</i> on page 178).	-
53.12	FBA A data out12	See parameter 53.01 FBA A data out1.	None

58 Em	bedded fieldbus	Configuration of the embedded fieldbus (EFB) interface. See also chapter <i>Fieldbus control through the embedded fieldbus interface (EFB)</i> (page 475).	
58.01	Protocol enable	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 uses the Modbus RTU protocol.	1
58.02	Protocol ID	Displays the protocol ID and revision. First 4 bits specify the protocol ID and last 12 bits specify the 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. Also called Station ID, MAC Address or Device Address. 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).	0
	0255	Node address (values 1247 are allowed).	1 = 1
58.04	Baud rate	Selects the transfer rate of the fieldbus link. When using selection Autodetect, the parity setting of the bus must be known and configured in parameter 58.05 Parity. When parameter 58.04 Baud rate is set to Autodetect, the EFB settings must be refreshed with parameter 58.06. The bus is monitored for a period of time and the detected baud rate is set as the value of this parameter. 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).	Modbus: 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

No.	Name/Value	Description	Def/FbEq16
	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
	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	Autobauding	1 = Automatic detection of baud rate is in use (see parameter 58.04)	
4	Wiring error	1 = Errors detected (A/B wires possibly swapped)	
5	Parity error	1 = Error detected: check parameters 58.04 and 58.05	
6	Baud rate error	1 = Error detected: check parameters 58.05 and 58.04	
7	No bus activity	1 = 0 bytes received during last 5 seconds	
8	No packets	1 = 0 packets (addressed to any device) detected during last 5	
		seconds	
9	Noise or addressing error	1 = Errors detected (interference, or another device with the same address on line)	
10	Comm loss	1 = 0 packets addressed to the drive received within timeout (58.16)	
11	CW/Ref loss	1 = No control word or references received within timeout (58.16)	
12	Inactive		
13	Protocol 1	Reserved	
14	Protocol 2	Reserved	
15	Internal error	1 = Internal error occurred. Contact your local ABB representative.	

	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.	1
	04294967295	Number of received packets addressed to the drive.	1 = 1

No.	Name/Value	Description	Def/FbEq16
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
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.	No action
	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. The 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 ATCE 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

No.	Name/Value	Description	Def/FbEq16
	Fault always	Drive continuously monitors for communication loss. Drive trips on 6681 EFB comm loss. This happens even though the drive is in a control location where the EFB start/stop or reference is not used.	4
	Warning	Drive generates an A7CE EFB comm loss warning. This occurs even though no control is expected from the EFB. WARNING! Make sure that it is safe to continue operation in case of a communication break.	5
58.15	Communication loss mode	Defines which message types reset the timeout counter for detecting an EFB communication loss. Changes to this parameter take effect after the control unit is rebooted or the new settings validated by parameter 58.06 Communication control (Refresh settings). See also parameters 58.14 Communication loss action and 58.16 Communication loss time.	Any message
	Any message	Any message addressed to the drive resets the timeout.	1
	Cw / Ref1 / Ref2	A write of the control word or a reference resets the timeout.	2
58.16	Communication loss time	Sets a timeout for EFB communication. If a communication break lasts longer than the timeout, the action specified by parameter 58.14 Communication loss action is taken. Changes to this parameter take effect after the control unit is rebooted or the new settings validated by parameter 58.06 Communication control (Refresh settings). See also parameter 58.15 Communication loss mode.	30.0 s
		Note: There is a 30-second boot-up delay immediately after power-up.	
	0.06000.0 s	EFB communication timeout.	1 = 1
58.17	Transmit delay	Defines a minimum response delay in addition to any fixed delay imposed by the protocol. Changes to this parameter take effect after the control unit is rebooted or the new settings validated by parameter 58.06 Communication control (Refresh settings).	0 ms
	065535 ms	Minimum response delay.	1 = 1
58.18	EFB control word	Displays the raw (unmodified) control word sent by the Modbus controller to the drive. For debugging purposes. This parameter is read-only.	-
	0000h FFFFh	Control word sent by Modbus controller to the drive.	1 = 1
58.19	EFB status word	Displays the raw (unmodified) status word for debugging purposes. This parameter is read-only.	-
	0000h FFFFh	Status word sent by the drive to the Modbus controller.	1 = 1
58.25	Control profile	Defines the communication profile used by the Modbus 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). See section About the control profiles on page 484.	ABB Drives
	ABB Drives	ABB Drives control profile (with a 16-bit control word)	0
	DCU Profile	DCU control profile (with a 16 or 32-bit control word)	5

No.	Name/Value	Description		Def/FbEq16	
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	currently active operation mode	Type and scaling is chosen automatically according to the currently active operation mode as follows.		
		Operation mode (see par. 19.01)	Reference 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	
	Torque	Torque reference. The scaling in Torque scaling.	s defined by parameter 46.03	3	
	Speed	Speed reference. The scaling is Speed scaling.	s defined by parameter 46.01	4	
	Frequency	Frequency reference. The scali 46.02 Frequency scaling.	ng is defined by parameter	5	
58.27	EFB ref2 type	Selects the type and scaling of the embedded fieldbus interfac The scaled reference is display	e.	Torque	
58.28	EFB act1 type	Selects the type of actual value	: 1.	Speed or frequency	
	Speed or frequency	Type and scaling is chosen automatically according to the currently active operation mode as follows.		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	
	Torque	Scaling is defined by paramete	r 46.03 Torque scaling.	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 value 1 when parameter 58.28 EFB act1 type is set to Transparent.		Not selected	
	Not selected None.			0	
	Other	Source selection (see <i>Terms and abbreviations</i> on page 178		-	
58.32	EFB act2 transparent source	Selects the source of actual va EFB act2 type is set to Transpa		Not selected	
	Not selected	None.		0	
	Other	Source selection (see Terms ar	nd abbreviations on page 178).	-	

No.	Name/Value	Description	Def/FbEq16
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
58.34	Word order	Selects in which order 16-bit registers of 32-bit parameters are transferred. For each register, the first byte contains the high order byte and the second byte contains the low order byte. Changes to this parameter take effect after the control unit is rebooted or the new settings validated by parameter 58.06 Communication control (Refresh settings).	LO-HI
	HI-LO	The first register contains the high order word, the second contains the low order word.	0
	LO-HI	The first register contains the low order word, the second contains the high order word.	1
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

No.	Name/Value	Description	Def/FbEq16
	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
	Setpoint data storage	Parameter 40.92 Setpoint data storage.	41
	Other	Source selection (see <i>Terms and abbreviations</i> on page 178).	-
58.102	Data I/O 2	Defines the address in the drive which the Modbus master accesses when it reads from or writes to register address 400002. For the selections, see parameter 58.101 Data I/O 1.	Ref1 16bit
58.103	Data I/O 3	Defines the address in the drive which the Modbus master accesses when it reads from or writes to register address 400003. For the selections, see parameter 58.101 Data I/O 1.	Ref2 16bit
58.104	Data I/O 4	Defines the address in the drive which the Modbus master accesses when it reads from or writes to register address 40004. For the selections, see parameter 58.101 Data I/O 1.	SW 16bit
58.105	Data I/O 5	Defines the address in the drive which the Modbus master accesses when it reads from or writes to register address 40005. 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 40006. For the selections, see parameter 58.101 Data I/O 1.	Act2 16bit
58.107	Data I/O 7	Parameter selector for Modbus register address 400007. For the selections, see parameter 58.101 Data I/O 1.	None
58.114	Data I/O 14	Parameter selector for Modbus register address 400014. For the selections, see parameter 58.101 Data I/O 1.	None

No.	Name/Value	Description	Def/FbEq16
71 External PID1		Configuration of external PID. See the control chain diagrams on pages 536 and 537.	
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.	-
71.06	PID status word	Displays status information on process external PID control. This parameter is read-only.	-
	Rit Name	Value	

Bit	Name	Value
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	Reserved	
7	Output limit high	1 = PID output is being limited by par. 71.37.
8	Output limit low	1 = PID output is being limited by par. 71.36.
9	Deadband active	1 = Deadband is active (see par. 71.39)
1011	Reserved	
12	Internal setpoint active	1 = Internal setpoint active (see par. 71.1671.23)
1315	Reserved	

	0000hFFFFh	Process PID control status word.	1 = 1
71.07	PID operation mode	See parameter 40.07 Process PID operation mode.	Off
71.08	Feedback 1 source	See parameter 40.08 Set 1 feedback 1 source.	Al2 percent
71.11	Feedback filter time	See parameter 40.11 Set 1 feedback filter time.	0.000 s
71.14	Setpoint scaling	Defines, together with parameter 71.15 Output scaling, a general scaling factor for the external PID control chain. The scaling can be utilized when, for example, the process setpoint is input in Hz, and the output of the PID controller is used as an rpm value in speed control. In this case, this parameter might be set to 50, and parameter 71.15 to the nominal motor speed at 50 Hz. In effect, the output of the PID controller [71.15] when deviation (setpoint - feedback) = [71.14] and [71.32] = 1. Note: The scaling is based on the ratio between 71.14 and 71.15. For example, the values 50 and 1500 would produce the same scaling as 1 and 3.	1500.00
	-200000.00 200000.00	Process setpoint base.	1 = 1
71.15	Output scaling	See parameter 71.14 Setpoint scaling.	1500.00
	-200000.00 200000.00	Process PID controller output base.	1 = 1
71.16	Setpoint 1 source	See parameter 40.16 Set 1 setpoint 1 source.	Al1 percent
71.19	Internal setpoint sel1	See parameter 40.19 Set 1 internal setpoint sel1.	Not selected

71.20 71.21 71.22	Internal setpoint sel2 Internal setpoint 1	See parameter 40.20 Set 1 internal setpoint sel2.	Not selected
	Internal setpoint 1		I
71 22		See parameter 40.21 Set 1 internal setpoint 1.	0.00 PID customer units
77.22	Internal setpoint 2	See parameter 40.22 Set 1 internal setpoint 2.	0.00 PID customer units
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.	200000.00
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.	-200000.00
71.37	Output max	See parameter 40.37 Set 1 output max.	200000.00
71.38	Output freeze enable	See parameter 40.38 Set 1 output freeze enable.	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
	0.0200000.0	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
	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
	Process 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.	2
	Process 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.	3

No.	Name/\	/alue	Description		Def/FbEq16
	Other		Source selection	(see Terms and abbreviations on page 178).	-
71.59	Decrea prevent		See parameter 4	0.59 Set 1 decrease prevention.	No
	No		Decrease prever	ntion not in use.	0
	Limiting			ion term is not decreased if the maximum output is reached. This parameter is valid	1
	Process lim	s PID min	output of the exte	integration term is not decreased when the ernal PID has reached its minimum limit. In ternal PID is used as a source for the	2
	Process	s PID max	output of the exte	integration term is not decreased when the ernal PID has reached its maximum limit. In ternal PID is used as a source for the	3
	Other		Source selection	(see Terms and abbreviations on page 178).	-
71.62	Internal actual	setpoint	See parameter 4	0.62 PID internal setpoint actual.	-
71.79	Externa	I PID units	Unit used for ext	ernal PID.	%
			For selections, se	ee parameter 40.79 Set 1 units.	
76 PFC configuration		juration		fan control) and Autochange configuration also section <i>Pump and fan control (PFC)</i> on	
76.01 PFC status		PFC1, PFC2, PF correspond to the Autochange auxi only, PFC1 repre PFC2 the first au 76.74 is set to Al 2nd. The drive ca	ning/stopped status of the PFC motors. C3, PFC4, PFC5 and PFC6 always e 1st6th motor of the PFC system. If 76.74 filiary PFC auxiliary PFC is set to Aux motors esents the motor connected to the drive and xiliary motor (the 2nd motor of the system). If I motors, PFC1 is the first motor, PFC2 the an be connected to any of these motors e Autochange functionality.	-	
	Bit	Name		Value	
	0	PFC 1 runr	ning	0 = Stop, 1 = Start	
	1	PFC 2 runr	U	0 = Stop, 1 = Start	
	2	PFC 3 runr	ning	0 = Stop, 1 = Start	
	3	PFC 4 runr	ning	0 = Stop, 1 = Start	
	4	PFC 5 runr	ning	0 = Stop, 1 = Start	
	5	PFC 6 runr	ning	0 = Stop, 1 = Start	
615 Reserved					
	0000h	.FFFFh	Status of the PF0	C relay outputs	1 = 1
76.02		mp system	Displays the state quick PFC system	us of the PFC system in text form. Provides a m overview, e.g. if the parameter is added to n the control panel.	PFC disabled
	PFC dis	sabled	PFC (Pump and	fan control) is enabled.	0
	PFC en	abled (not	PFC is enabled b	out not started.	1

No.	Name/Value	Description	Def/FbEq16
	SPFC enabled (not started)	SPFC (Soft pump and fan control) is enabled but not started.	2
	Running with VSD	The drive is controlling one pump/fan motor, no auxiliary motors are used.	100
	Running with VSD + 1 Aux	One auxiliary motor has been taken in use.	101
	Running with VSD + 2 Aux	Two auxiliary motor have been taken in use.	102
	Running with VSD + 3 Aux	Three auxiliary motor have been taken in use.	103
	Running with VSD + 4 Aux	Four auxiliary motor have been taken in use.	104
	Running with VSD + 5 Aux	Five auxiliary motor have been taken in use.	105
	Starting Aux1	Auxiliary motor 1 is being started.	200
	Starting Aux2	Auxiliary motor 2 is being started.	201
	Starting Aux3	Auxiliary motor 3 is being started.	202
	Starting Aux4	Auxiliary motor 4 is being started.	203
	Starting Aux5	Auxiliary motor 5 is being started.	204
	Stopping Aux1	Auxiliary motor 1 is being stopped.	300
	Stopping Aux2	Auxiliary motor 2 is being stopped.	301
	Stopping Aux3	Auxiliary motor 3 is being stopped.	302
	Stopping Aux4	Auxiliary motor 4 is being stopped.	303
	Stopping Aux5	Auxiliary motor 5 is being stopped.	304
	Autochange active	Autochange, that is, automatic rotation of the start order is active.	400
	No auxiliary motors available to be started	No auxiliary motors are available to be started, eg, all are already running, or a motor in not available due to maintenance.	500
	Regulator bypass active	Direct-on-line pumps are automatically started and stopped.	600
	PID sleep	PID sleep is in use, and the pump can be stopped in during low demand.	800
	PID sleep boost	PID sleep with extended sleep time is in use, and the pump can be stopped in during low demand.	801
	Invalid configuration	PFC configuration is invalid.	4
	PFC inactive (local control)	PFC is inactive because the drive is in local control.	5
	PFC inactive (invalid operation mode)	PFC is inactive because of an invalid operation mode.	6
	Drive motor interlocked	The motor connected to the drive is interlocked (not available). Warning D503 VSD controlled PFC motor interlocked (page 463) is generated.	7
	All motors interlocked	All motors are interlocked (not available). Warning D502 All motors interlocked (page 463) is generated.	8
	PFC inactive (ext1 active)	PFC is inactive because external control location EXT1 is in use. PFC is supported in EXT2 only.	9

No.	Name/Value		Description	Def/FbEq16
76.11	Pump s	tatus 1	Shows the status of pump 1.	-
	Bit	Name	Value	
	0	Ready	0 = False, 1 = True	
	1	Reserved	o raise, raise	
	2	Running	0 = False, 1 = True	
	34	Reserved	,	
	5	In PFC cor	itrol 0 = False, 1 = True	
	610	Reserved	<u> </u>	
	11	Interlocked	0 = False, 1 = True	
	1215	Reserved	<u> </u>	
	0000h	.FFFFh	Status of pump 1.	1 = 1
76.12	Pump s	tatus 2	See parameter 76.11 Pump status 1.	-
76.13	Pump s	tatus 3	See parameter 76.11 Pump status 1.	-
76.14	Pump s	tatus 4	See parameter 76.11 Pump status 1.	-
76.15	Pump s	tatus 5	See parameter 76.11 Pump status 1.	-
76.16	Pump s	tatus 6	See parameter 76.11 Pump status 1.	-
76.21	Multipui configui		Selects the multipump/fan control (PFC) mode.	Off
	Off		PFC disabled.	0
	Reserve	ed		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 and fan control (SPFC) on page.133	3
76.25	Number	r of motors	Total number of motors used in the application, including the motor connected directly to the drive.	1
	16		Number of motors.	1 = 1
76.26	Min nun motors		Minimum number of motors running simultaneously.	1
	06		Minimum number of motors.	1 = 1
76.27	Max nui motors a		Maximum number of motors running simultaneously.	1
	16		Maximum number of motors.	1 = 1

No.	Name/Value	Description	Def/FbEq16
76.30	Start point 1	Defines the start point for the first auxiliary motor. As the motor speed or frequency (defined by the PID output value) exceeds the limit defined by this parameter, a new auxiliary motor is started. To avoid nuisance starts of the 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 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	I	
	76.30 76.41 Min. speed ON OFF ON OFF	76.55 76.57 76.58 Tim Increasing flow Decreasing flow Decreasing flow Decreasing flow The start flow flow flow flow flow flow flow flow	9
	311	Stop	
	032767 rpm/Hz	Speed/frequency.	1 = 1 unit
76.31	Start point 2	Defines the start speed (Hz/rpm) for the second auxiliary motor. See parameter 76.31 Start point 1.	Vector: 1300 rpm; Scalar 48 Hz; 58 Hz (95.20 b0)
76.32	Start point 3	Defines the start speed (Hz/rpm) for the third auxiliary motor. See parameter 76.31 Start point 1.	Vector: 1300 rpm; Scalar 48 Hz; 58 Hz (95.20 b0)
76.33	Start point 4	Defines the start speed (Hz/rpm) for the fourth auxiliary motor. See parameter 76.31 Start point 1.	Vector: 1300 rpm; Scalar 48 Hz; 58 Hz (95.20 b0)

No.	Name/Value	Description	Def/FbEq16
76.34	Start point 5	Defines the start speed (Hz/rpm) for the fifth auxiliary motor. See parameter 76.31 Start point 1.	Vector: 1300 rpm; Scalar 48 Hz; 58 Hz (95.20 b0)
76.41	Stop point 1	Defines the stop speed (Hz/rpm) for the first auxiliary motor. When the speed (defined by the PID output value) of the motor connected directly to the drive falls below this value and 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 auxiliary motor stops. The running speed of the drive is increased by [Start point 1 - Stop point 1] after the 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 point 2	Defines the stop speed (Hz/rpm) for the second auxiliary motor. See parameter 76.31 Stop point 1.	Vector: 800 rpm; Scalar 25 Hz; 30 Hz (95.20 b0)
76.43	Stop point 3	Defines the stop speed (Hz/rpm) for the third auxiliary motor. See parameter 76.31 Stop point 1.	Vector: 800 rpm; Scalar 25 Hz; 30 Hz (95.20 b0)
76.44	Stop point 4	Defines the stop speed (Hz/rpm) for the fourth auxiliary motor. See parameter 76.31 Stop point 1.	Vector: 800 rpm; Scalar 25 Hz; 30 Hz (95.20 b0)
76.45	Stop point 5	Defines the stop speed (Hz/rpm) for the fifth auxiliary motor. See parameter 76.31 Stop point 1.	Vector: 800 rpm; Scalar 25 Hz; 30 Hz (95.20 b0)
76.55	Start delay	Defines a start delay for auxiliary motors. See parameter 76.31 Start point 1.	10.00 s
	0.0012600.00 s	Time delay.	1 = 1 s
76.56	Stop delay	Defines a stop delay for auxiliary motors. See parameter 76.31 Stop point 1.	10.00 s
	0.0012600.00 s	Time delay.	1 = 1 s
76.57	PFC speed hold on	Hold time for auxiliary motor switch-on. See parameter 76.31 Start point 1.	0.00 s
	0.001000.00 s	Time.	1 = 1 s
76.58	PFC speed hold off	Hold time for auxiliary motor switch-off. See parameter 76.31 Stop point 1.	0.00 s
_	0.001000.00 s	Time.	1 = 1 s

No.	Name/Value	Description	Def/FbEq16
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. 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.	0.50 s
	0.20600.00 s	Time delay.	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. Defines the acceleration time if the latest reference received by the drive is higher than the previous reference. This parameter is used also to accelerate the pump when the auxiliary pump is started. The parameter sets the ramp-up time as seconds from zero to maximum frequency (not from the previous reference to the new reference).	1.00 s
	0.001800.00 s	Time.	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 decelerate after an autochange has occurred. Defines the deceleration time if the latest reference received by the drive is lower than the previous reference. This parameter is used also to decelerate the pump when the auxiliary pump is stopped. The parameter sets the ramp-down time as seconds from maximum to zero frequency (not from the previous reference to the new reference).	1.00 s
<u> </u>	0.001800.00 s	Time.	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 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 <i>level</i> . See also section <i>Autochange</i> on page 133.	Not selected
	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

No.	Name/Value	Description	Def/FbEq16
	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 307)).	8
	Timed function 2	Autochange triggered by timed function 2 (bit 1 of 34.01 Timed functions status (see page 307)).	9
	Timed function 3	Autochange triggered by timed function 3 (bit 2 of 34.01 Timed functions status (see page 307)).	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
	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 PFC maintenance and monitoring.	13
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 178).	-
76.71	PFC autochange interval	Specifies the interval that is used in setting Fixed interval of parameter 76.70 PFC autochange.	1.00 h
	0.0042949672.95 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 <i>PFC autochange</i> .	10.00 h
	0.001000000.00 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.	Aux motors only

No.	Name/Value	Description	Def/FbEq16
	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
76.81	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 307).	8
	Timed function 2	Bit 1 of 34.01 Timed functions status (see page 307).	9
	Timed function 3	Bit 2 of 34.01 Timed functions status (see page 307).	10
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 178).	-
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.	Disable
	Disable	Digital input DI2 (10.02 DI delayed status, bit 1).	0

No.	. Name/Value Description		Def/FbEq16
	Enable	Digital input DI3 (10.02 DI delayed status, bit 2).	1
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 178).	-

77 PFC maintenance and monitoring		, ,	
77.10	PFC runtime change	Enables the reset, or arbitrary setting, of 77.11 Pump 1 running time 77.14 Pump 4 running time.	Done
	Done	The parameter automatically reverts back to this value.	0
	Set any PFC run time	Enables the setting of 77.11 Pump 1 running time 77.14 Pump 4 running time to an arbitrary value.	1
	Reset PFC1 run time	Resets parameter 77.11 Pump 1 running time.	2
	Reset PFC2 run time	Resets parameter 77.12 Pump 2 running time.	3
	Reset PFC3 run time	Resets parameter 77.13 Pump 3 running time.	4
	Reset PFC4 run time	Resets parameter 77.14 Pump 4 running time.	5
	Reset PFC5 run time	Resets parameter 77.15 Pump 5 running time.	6
	Reset PFC6 run time	Resets parameter 77.16 Pump 6 running time.	7
77.11	Pump 1 running time	Running time counter of pump/fan 1. Can be set or reset by parameter 77.10 Pump 1 running time.	0.00 h
	0.00 42949672.95 h	Time	1 = 1 h
77.12	Pump 2 running time	See parameter 77.11 Pump 1 running time.	0.00 h
77.13	Pump 3 running time	See parameter 77.11 Pump 1 running time.	0.00 h
77.14	Pump 4 running time	See parameter 77.11 Pump 1 running time.	0.00 h
77.15	Pump 5 running time	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
		•	

No.	Name/Value	Description	Def/FbEq16
95 HW	configuration	Various hardware-related settings.	
95.01	Supply voltage	Selects the supply voltage range. This parameter is used by the drive to determine the nominal voltage of the supply network. The parameter also affects the current ratings and the DC voltage control functions (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
95.02	Adaptive voltage limits	Enables adaptive voltage limits. Adaptive voltage limits can be used if, for example, an IGBT supply unit is used to raise the DC voltage level. If the communication between the inverter and IGBT supply unit is active, the voltage limits are related to the DC voltage reference from the IGBT supply unit. Otherwise the limits are calculated based on the measured DC voltage at the end of the pre-charging sequence. This function is also useful if the AC supply voltage to the drive is high, as the warning levels are raised accordingly.	Enable
	Disable	Adaptive voltage limits disabled.	0
	Enable	Adaptive voltage limits enabled.	1
95.03	Estimated AC supply voltage	AC supply voltage estimated by calculation. Estimation is done every time the drive is powered up and is based on the rise speed of voltage level of the DC bus while the drive charges the DC bus.	-
	065535 V	Voltage.	10 = 1 V
95.04	Control board supply	Specifies how the control unit of the drive is powered.	Internal 24V
	Internal 24V	The drive control unit is powered from the drive power unit it is connected to.	0
	External 24V	The drive control unit is powered from an external power supply.	1

No.	Name/Value	Description	Def/FbEq16	
95.15	95.15	Special HW settings	Contains hardware-related settings that can be enabled and disabled by toggling the specific bits.	0b0000
		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	Reserved	
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
95.20	HW options word 1	Specifies hardware-related options that require differentiated parameter defaults. This parameter is not affected by a parameter restore.	060000

Bit	Name	Value
0	Supply frequency 60 Hz	See section Differences in the default values between 50 Hz and 60 Hz supply frequency settings on page 412. 0 = 50 Hz. 1 = 60 Hz.
112	Reserved	
13	du/dt filter activation	When active, an external du/dt filter is connected to the drive/inverter output. The setting will limit the output switching frequency, and force the fan of the drive/inverter module to full speed. 0 = du/dt filter inactive. 1 = du/dt filter active.
1415	Reserved	

0000hFFFFh	Hardware options configuration word.	1 = 1

No.	Name/V	alue	Descri	ption	Def/FbEq16	
95.21	HW options word 2		Specifi differer	es more hardware-related options that require ntiated parameter defaults. See parameter 95.20 HW s word 1. WARNING! After switching any bits in this word, recheck the values of the affected parameters.	0ь0000	
	Bit Name			Information		
	04	Reserved				
	5	Bypass pre	sent	ent 1 = Bypass is used.		
	6	Cabinet dri		0 = Inactive, 1 = Active. Only for drive frames R6 or lar		
	7	Cabinet fan	• •	0 = Inactive, 1 = Active. Only for drive frames R6 or lar	ger.	
	8	Legacy byp	ass	0 = Inactive, 1 = Active		
	915	Reserved				
		•				
	0000b	.0101b	Hardw	are options configuration word 2.	1 = 1	
95.200	Cooling	fan mode	Cooling	g fan operation mode.	Auto	
	Auto			ns normally: Fan on/off, fan speed reference can ange according to the drive state.	0	
	Always	on	Fan alv	ways runs at 100% speed reference.	1	
96 System		param param	age selection; access levels; macro selection; eter save and restore; control unit reboot; user eter sets; unit selection.			
96.01	96.01 Language		display Notes: Not This Driv	s the language of the parameter interface and other red information when viewed on the control panel. all languages listed below are necessarily supported. parameter does not affect the languages visible in the e composer PC tool. (Those are specified under View tings - Drive default language.)	Not selected	
	Not sele	cted	None.		0	
	English		English	1.	1033	
	Deutsch		Germa	n.	1031	
	Italiano		Italian.		1040	
	Español		Spanis	h.	3082	
	Portugue	es	Portuguese.		2070	
	Nederla	nds	Dutch.		1043	
Français Dansk Suomi Svenska Russki		French	l.	1036		
		Danish	l.	1030		
		Finnish	1.	1035		
		Swedis	sh.	1053		
		Russia	n.	1049		
	Polski		Polish.		1045	
	Ceský		Czech		1029	
Magyar			Hunga		1038	

No.	Name/Va	alue	Description	Def/FbEq16	
	Chinese PRC)	(Simplified,	Simplified Chinese.	2052	
	Greek		Greek		
	Japanes	e	Japanese.		
	Korean		Korean		
	Thai				
	Türkçe		Turkish.	1055	
96.02	Pass coo	de	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. If they are not, enter another (random) pass code. 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 175).		
	09999	9999	Pass code.	-	
96.03	Access I	level status	Shows which access levels have been activated by pass codes entered into parameter <i>96.02 Pass code</i> .	0001b	
	Bit	Name			
	0	End user			
	1	Service			
	2	Advanced p			
	 	/ luvarioca p			
	310	Reserved			
		_			

Bit	Name
0	End user
1	Service
2	Advanced programmer
310	Reserved
11	OEM access level 1
12	OEM access level 2
13	OEM access level 3
14	Parameter lock
15	Reserved

	0000b0111b	Active access levels.	-
96.04	Macro select	Selects the control macro. See chapter <i>Control macros</i> (page 73) for more information. After a selection is made, the parameter reverts automatically to <i>Done</i> .	Done
	Done	Macro selection complete; normal operation.	0
	ABB standard	Factory macro (see page 75). For scalar motor control.	1
	Hand/Auto	Hand/Auto macro (see page 88).	2
	Hand/PID	Hand/PID macro (see page 90).	3

No.	Name/Value	Description	Def/FbEq16
	ABB limited 2-wire	ABB limited 2-wire macro (see page 81).	4
	3-wire	3-wire macro see page 82).	11
	Alternate	Alternate macro see page 84).	12
	Motor potentiometer	Motor potentiometer macro (see page 86).	13
	PID	PID macro (see page 92).	14
	Panel PID	Panel PID macro (see page 94).	15
	PFC	PFC macro (see page 96).	16
	ABB standard (vector)	ABB standard (vector) macro (see page 77). For vector motor control.	17
	Torque control	Torque control macro	
96.05	Macro active	Shows which control macro is currently selected. See chapter <i>Control macros</i> (page 73) for more information. To change the macro, use parameter <i>96.04 Macro select</i> .	ABB standard
	ABB standard	Factory macro (see page 75). For scalar motor control.	1
	Hand/Auto	Hand/Auto macro (see page 88).	2
	Hand/PID	Hand/PID macro (see page 90).	3
	ABB limited 2-wire	ABB limited 2-wire macro (see page 81).	4
	3-wire	3-wire macro see page 82).	11
	Alternate	Alternate macro see page 84).	12
	Motor potentiometer	Motor potentiometer macro (see page 86).	13
	PID	PID macro (see page 92).	14
	Panel PID	Panel PID macro (see page 94).	15
	PFC	PFC macro (see page 96).	16
	ABB standard (vector)	ABB standard (vector) macro (see page 77). For vector motor control.	17
	Torque control	Torque control macro	
96.06	Parameter 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	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 • parameter 95.01 Supply voltage • differentiated defaults implemented by parameters 95.20 HW options word 1 and 95.21 HW options word 2 • user lock configuration parameters 96.10096.102.	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 panel/PC communication settings • control macro selection and the parameter defaults • parameter 95.01 Supply voltage • differentiated defaults implemented by parameters 95.20 HW options word 1 and 95.21 HW options word 2 • user lock configuration parameters 96.10096.102. • 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. Note: PID unit is reset only if it is user editable text, that is, parameter 40.79 Set 1 units is set to User text.	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 • differentiated defaults implemented by parameters 95.20 HW options word 1 and 95.21 HW options word 2.	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 173).	n/a
	n/a	No user parameter sets have been saved.	0
	Loading	A user set is being loaded.	1

No.	Name/Value	Description	Def/FbEq16
	Saving	A user set is being saved.	2
	Faulted	Invalid or empty parameter set.	3
	User1 IO active	User set 1 has been selected by parameters 96.12 User set I/O mode in1 and 96.13 User set I/O mode in2.	4
	User2 IO active	User set 2 has been selected by parameters 96.12 User set I/O mode in1 and 96.13 User set I/O mode in2.	5
	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 backu	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	me/Value Description						
96.12	User set I/O mode in1	When parameter 96. I/O mode, selects the parameter 96.13 Use	Not selected					
		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.						
	Selected	1.	1					
	DI1	Digital input DI1 (10.	DI1 (10.02 DI delayed status, bit 0).					
	DI2	Digital input DI2 (10.	3					
	DI3	Digital input DI3 (10.	4					
	DI4	Digital input DI4 (10.	5					
	DI5	Digital input DI5 (10.	6					
	DI6	Digital input DI6 (10.	Digital input DI6 (10.02 DI delayed status, bit 5).					
	Reserved		817					
	Timed function 1	Bit 0 of 34.01 Timed	Bit 0 of 34.01 Timed functions status (see page 307).					
	Timed function 2	Bit 1 of 34.01 Timed	functions status (see	e page 307).	19			
	Timed function 3	Bit 2 of 34.01 Timed	functions status (see	e page 307).	20			
	Reserved							
	Supervision 1	Bit 0 of 32.01 Super	vision status (see pag	ge 299).	24			
	Supervision 2	Bit 1 of 32.01 Super	25					
	Supervision 3	Bit 2 of 32.01 Super	26					
	Other [bit]	Source selection (se	e Terms and abbrevi	ations on page 178).	-			
96.13	User set I/O mode in2	See parameter 96.12	2 User set I/O mode	in1.	Not selected			

No.	Name/V	alue	Description	Def/FbEq16				
96.16	Unit sel	ection	Selects the unit of parameters indicating power, temperature and torque.	0b0000				
	Bit Name Information							
	0	Power unit	0 = kW					
			1 = hp					
	1	Reserved						
	2	Temperatur unit	e 0 = °C 1 = °F					
	3	Reserved						
	4	Torque unit	0 = Nm (N·m)					
		'	1 = lbft (lb·ft)					
	515	Reserved						
	0000h	.FFFFh	Unit selection word.	1 = 1				
96.20	Time sy source	nc primary	Defines the 1st priority external source for synchronization of the drive's time and date.	Panel link				
	Internal		No external source selected.	0				
	Fieldbus	s A	FENA/FPNO can get the time from SNTP server and set it as time for the drive.	3				
	Embedo	led FB	EFB BACnet MS/TP time-sync service can be used to set the time for the drive.	6				
	Panel lir	nk	Control panel, or Drive composer PC tool connected to the control panel.	8				
	Etherne	t tool link	You can set the time manually by using DCP over Ethernet. The time can be set in the same way when you do it with USB and panel.	9				
96.51	Clear fa event lo		Clears all events from the drive's fault and event logs.	Done				
	Done		0 = No action.	0				
	Reset		1 = Resets (clears) the loggers.	1				
96.54	Checksum action		Selects how the drive reacts. • when 96.55 Checksum control word, bit 8 = 1 (Approved checksum A): if the parameter checksum 96.68 Actual checksumA does not match 96.71 Approved checksum A, and/or • when 96.55 Checksum control word, bit 9 = 1 (Approved checksum B): if the parameter checksum 96.69 Actual checksumB does not match 96.72 Approved checksum B.	No action				
	No actio	n	No action taken. (The checksum feature is not in use.)	0				
	Pure ev	ent	The drive generates an event log entry (B686 Checksum mismatch).	1				
	Warning	1	The drive generates a warning (A686 Checksum mismatch).	2				
	Warning prevent		The drive generates a warning (A686 Checksum mismatch). Starting the drive is prevented.	3				
	Fault		The drive trips on 6200 Checksum mismatch.	4				

No.	o. Name/Value Description							
96.55	Checkst. word	im control	Bit 8 = 1 (Approved checksum A): 96.68 Actual checksumA is compared to 96.71 Approved checksum A, and/or Bit 9 = 1 (Approved checksum A): if 96.69 Actual checksumB is compared to 96.72 Approved checksum B. Bit 12 = 1 (Set approved (reference) checksum aparameter(s) into which the actual checksum(s) from parameter(s) are copied: Bit 12 = 1 (Set approved checksum A): Value of 96.68 Actual checksum A is copied into 96.71 Approved checksum A, and/or Bit 13 = 1 (Set approved checksum B): Value of 96.69 Actual checksum B copied into 96.72 Approved checksum B.					
	Bit Name Information							
	07	Reserved	mormation					
	8	Approved checksum A	1 = Enabled: Checksum A (96.71) is observed. 0 = Disabled.					
	9	Approved checksum B	1 = Enabled: Checksum B (96.72) is observed. 0 = Disabled.					
	1011	Reserved						
	12	Set approve checksum A						
	13	Set approve checksum B						
			1 = lbft (lb·ft)					
	1415	Reserved						
	0000000 FFFFF		Checksum control word.	1 = 1				
96.68 Actual checksumA		hecksumA	Displays the actual parameter configuration checksum A. The checksum A is generated and updated whenever an action is selected in 96.54 Checksum action and 96.55 Checksum control word, bit 8 = 1 (Approved checksum A). Checksum A calculation does not include • fieldbus settings. The parameters included in the calculation are user editable parameters in parameter groups 10, 11, 12, 13,15, 19, 20, 21, 22, 23, 24, 25, 28, 30, 31, 32, 34, 35, 36, 37, 40, 41, 43, 45, 46, 71, 76, 95, 96, 97, 98, 99. See also section Parameter checksum calculation (page 174).	Oh				
	0000000		Actual checksum.	-				
	FFFFFF	FFh						

No. Name/Value 96.69 Actual checksumB		Description	Def/FbEq16	
		Displays the actual parameter configuration checksum B. The checksum B is generated and updated whenever an action is selected in 96.54 Checksum action and 96.55 Checksum control word, bit 9 = 1 (Approved checksum B). Checksum B calculation does not include • fieldbus settings • motor data settings • energy data settings. The parameters included in the calculation are user editable parameters in parameter groups 10, 11, 12, 13,15, 19, 20, 21, 22, 23, 24, 25, 28, 30, 31, 32, 34, 35, 36, 37, 40, 41, 43, 46, 71, 76, 95, 96, 97. See also section Parameter checksum calculation (page 174).	Oh	
	00000000h FFFFFFFh	Actual checksum.	-	
96.70	Disable adaptive program	Enables/disables the adaptive program (if present). See also section <i>Adaptive programming</i> (page 115).	Yes	
	No	Adaptive program enabled.	0	
	Yes	Adaptive program disabled.	1	
96.71	Approved checksum A	Approved (reference) checksum A.	0h	
	00000000h FFFFFFFh	Approved checksum A.	-	
96.72	Approved checksum B	Approved (reference) checksum B.	0h	
	00000000h FFFFFFFh	Approved checksum B.	-	
96.78	550 compatibility mode	Enables/disables a Modbus user to access a select set of parameters using 550 register numbering.	Disable	
	Disable	Using 550 compatibility mode is disabled.	0	
	Enable	Using 550 compatibility mode is enabled.	1	
96.100	Change user pass code	(Visible when user lock is open) To change the current user pass code, enter a new code into this parameter as well as 96.101 Confirm user pass code. A warning will be active until the new pass code is confirmed. To cancel changing the pass code, close the user lock without confirming. To close the lock, enter an invalid pass code in parameter 96.02 Pass code, activate parameter 96.08 Control board boot, or cycle the power. See also section User lock (page 175).	10000000	
	10000000 99999999	New user pass code.	-	
96.101	Confirm user pass code	(Visible when user lock is open) Confirms the new user pass code entered in 96.100 Change user pass code.		
	10000000 9999999	Confirmation of new user pass code.	-	

No.	Name/Value 2 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: ABB recommends you select all the actions and functionalities unless otherwise required by the application.						
06.102							
	Bit	Name	Information				
	0	Disable ABB access levels	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	Freeze parameter lock state					
	download • firmware upgrades • parameter restore • loading an adaptive program • changing Home view of control panel • editing drive texts • editing the favorite parameters list on control panel • configuration settings made through control panel		parameter restore loading an adaptive program changing Home view of control panel	l such as			
	310	Reserved					
	11	Disable OEM access level 1	s 1 = OEM access level 1 disabled				
	12	Disable OEM access level 2	1 = OEM access level 2 disabled				
	13	Disable OEM access level 3	1 = OEM access level 3 disabled				
	1415	Reserved					

0000hFFFFh Selection of actions to be prevented by user lock.	
---	--

97 Motor control		Switching frequency; slip gain; voltage reserve; flux braking; anti-cogging (signal injection); IR compensation.	
97.01	Switching frequency reference	Defines the switching frequency of the drive that is used as long as the drive stays below the thermal limit. See section Switching frequency on page 149. Higher switching frequency results in lower acoustic motor noise. Lower switching frequency generates less switching losses and reduce EMC emissions. 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

No.	Name/Value	Description	Def/FbEq16	
97.02	Minimum switching frequency	Lowest switching frequency value that is allowed. Depends on the frame size. When drive is reaching the thermal limit, it will automatically start to reduce the switching frequency until the minimum allowed value is reached. Once the minimum has been reached, the drive will automatically start limiting the output current to keep the temperature below the thermal limit. Inverter temperature is shown by parameter 05.11 Inverter temperature. •	1.5 kHz	
	1.5 kHz	1.5 kHz. Not for all frame sizes.	1	
	2 kHz	2 kHz.	2	
	4 kHz	4 kHz.	4	
	8 kHz	8 kHz.	8	
	12 kHz	12 kHz.	12	
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	
	Moderate	Flux level is limited during the braking. Deceleration time is longer compared to full braking.	1	

No.	Name/Value	Description	Def/FbEq16	
	Full	Maximum braking power. Almost all available current is used to convert the mechanical braking energy to thermal energy in the motor. **Marning!* 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	
97.08	Optimizer minimum torque	This parameter can be used to improve the control dynamics of a synchronous reluctance motor or a salient permanent magnet synchronous motor. As a rule of thumb, define a level to which the output torque must rise with minimum delay. This will increase the motor current and improve the torque response at low speeds.	0.0%	
	0.0 1600.0%	Optimizer torque limit.	10 = 1%	
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%	

No.	Name/Value	Description									Def/FbEq16
97.13	IR compensation	Description Defines the relacompensation) high break-awa applied. U / U _N (%) Relative compensation of the compensation of	re outpressed on the state of t	put vol	n is under the control of the contro	IR %.	in app contro ive ou mpen	olicatio	ons winot be	th a	3.50%
	See also section <i>IR compensation for scalar motor control</i> on page <i>142</i> . Typical IR compensation values are shown below.									<i>trol</i> on	
		3-phase 380									
		P _N (kW) IR compensation (%)	3.5	3.5	3.2	2.2	2	7.5 1.5	15 1.25	1.2	
		3-phase 200	240V	drives	;						
		P _N (kW)	0.37		1.1	2.2	3	7.5	11		
		IR compensation (%)	3.5	3.5	2.6	2.4	2.2	1.7	1.5		
		1-phase 200								•	
		P _N (kW)	0.37		1.1	1.5	2.2				
		IR compensation (%)	3.0	2.3	2.0	1.7	1.5				
		WARNING! Set IR compensation value as low as possible. Large IR compensation value can lead to overheating of the motor and damage to the drive, if operated for longer periods at low speed.									
	0.0050.00%	Voltage boost a voltage.	it zero	spee	in p	ercen	t of no	mina	moto	or	1 = 1%
97.15	Motor model temperature adaptation	Enables the mo motor temperal dependent para	ure ca	an be ι	ısed t	o ada	pt ten	npera	ture		Disabled
	Disabled	Temperature ad	daptat	ion dis	abled	l.					0
	Estimated temperature	Temperature ac (parameter 35.							stima	te	1

0

No.	Name/Value	Description	Def/FbEq16
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 (e.g. rotor resistance).	100%
	0200%	Tuning factor.	1 = 1%
97.20	U/F ratio	Selects the form for the <i>Ulf</i> (voltage to frequency) ratio below field weakening point. For scalar control only. Note: The <i>Ulf</i> function cannot be used with energy optimization; if <i>45.11 Energy optimizer</i> is set to <i>Enable</i> , parameter <i>97.20 U/F ratio</i> is ignored.	Squared
	Linear	Linear ratio for constant torque applications.	0
	Squared	Squared ratio for centrifugal pump and fan applications. With squared U/f ratio the noise level is lower for most operating frequencies. Not recommended for permanent magnet motors.	1
97.49	Slip gain for scalar	Sets gain for slip compensation in percent when the drive is operating in scalar control mode. A squirrel-cage motor slips under load. Increasing the frequency as the motor torque increases compensates for the slip. Note: This parameter is only effective in scalar motor control mode (parameter 99.04 Motor control mode is set to Scalar).	0%
	0200 %	0% = No slip compensation. 0200% = Increasing slip compensation. 100% means full slip compensation according to parameter 99.08 Motor nominal frequency and 99.09 Motor nominal speed.	1 = 1%
97.94	IR comp max frequency	Sets the frequency at which IR compensation set by parameter 97.13 IR compensation reaches 0 V. Unit is percent of the motor nominal frequency.	50.0%
	1.0200.0 %	Frequency.	1 = 1%
98 Uso 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.	Not selected

This parameter cannot be changed while the drive is

The values of parameters 98.02... 98.12 are used as the

running.

motor model.

Parameters 98.02...98.12 inactive.

Not selected

Motor parameters

No.	Name/Value	Description	Def/FbEq16	
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. Resistance value is given at 20 °C (68 °F).	0.00000 p.u.	
	0.000000.50000 p.u.	Stator resistance in per unit.	-	
98.03	Rr user	Defines the rotor resistance R_{R} of the motor model. Resistance value is given at 20 °C (68 °F). 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 $\sigma L_{\rm S}$. 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.	-	
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 $R_{\rm S}$ of the motor model. Resistance value is given at 20 °C (68 °F).	0.00000 ohm	
	0.00000 100.00000 ohm	Stator resistance.	-	
98.10	Rr user SI	Defines the rotor resistance $R_{\rm R}$ of the motor model. Resistance value is given at 20 °C (68 °F). Note: This parameter is valid only for asynchronous motors.	0.00000 ohm	
	0.00000 100.00000 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	
	0.00100000.01 mH	Main inductance.	1 = 10000 mH	

No.	Name/Value	Description	Def/FbEq16
98.12	SigmaL user SI	Defines the leakage inductance σL_{S} . Note: This parameter is valid only for asynchronous motors.	0.00 mH
	0.00100000.01 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
	0.00100000.01 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
	0.00100000.01 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. You must use vector control for this selection.	2
99.04	Motor control mode	Selects the motor control mode.	Scalar
	Vector	Vector control. Vector control has better accuracy than scalar control but cannot be used in all situations (see selection <i>Scalar</i> below). Requires motor identification run (ID run). See parameter 99-13 ID run requested. Notes: 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. To achieve a better motor control performance, you can perform a normal ID run without load.	0

See also section *Operating modes of the drive* (page 110).

No.	Name/Value	Description	Def/FbEq16
	Scalar	Scalar control. Suitable for most applications, if top performance is not required. Motor identification run is not required. Note: Scalar control must be used in the following situations: • with multimotor systems 1) if the load is not equally shared between the motors, 2) if the motors are of different sizes, or 3) if the motors are going to be changed after the motor identification (ID run) • if the nominal current of the motor is less than 1/6 of the nominal output current of the drive • if the drive is used with no motor connected (for example, for test purposes). Note: Correct motor operation requires that the magnetizing current of the motor does not exceed 90% of the nominal current of the inverter. See also section Speed compensated stop (page 153), and section Operating modes of the drive (page 110).	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.	1.80 A
	0.005.20 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; See 46.05
99.07	Motor nominal voltage	Defines the nominal motor voltage supplied to the motor. This setting must match the value on the rating plate of the motor. Notes: • With permanent magnet motors, the nominal voltage is the BackEMF voltage at nominal speed of the motor. If the voltage is given as voltage per rpm, e.g. 60 V per 1000 rpm, the voltage for a nominal speed of 3000 rpm is 3 × 60 V = 180 V. • The stress on the motor insulation is always dependent on the drive supply voltage. This also applies to the case where the motor voltage rating is lower than that of the drive and the supply. • This parameter cannot be changed while the drive is running.	400.0 V
	69.2830.0V	Nominal voltage of the motor.	10 = 1 V
99.08	Motor nominal frequency	Defines the nominal motor frequency. This setting must match the value on the rating plate of the motor. Note: This parameter cannot be changed while the drive is running.	50.00 Hz
	0.00500.00 Hz	Nominal frequency of the motor.	10 = 1 Hz
99.09	Motor nominal speed	Defines the nominal motor speed. The setting must match the value on the rating plate of the motor. Note: This parameter cannot be changed while the drive is running.	1430 rpm
	030000 rpm	Nominal speed of the motor.	1 = 1 rpm

No.	Name/Value	Description	Def/FbEq16
99.10	Motor nominal power	Defines the nominal motor power. The setting must match the value on the rating plate of the motor. If multiple motors are connected to the drive, enter the total power of the motors. The unit is selected by parameter 96.16 Unit selection. Note: This parameter cannot be changed while the drive is running.	0.75 kW or hp; See 46.05
	0.00 10000.00 kW or 0.00 13404.83 hp	Nominal power of the motor.	1 = 1 unit
99.11	Motor nominal cos Φ	Defines the cosphi of the motor for a more accurate motor model. The value is not obligatory, but is useful with an asynchronous motor, especially when performing a standstill identification run. With a permanent magnet or synchronous reluctance motor, this value is not needed. Notes: Do not enter an estimated value. If you do not know the exact value, leave the parameter at zero. This parameter cannot be changed while the drive is running.	0.00
	0.001.00	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 96.16 Unit selection. 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 e.g. speed limits are less than the motor nominal speed, the ID run cannot be completed. Make sure the motor is stopped before starting the ID run. 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), the ID run is not requested automatically. However, an ID run can be performed for more accurate torque estimation. 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. Mechanical brake (if present) is not opened by the logic for the ID run.	None
	None	No motor ID run is requested. This mode can be selected only if the ID run (Normal/Reduced/Standstill/Advanced) has already been performed once.	0
	Normal	Normal ID run. Guarantees good control accuracy for all cases. The ID run takes about 90 seconds. This mode should be selected whenever it is possible. Notes: If the load torque will be higher than 20% of motor nominal torque, or if the machinery is not able to withstand the nominal torque transient during the ID run, then the driven machinery must be de-coupled from the motor during a Normal ID run. Check the direction of rotation of the motor before starting the ID run. During the run, the motor will rotate in the forward direction. WARNING! The motor will run at up to approximately 50100% of the nominal speed during the ID run. ENSURE THAT IT IS SAFE TO RUN THE MOTOR BEFORE PERFORMING THE ID RUN!	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 (eg. with lift or crane applications).	3
	Reserved		4
	Advanced	Advanced ID run. Only for frames R6R11. Guarantees the best possible control accuracy. The ID run takes a very long time to complete. This mode should be selected when top performance is needed across the whole operating area. Note: The driven machinery must be de-coupled from the motor because of high torque and speed transients that are applied. WARNING! The motor may run at up to the maximum (positive) and minimum (negative) allowed speed during the ID run. Several accelerations and decelerations are done. The maximum torque, current and speed allowed by the limit parameters may be utilized. ENSURE THAT IT IS SAFE TO RUN THE MOTOR BEFORE PERFORMING THE ID RUN!	6
	Adaptive	Adaptive ID run. Improves the motor model accuracy during normal operation of the drive. The drive performs a Standstill ID run first. Motor parameters are then updated with better accuracy during an adaptation sequence when following user's driving profile. When the adaptation is complete, parameters 99.14 Last ID run performed changes from Standstill to Adaptive. Motor parameters are updated automatically and the user is not required to update any other parameter. Notes: For vector control only. For frame sizes R1R4 only.	8

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No.	Name/Value	Description	Def/FbEq16
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
	Advanced	Advanced ID run.	6
	Adaptive	Adaptive ID run.	8
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
12.20	Al1 scaled at Al1 max	50.000	60.000
13.18	AO1 source max	50.0	60.0
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
46.31	Above speed limit	1500.00 rpm	1800.00 rpm
46.32	Above frequency limit	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 177).

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 177).
List	Selection list.

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 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	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	0.0004000000.000	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	
01.54	Cumulative inverter energy	Real	-200000000.0 200000000.0	kWh	1 = 1 kWh	
01.55	Inverter GWh counter (resettable)	Real	065535	GWh	1 = 1 GWh	
01.56	Inverter MWh counter (resettable)	Real	01000	MWh	1 = 1 MWh	
01.57	Inverter kWh counter (resettable)	Real	01000	kWh	1 = 1 kWh	
01.58	Cumulative inverter energy (resettable)	Real	-200000000.0 200000000.0	kWh	1 = 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%	

No.	Name	Туре	Range	Unit	FbEq32	
01.68	Abs motor shaft power		0.0032767.00	kW	100 = 1 kW	
03 Input	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	
04 Warn	ings and faults					
04.01	Tripping fault	Data	0000hFFFFh	-	1 = 1	
04.02	Active fault 2	Data	0000hFFFFh	-	1 = 1	
04.03	Active fault 3	Data	0000hFFFFh	-	1 = 1	
04.06	Active warning 1	Data	0000hFFFFh	-	1 = 1	
04.07	Active warning 2	Data	0000hFFFFh	-	1 = 1	
04.08	Active warning 3	Data	0000hFFFFh	-	1 = 1	
04.11	Latest fault	Data	0000hFFFFh	-	1 = 1	
04.12	2nd latest fault	Data	0000hFFFFh	-	1 = 1	
04.13	3rd latest fault	Data	0000hFFFFh	-	1 = 1	
04.16	Latest warning	Data	0000hFFFFh	-	1 = 1	
04.17	2nd latest warning	Data	0000hFFFFh	-	1 = 1	
04.18	3rd latest warning	Data	0000hFFFFh	-	1 = 1	
04.40	Event word 1	PB	0000hFFFFh	-	1 = 1	
04.41	Event word 1 bit 0 code	Data	0x2310FFFFh	-	1 = 1	
04.43	Event word 1 bit 1 code	Data	0x3210FFFFh	-	1 = 1	
04.45,	•••		***			
04,47, 04,49,						
04.71	Event word 1 bit 15 code	Data	0x2330FFFFh	-	1 = 1	
05 Diag	nostics					
05.01	On-time counter	Real	065535	d	1 = 1 d	
05.02	Run-time counter	Real	065535	d	1 = 1 d	
05.03	Hours run	Real	0.0429496729.5	h	10 = 1 h	
05.04	Fan on-time counter	Real	065535	d	1 = 1 d	
05.10	Control board temperature	Real	-100300	°C or °F	10 = 1 °	
05.11	Inverter temperature	Real	-40.0160.0	%	10 = 1%	
05.20	Diagnostic word 1	PB	0000hFFFFh	-		
05.21	Diagnostic word 2	PB	0000hFFFFh	-		
05.22	Diagnostic word 3	PB	0000hFFFFh	-		
05.80	Motor speed at fault	Real	-30000.0030000.00	rpm	100 = 1 rpm	
05.81	Output frequency at fault	Real	-500.00500.00	Hz	100 = 1 Hz	
05.82	DC voltage at fault	Real	0.002000.00	V	100 = 1 V	

No.	Name	Type	Range	Unit	FbEq32
05.83	Motor current at fault	Real	0.0030000.00	Α	100 = 1 A
05.84	Motor torque at fault	Real	-1600.01600.0	%	10 = 1 %
05.85	Main status word at fault	PB	0000hFFFFh	-	1 = 1
05.86	DI delayed status at fault	PB	0000hFFFFh	-	1 = 1
05.87	Inverter temperature at fault	Real	-40160	°C	10 = 1 %
05.88	Reference used at fault	Real	-30000.0030000.00	Hz	100 = 1 Hz
06 Cont	rol and status words				
06.01	Main control word	PB	0000hFFFFh	-	1 = 1
06.11	Main status word	PB	0000hFFFFh	-	1 = 1
06.16	Drive status word 1	PB	0000hFFFFh	-	1 = 1
06.17	Drive status word 2	PB	0000hFFFFh	-	1 = 1
06.18	Start inhibit status word	PB	0000hFFFFh	-	1 = 1
06.19	Speed control status word	PB	0000hFFFFh	-	1 = 1
06.20	Constant speed status word	PB	0000hFFFFh	-	1 = 1
06.21	Drive status word 3	PB	0000hFFFFh	-	1 = 1
06.29	MSW bit 10 selection	Binary src	-	-	1 = 1
06.30	MSW bit 11 selection	Binary src	-	-	1 = 1
06.31	MSW bit 12 selection	Binary src	-	-	1 = 1
06.32	MSW bit 13 selection	Binary src	-	-	1 = 1
06.33	MSW bit 14 selection	Binary src	-	-	1 = 1
07 Syst	em info				
07.03	Drive rating id	List	-	-	1 = 1
07.04	Firmware name	List	-	-	1 = 1
07.05	Firmware version	Data	-	-	1 = 1
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
07.30	Adaptive program status	PB	0000hFFFFh	-	1 = 1
07.31	AP sequence state	Data	020	-	1 = 1
07.35	Drive configuration	PB	0000hFFFFh	-	1 = 1
07.36	Drive configuration 2	PB	0000hFFFFh	-	1 = 1

Parameter groups 10...99

No.	Name	Туре	Range	Unit	FbEq32			
10 Standard DI, RO								
10.01	DI status	PB	0000hFFFFh	-	1 = 1			
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			
10.05	DI1 ON delay	Real	0.003000.00	S	100 = 1			
10.06	DI1 OFF delay	Real	0.003000.00	S	100 = 1			
10.07	DI2 ON delay	Real	0.003000.00	s	100 = 1			
10.08	DI2 OFF delay	Real	0.003000.00	s	100 = 1			
10.09	DI3 ON delay	Real	0.003000.00	s	100 = 1			
10.10	DI3 OFF delay	Real	0.003000.00	s	100 = 1			
10.11	DI4 ON delay	Real	0.003000.00	s	100 = 1			
10.12	DI4 OFF delay	Real	0.003000.00	s	100 = 1			
10.13	DI5 ON delay	Real	0.003000.00	s	100 = 1			
10.14	DI5 OFF delay	Real	0.003000.00	s	100 = 1			
10.15	DI6 ON delay	Real	0.003000.00	s	100 = 1			
10.16	DI6 OFF delay	Real	0.003000.00	s	100 = 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 Stan	dard DIO, FI, FO							
11.02	DIO delayed status	PB	0000hFFFFh	-	1 = 1			
11.03	DIO force selection	PB	0000hFFFFh	-	1 = 1			
11.04	DIO force data	PB	0000hFFFFh	-	1 = 1			

No.	Name	Туре	Range	Unit	FbEq32
11.05	DIO1 configuration	List	0, 2	-	1 = 1
11.06	DIO1 output source	PB	0000hFFFFh	-	1 = 1
11.07	DIO1 ON delay	Real	0.03000.0	s	10 = 1 s
11.08	DIO1 OFF delay	Real	0.03000.0	s	10 = 1 s
11.17	DI4 configuration	List	01	-	1 = 1
11.21	DI5 configuration	List	-	-	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 = 1vHz
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 Stan	dard Al	•		•	
12.02	Al force selection	PB	0000hFFFFh	-	1 = 1
12.03	Al supervision function	List	-	-	1 = 1
12.04	Al supervision selection	PB	0000hFFFFh	-	1 = 1
12.11	Al1 actual value	Real	0.00022.000 mA or 0.00011.000 V	mA or V	1000 = 1 unit
12.12	Al1 scaled value	Real	-32768.00032767.000	-	1000 = 1
12.13	Al1 forced value	Real	0.00022.000 mA or 0.00011.000 V	mA or V	1000 = 1 unit
12.15	Al1 unit selection	List	-	-	1 = 1
12.16	Al1 filter time	Real	0.00030.000	s	1000 = 1 s
12.17	Al1 min	Real	0.00022.000 mA or 0.00011.000 V	mA or V	1000 = 1 unit
12.18	Al1 max	Real	0.00022.000 mA or 0.00011.000 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	-	_	1 = 1
12.26	Al2 filter time	Real	0.00030.000	s	1000 = 1 s
12.27	Al2 min	Real	0.00022.000 mA or 0.00011.000 V	mA or V	1000 = 1 unit
12.28	Al2 max	Real	0.00022.000 mA or 0.00011.000 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%

No.	Name	Type	Range	Unit	FbEq32
13 Stand	dard AO	<u> </u>		1	•
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
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 ex	xtension module			•	
15.01	Extension module type	List	-	-	1 = 1
15.02	Detected extension module	List	-	-	1 = 1
15.04	RO status	PB	0000hFFFFh	-	1 = 1
15.05	RO force selection	PB	0000hFFFFh	-	1 = 1
15.06	RO 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
15.13	RO6 source	Binary src	-	-	1 = 1
15.14	RO6 ON delay	Real	0.03000.0	s	10 = 1 s

No.	Name	Туре	Range	Unit	FbEq32
15.15	RO6 OFF delay	Real	0.03000.0	s	10 = 1 s
15.16	RO7 source	Binary src	-	-	1 = 1
15.17	RO7 ON delay	Real	0.03000.0	s	10 = 1 s
15.18	RO7 OFF delay	Real	0.03000.0	s	10 = 1 s
19 Oper	ration mode				
19.01	Actual operation mode	List	-	-	1 = 1
19.11	Ext1/Ext2 selection	Binary src	-	-	1 = 1
19.12	Ext1 control mode	List		-	1 = 1
19.14	Ext2 control mode	List		-	1 = 1
19.16	Local control mode	List	-	-	1 = 1
19.17	Local control disable	List	-	-	1 = 1
20 Start	/stop/direction				
20.01	Ext1 commands	List	-	-	1 = 1
20.02	Ext1 start trigger type	List	-	-	1 = 1
20.03	Ext1 in1 source	Binary src	-	-	1 = 1
20.04	Ext1 in2 source	Binary src	-	-	1 = 1
20.05	Ext1 in3 source	Binary src	-	-	1 = 1
20.06	Ext2 commands	List	-	-	1 = 1
20.07	Ext2 start trigger type	List	-	-	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
20.11	Run enable stop mode	List	-	-	1 = 1
20.12	Run enable 1 source	Binary src	-	-	1 = 1
20.19	Enable start command	Binary src	-	-	1 = 1
20.21	Direction	List	-	-	1 = 1
20.22	Enable to rotate	Binary src	-	-	1 = 1
20.25	Jogging enable	Binary src	-	-	1 = 1
20.26	Jogging 1 start source	Binary src	-	-	1 = 1
20.27	Jogging 2 start source	Binary src	-	-	1 = 1

No.	Name	Туре	Range	Unit	FbEq32			
21 Start/stop mode								
21.01	Start mode	List	-	-	1 = 1			
21.02	Magnetization time	Real	010000	ms	1 = 1 ms			
21.03	Stop mode	List	-	-	1 = 1			
21.04	Emergency stop mode	List	-	-	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			
21.15	Pre-heating time delay	Real	103000	s	1 = 1 s			
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	-	-	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	-	-	1 = 1			
21.24	Smooth start current	Real	10.0200.0	%	100 = 1%			
21.25	Smooth start speed	Real	2.0100.0	%	100 = 1%			
21.26	Torque boost current	Real	15.0300.0	%	100 = 1%			
21.27	Torque boost time	Real	0.060.0	s	10 = 1 s			
21.30	Speed compensated stop mode	Real	-	-	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%			
21.34	Force auto restart	List	-	-	1 = 1			
21.35	Preheating power	Real	0.0010.00	kW	100 = 1 kW			
21.36	Preheating unit	List	=	-	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			
22.12	Ext1 speed ref2	Analog src	-	-	1 = 1			
22.13	Ext1 speed function	List	-	-	1 = 1			
22.18	Ext2 speed ref1	Analog src	-	-	1 = 1			

No.	Name	Туре	Range	Unit	FbEq32
22.19	Ext2 speed ref2	Analog src	-	-	1 = 1
22.20	Ext2 speed function	List	_	_	1 = 1
22.21	Constant speed function	PB	00b11b	_	1 = 1
22.22	Constant speed sel1	Binary	-	_	1 = 1
22.22	Ochstant speed seri	src	_		, – ,
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
22.42	Jogging 1 ref	Real	-30000.0030000.00	rpm	100 = 1 rpm
22.43	Jogging 2 ref	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	-	-	1 = 1
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
23.12 Acceleration time 1 Real 0.0001800.000 s 1000	
23.13 Deceleration time 1 Real 0.0001800.000 s 1000 23.14 Acceleration time 2 Real 0.0001800.000 s 1000 23.15 Deceleration time 2 Real 0.0001800.000 s 1000 23.20 Acc time jogging Real 0.0001800.000 s 1000 23.21 Dec time jogging Real 0.0001800.000 s 1000 23.23 Emergency stop time Real 0.0001800.000 s 1000 23.28 Variable slope enable List - - 1 23.29 Variable slope rate Real 230000 ms 1 = 23.32 Shape time 1 Real 0.0001800.000 s 1000 24.33 Shape time 2 Real 0.0001800.000 s 1000 24 Speed reference conditioning Real -30000.003000.00 rpm 100 = 24.02 Used speed feedback Real -30000.003000.00 rpm	
23.14 Acceleration time 2 Real 0.0001800.000 s 1000 23.15 Deceleration time 2 Real 0.0001800.000 s 1000 23.20 Acc time jogging Real 0.0001800.000 s 1000 23.21 Dec time jogging Real 0.0001800.000 s 1000 23.23 Emergency stop time Real 0.0001800.000 s 1000 23.28 Variable slope enable List - - 1 23.29 Variable slope rate Real 230000 ms 1 = 23.32 Shape time 1 Real 0.0001800.000 s 1000 23.33 Shape time 2 Real 0.0001800.000 s 1000 24 Speed reference conditioning 24.01 Used speed feedback Real -30000.0030000.00 rpm 100 = 24.02 Used speed feedback Real -30000.0030000.00 rpm 100 = 24.04 Speed error filtered Real </td <td>) = 1 s</td>) = 1 s
23.15 Deceleration time 2 Real 0.0001800.000 s 1000) = 1 s
23.20 Acc time jogging Real 0.0001800.000 s 1000 23.21 Dec time jogging Real 0.0001800.000 s 1000 23.23 Emergency stop time Real 0.0001800.000 s 1000 23.28 Variable slope enable List - - 1 23.29 Variable slope rate Real 230000 ms 1 = 23.32 Shape time 1 Real 0.0001800.000 s 1000 24 Speed reference conditioning 24 Speed reference conditioning 24.01 Used speed feedback Real -30000.0030000.00 rpm 100 = 24.02 Used speed feedback Real -30000.0030000.00 rpm 100 = 24.03 Speed error filtered Real -30000.0030000.00 rpm 100 = 24.04 Speed error inverted Real -30000.0030000.00 rpm 100 = 24.12 Speed error filter time Real -10000.0010000.00 rpm) = 1 s
23.21 Dec time jogging Real 0.0001800.000 s 1000 23.23 Emergency stop time Real 0.0001800.000 s 1000 23.28 Variable slope enable List - - 1 23.29 Variable slope rate Real 230000 ms 1 = 23.32 Shape time 1 Real 0.0001800.000 s 1000 23.33 Shape time 2 Real 0.0001800.000 s 1000 24 Speed reference conditioning 24.01 Used speed feedback Real -30000.0030000.00 rpm 100 = 24.02 Used speed feedback Real -30000.0030000.00 rpm 100 = 24.03 Speed error filtered Real -30000.0030000.00 rpm 100 = 24.04 Speed error inverted Real -30000.0030000.00 rpm 100 = 24.11 Speed error filter time Real -10000.0010000.00 rpm 100 = 25 Speed control) = 1 s
23.23 Emergency stop time Real 0.0001800.000 s 1000 23.28 Variable slope enable List - - 1 23.29 Variable slope rate Real 230000 ms 1 = 23.32 Shape time 1 Real 0.0001800.000 s 1000 23.33 Shape time 2 Real 0.0001800.000 s 1000 24 Speed reference conditioning 24.01 Used speed feedback Real -30000.0030000.00 rpm 100 = 24.02 Used speed feedback Real -30000.0030000.00 rpm 100 = 24.03 Speed error filtered Real -30000.0030000.00 rpm 100 = 24.04 Speed error inverted Real -30000.0030000.00 rpm 100 = 24.11 Speed correction Real -10000.0010000.00 rpm 100 = 24.12 Speed error filter time Real 010000 ms 1 = 25 Speed control <t< td=""><td>) = 1 s</td></t<>) = 1 s
23.28 Variable slope enable List - 1) = 1 s
23.29 Variable slope rate Real 230000 ms 1 = 23.32 Shape time 1 Real 0.0001800.000 s 1000 23.33 Shape time 2 Real 0.0001800.000 s 1000 24 Speed reference conditioning 24.01 Used speed reference Real -30000.0030000.00 rpm 100 = 24.02 Used speed feedback Real -30000.0030000.00 rpm 100 = 24.03 Speed error filtered Real -30000.0030000.00 rpm 100 = 24.04 Speed error inverted Real -30000.0030000.00 rpm 100 = 24.11 Speed correction Real -10000.0010000.00 rpm 100 = 24.12 Speed error filter time Real 010000 ms 1 = 25 Speed control 25.01 Torque reference speed Real -1600.01600.0 % 10) = 1 s
23.32 Shape time 1 Real 0.0001800.000 s 1000 23.33 Shape time 2 Real 0.0001800.000 s 1000 24 Speed reference conditioning 24.01 Used speed reference Real -30000.0030000.00 rpm 100 = 24.02 Used speed feedback Real -30000.0030000.00 rpm 100 = 24.03 Speed error filtered Real -30000.0030000.00 rpm 100 = 24.04 Speed error inverted Real -30000.0030000.00 rpm 100 = 24.11 Speed correction Real -10000.0010000.00 rpm 100 = 24.12 Speed error filter time Real 010000 ms 1 = 25 Speed control Real -1600.01600.0 % 10	= 1
23.33 Shape time 2 Real 0.0001800.000 s 1000 24 Speed reference conditioning 24.01 Used speed reference Real -30000.0030000.00 rpm 100 = 24.02 Used speed feedback Real -30000.0030000.00 rpm 100 = 24.03 Speed error filtered Real -30000.0030000.00 rpm 100 = 24.04 Speed error inverted Real -30000.0030000.00 rpm 100 = 24.11 Speed correction Real -10000.0010000.00 rpm 100 = 24.12 Speed error filter time Real 010000 ms 1 = 25 Speed control Real -1600.01600.0 % 10	1 ms
24 Speed reference conditioning 24.01 Used speed reference Real -30000.0030000.00 rpm 100 = 24.02 Used speed feedback Real -30000.0030000.00 rpm 100 = 24.03 Speed error filtered Real -30000.0030000.00 rpm 100 = 24.04 Speed error inverted Real -30000.0030000.00 rpm 100 = 24.11 Speed correction Real -10000.0010000.00 rpm 100 = 24.12 Speed error filter time Real 010000 ms 1 = 25 Speed control 25.01 Torque reference speed control Real -1600.01600.0 % 10) = 1 s
24.01 Used speed reference Real -30000.0030000.00 rpm 100 = 24.02 Used speed feedback Real -30000.0030000.00 rpm 100 = 24.03 Speed error filtered Real -30000.0030000.00 rpm 100 = 24.04 Speed error inverted Real -30000.0030000.00 rpm 100 = 24.11 Speed correction Real -10000.0010000.00 rpm 100 = 24.12 Speed error filter time Real 010000 ms 1 = 25 Speed control 25.01 Torque reference speed control Real -1600.01600.0 % 10) = 1 s
24.02 Used speed feedback Real -30000.0030000.00 rpm 100 = 24.03 Speed error filtered Real -30000.0030000.00 rpm 100 = 24.04 Speed error inverted Real -30000.0030000.00 rpm 100 = 24.11 Speed correction Real -10000.0010000.00 rpm 100 = 24.12 Speed error filter time Real 010000 ms 1 = 25 Speed control 25.01 Torque reference speed control Real -1600.01600.0 % 10	
24.03 Speed error filtered Real -30000.0030000.00 rpm 100 = 24.04 Speed error inverted Real -30000.0030000.00 rpm 100 = 24.11 Speed correction Real -10000.0010000.00 rpm 100 = 24.12 Speed error filter time Real 010000 ms 1 = 25 Speed control 25.01 Torque reference speed control Real -1600.01600.0 % 10	= 1 rpm
24.04 Speed error inverted Real -30000.0030000.00 rpm 100 = 24.11 Speed correction Real -10000.0010000.00 rpm 100 = 24.12 Speed error filter time Real 010000 ms 1 = 25 Speed control 25.01 Torque reference speed control Real -1600.01600.0 % 10	= 1 rpm
24.11 Speed correction Real -10000.0010000.00 rpm 100 = 24.12 Speed error filter time Real 010000 ms 1 = 25 Speed control 25.01 Torque reference speed control Real -1600.01600.0 % 10	= 1 rpm
24.12 Speed error filter time Real 010000 ms 1 = 25 Speed control 25.01 Torque reference speed control -1600.01600.0 % 10	= 1 rpm
25 Speed control 25.01 Torque reference speed control Real -1600.01600.0 % 10	= 1 rpm
25.01 Torque reference speed Real -1600.01600.0 % 10 control	1 ms
control	
25.02 Speed proportional gain Real 0.00250.00 - 100	= 1%
	0 = 1
25.03 Speed integration time Real 0.001000.00 s 1000) = 1 s
25.04 Speed derivation time Real 0.00010.000 s 1000) = 1 s
25.05 Derivation filter time	1 ms
25.06 Acc comp derivation time Real 0.001000.00 s 100	= 1 s
25.07 Acc comp filter time	= 1 ms
25.15 Proportional gain em stop Real 1.00250.00 - 100	0 = 1
25.33 Speed controller autotune List - 1	= 1
25.34 Speed controller autotune List - 1	= 1
25.37 Mechanical time constant Real 0.001000.00 s 100	= 1 s
25.38 Autotune torque step	= 1%
25.39 Autotune speed step	= 1%
25.40 Autotune repeat times Real 110 - 1	= 1
25.53 Torque prop reference	- 1
25.54 Torque integral reference	= 1%
25.55 Torque deriv reference Real -30000.030000.0 % 10	
25.56 Torque acc compensation Real -30000.030000.0 % 10	= 1%

No.	Name	Туре	Range	Unit	FbEq32
26 Torq	ue reference chain			_	•
26.01	Torque reference to TC	Real	-1600.01600.0	%	10 = 1%
26.02	Torque reference used	Real	-1600.01600.0	%	10 = 1%
26.08	Minimum torque ref	Real	-1000.00.0	%	10 = 1%
26.09	Maximum torque ref	Real	0.01000.0	%	10 = 1%
26.11	Torque ref1 source	Analog src	-	-	1 = 1
26.12	Torque ref2 source	Analog src	-	-	1 = 1
26.13	Torque ref1 function	List	05	-	1 = 1
26.14	Torque ref1/2 selection	Binary src	-	-	1 = 1
26.17	Torque ref filter time	Real	0.00030.000	s	1000 = 1 s
26.18	Torque ramp up time	Real	0.00060.000	s	1000 = 1 s
26.19	Torque ramp down time	Real	0.00060.000	s	1000 = 1 s
26.20	Torque reversal	List	-	-	1 = 1
26.21	Torque sel torque in	Binary src	-	-	1 = 1
26.22	Torque sel speed in	Binary src	-	-	1 = 1
26.70	Torque reference act 1	Real	-1600.01600.0	%	10 = 1%
26.71	Torque reference act 2	Real	-1600.01600.0	%	10 = 1%
26.72	Torque reference act 3	Real	-1600.01600.0	%	10 = 1%
26.73	Torque reference act 4	Real	-1600.01600.0	%	10 = 1%
26.74	Torque ref ramp out	Real	-1600.01600.0	%	10 = 1%
26.75	Torque reference act 5	Real	-1600.01600.0	%	10 = 1%
26.81	Rush control gain	Real	0.010000.0	-	10 = 1
26.82	Rush control integration time	Real	0.010.0	s	10 = 1
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 src	-	-	1 = 1
28.12	Ext1 frequency ref2	Analog src	-	-	1 = 1
28.13	Ext1 frequency function	List	-	-	1 = 1
28.15	Ext2 frequency ref1	Analog src	-	-	1 = 1
28.16	Ext2 frequency ref2	Analog src	-	-	1 = 1
28.17	Ext2 frequency function	List	-	-	1 = 1
28.21	Constant frequency function	PB	00b11b	-	1 = 1
28.22	Constant frequency sel1	Binary src	-	-	1 = 1

No.	Name	Type	Range	Unit	FbEq32
28.23	Constant frequency sel2	Binary	-	-	1 = 1
		src			
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
28.42	Jogging 1 frequency ref	Real	-500.00500.00	Hz	100 = 1 Hz
28.43	Jogging 2 frequency ref	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
28.71	Freq ramp set selection	Binary src	-	-	1 = 1
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
28.74	Freq acceleration time 2	Real	0.0001800.000	s	1000 = 1 s
28.75	Freq deceleration time 2	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
28.83	Shape time 2	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	s				
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
30.14	Maximum frequency	Real	-500.00500.00	Hz	100 = 1 Hz
30.17	Maximum current	Real	0.002.16	Α	100 = 1 A

No.	Name	Туре	Range	Unit	FbEq32
30.18	Torq lim sel	Binary	-	-	1 = 1
20.40	Minimum Annua 4	src	40000 0 0	0/	40 - 40/
30.19	Minimum torque 1	Real	-1600.00.0 0.01600.0	%	10 = 1% 10 = 1%
	Maximum torque 1	Real	0.01600.0		
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	-	-	1 = 1
30.31	Undervoltage control	List	-	-	1 = 1
30.35	Thermal current limitation	List	-	-	1 = 1
30.36	Speed limit selection	Binary src	-	-	1 = 1
30.37	Minimum speed source	Analog src	-	-	1 = 1
30.38	Maximum speed source	Analog src	-	-	1 = 1
31 Faul	t functions				
31.01	External event 1 source	Binary src	-	-	1 = 1
31.02	External event 1 type	List	-	-	1 = 1
31.03	External event 2 source	Binary src	-	-	1 = 1
31.04	External event 2 type	List	-	-	1 = 1
31.05	External event 3 source	Binary src	-	-	1 = 1
31.06	External event 3 type	List	-	-	1 = 1
31.07	External event 4 source	Binary src	-	-	1 = 1
31.08	External event 4 type	List	-	-	1 = 1
31.09	External event 5 source	Binary src	-	-	1 = 1
31.10	External event 5 type	List	-	-	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	-	-	1 = 1

No.	Name	Туре	Range	Unit	FbEq32
31.21	Supply phase loss	List	-	-	1 = 1
31.22	STO indication run/stop	List	-	-	1 = 1
31.23	Wiring or earth fault	List	-	-	1 = 1
31.24	Stall function	List	-	-	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
31.31	Frequency trip margin	Real	0.0010000.0	Hz	100 = 1 Hz
31.32	Emergency ramp supervision	Real	0300	%	1 = 1%
31.33	Emergency ramp supervision delay	Real	0100	s	1 = 1 s
31.35	Main fan fault function	List	-	-	1 = 1
32 Supe	ervision				
32.01	Supervision status	PB	00000111b	-	1 = 1
32.05	Supervision 1 function	List	•	-	1 = 1
32.06	Supervision 1 action	List	•	-	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	•	-	1 = 1
32.16	Supervision 2 action	List	•	-	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	-	-	1 = 1
32.26	Supervision 3 action	List	-	-	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

No.	Name	Type	Range	Unit	FbEq32
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	-	-	1 = 1
32.36	Supervision 4 action	List	-	-	1 = 1
32.37	Supervision 4 signal	Analog src	-	-	1 = 1
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	-	-	1 = 1
32.46	Supervision 5 action	List	-	-	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	-	-	1 = 1
32.56	Supervision 6 action	List	-	-	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

No.	Name	Туре	Range	Unit	FbEq32
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
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	•	-	1 = 1 d
34.61	Season 2 start date	Date	-	-	1 = 1 d
34.62	Season 3 start date	Date	-	-	1 = 1 d
34.63	Season 4 start date	Date	-	-	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	-	-	1 = 1 d
34.73	Exception 1 length	Real	060	d	1 = 1 d
34.74	Exception 2 start	Date	-	-	1 = 1 d
34.75	Exception 2 length	Real	060	d	1 = 1 d
34.76	Exception 3 start	Date	-	-	1 = 1 d

No.	Name	Туре	Range	Unit	FbEq32
34.77	Exception 3 length	Real	060	d	1 = 1 d
34.78	Exception day 4	Date	-	-	1 = 1 d
34.79	Exception day 5	Date	-	-	1 = 1 d
34.80	Exception day 6	Date	-	-	1 = 1 d
34.81	Exception day 7	Date	-	-	1 = 1 d
34.82	Exception day 8	Date	-	-	1 = 1 d
34.83	Exception day 9	Date	-	-	1 = 1 d
34.84	Exception day 10	Date	-	-	1 = 1 d
34.85	Exception day 11	Date	-	-	1 = 1 d
34.86	Exception day 12	Date	-	-	1 = 1 d
34.87	Exception day 13	Date	-	-	1 = 1 d
34.88	Exception day 14	Date	-	-	1 = 1 d
34.89	Exception day 15	Date	-	-	1 = 1 d
34.90	Exception day 16	Date	•	-	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	-	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 [35.12] ohm	°C, °F or ohm	1 = 1 unit
35.03	Measured temperature 2	Real	-605000 °C or -769032 °F, 0 ohm or [35.22] ohm	°C, °F or ohm	1 = 1 unit
35.05	Motor overload level	Real	0.0300.0	%	10 = 1%
35.11	Temperature 1 source	List	-	-	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
35.21	Temperature 2 source	List	-	-	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

No.	Name	Туре	Range	Unit	FbEq32
35.24	Temperature 2 Al source	Analog	-	-	1 = 1
		src			
35.50	Motor ambient temperature	Real	-60100 °C or -76 212 °F	°C	1 = 1 °
35.51	Motor load curve	Real	50150	%	1 = 1%
35.52	Zero speed load	Real	25150	%	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 constant	Real	10010000	s	1 = 1 s
35.56	Motor overload action	List	-	-	1 = 1
35.57	Motor overload class	List	-	-	1 = 1
36 Load	l 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	-	-	1 = 1
36.10	PVL peak value	Real	-32768.0032767.00	-	100 = 1
36.11	PVL peak date	Data	1/1/19806/5/2159	-	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	1/1/19806/5/2159	-	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%

No.	Name	Туре	Range	Unit	FbEq32
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%
36.50	AL2 reset date	Data	1/1/19806/5/2159	-	1 = 1
36.51	AL2 reset time	Data	-	-	1 = 1
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	-	-	1 = 1
37.04	ULC underload actions	List	-	-	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				
40.01	Process PID output actual	Real	-200000.00200000.00	%	100 = 1 PID customer unit
40.02	Process PID feedback actual	Real	-200000.00200000.00	PID customer units	100 = 1 PID customer unit

No.	Name	Type	Range	Unit	FbEq32
40.03	Process PID setpoint actual	Real	-200000.00200000.00	PID customer units	100 = 1 PID customer unit
40.04	Process PID deviation actual	Real	-200000.00200000.00	PID customer units	100 = 1 PID customer unit
40.05	Process PID trim output act	Real	-3276832768	-	1 = 1
40.06	Process PID status word	PB	0000hFFFFh	-	1 = 1
40.07	Process PID operation mode	List	-	-	1 = 1
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	-	-	1 = 1
40.11	Set 1 feedback filter time	Real	0.00030.000	s	1000 = 1 s
40.14	Set 1 setpoint scaling	Real	-200000.00200000.00	-	100 = 1
40.15	Set 1 output scaling	Real	-200000.00200000.00	-	100 = 1
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	-	-	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	-200000.00200000.00	PID customer units	100 = 1 PID customer unit
40.22	Set 1 internal setpoint 2	Real	-200000.00200000.00	PID customer units	100 = 1 PID customer unit
40.23	Set 1 internal setpoint 3	Real	-200000.00200000.00	PID customer units	100 = 1 PID customer unit
40.24	Set 1 internal setpoint 0	Real	-200000.00200000.00	PID customer units	100 = 1 PID customer unit
40.26	Set 1 setpoint min	Real	-200000.00200000.00	PID customer units	100 = 1
40.27	Set 1 setpoint max	Real	-200000.00200000.00	PID customer units	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

No.	Name	Туре	Range	Unit	FbEq32
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	-200000.00200000.00	-	10 = 1
40.37	Set 1 output max	Real	-200000.00200000.00	-	10 = 1
40.38	Set 1 output freeze enable	Binary src	-	-	1 = 1
40.39	Set 1 deadband range	Real	0200000.0	-	10 = 1
40.40	Set 1 deadband delay	Real	0.0 3600.0	s	10 = 1 s
40.43	Set 1 sleep level	Real	0.0200000.0	-	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	0.0200000.0	PID customer units	10 = 1 PID customer unit
40.47	Set 1 wake-up deviation	Real	-200000.00200000.00	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
40.50	Set 1 tracking ref selection	Analog src	-	-	1 = 1
40.51	Set 1 trim mode	List	-	-	1 = 1
40.52	Set 1 trim selection	List	-	-	1 = 1
40.53	Set 1 trimmed ref pointer	List	-	-	1 = 1
40.54	Set 1 trim mix	Real	0.000 1.000	-	1000 = 1
40.55	Set 1 trim adjust	Real	-100.000 100.000	-	1000 = 1
40.56	Set 1 trim source	List	-	-	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
40.60	Set 1 PID activation source	Binary src	-	-	1 = 1
40.61	Setpoint scaling actual	Real	-200000.00200000.00	-	100 = 1
40.62	PID internal setpoint actual	Real	-200000.00200000.00	PID customer units	100 = 1 PID customer unit
40.79	Set 1 units	List	-	-	1 = 1
40.80	Set 1 PID output min source	List	-	-	1 = 1

No.	Name	Туре	Range	Unit	FbEq32
40.81	Set 1 PID output max source	List	-	-	1 = 1
40.89	Set 1 setpoint multiplier	Real	-200000.00200000.00	-	100 = 1
40.90	Set 1 feedback multiplier	Real	-200000.00200000.00	-	100 = 1
40.91	Feedback data storage	Real	-327.68327.67	-	100 = 1
40.92	Setpoint data storage	Real	-327.68327.67	-	100 = 1
40.96	Process PID output %	Real	-100.00100.00	%	100 = 1
40.97	Process PID feedback %	Real	-100.00100.00	%	100 = 1
40.98	Process PID setpoint %	Real	-100.00100.00	%	100 = 1
40.99	Process PID deviation %	Real	-100.00100.00	%	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	-	-	1 = 1
41.11	Set 2 feedback filter time	Real	0.00030.000	s	1000 = 1 s
41.14	Set 2 setpoint scaling	Real	-200000.00200000.00	-	100 = 1
41.15	Set 2 output scaling	Real	-200000.00200000.00	-	100 = 1
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	-	-	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	-200000.00200000.00	PID customer unit	100 = 1 PID customer unit
41.22	Set 2 internal setpoint 2	Real	-200000.00200000.00	PID customer units	100 = 1 PID customer unit
41.23	Set 2 internal setpoint 3	Real	-200000.00200000.00	PID customer units	100 = 1 PID customer unit
41.24	Set 2 internal setpoint 0	Real	-200000.00200000.00	PID customer units	100 = 1 PID customer unit
41.26	Set 2 setpoint min	Real	-200000.00200000.00	PID customer units	100 = 1
41.27	Set 2 setpoint max	Real	-200000.00200000.00	PID customer units	100 = 1
41.28	Set 2 setpoint increase time	Real	0.01800.0	s	10 = 1 s
41.29	Set 2 setpoint decrease time	Real	0.01800.0	s	10 = 1 s

No.	Name	Туре	Range	Unit	FbEq32
41.30	Set 2 setpoint freeze enable	Binary	-	-	1 = 1
		src			
41.31	Set 2 deviation inversion	Binary src	-	-	1 = 1
41.32	Set 2 gain	Real	0.01100.00	-	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	-200000.00200000.00	-	10 = 1
41.37	Set 2 output max	Real	-200000.00200000.00	-	10 = 1
41.38	Set 2 output freeze enable	Binary src	-	-	1 = 1
41.39	Set 2 deadband range	Real	0200000.0	-	10 = 1
41.40	Set 2 deadband delay	Real	0.0 3600.0	S	10 = 1 s
41.43	Set 2 sleep level	Real	0.0200000.0	-	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	0.0200000.0	PID customer units	10 = 1 PID customer unit
41.47	Set 2 wake-up deviation	Real	-200000.00200000.00	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
41.51	Set 2 trim mode	List	•	-	1 = 1
41.52	Set 2 trim selection	List	-	-	1 = 1
41.53	Set 2 trimmed ref pointer	Analog src	-	-	1 = 1
41.54	Set 2 trim mix	Real	0.000 1.000	-	1000 = 1
41.55	Set 2 trim adjust	Real	-100.000 100.000	-	1000 = 1
41.56	Set 2 trim source	List	•	-	1 = 1
41.58	Set 2 increase prevention	Binary src	-	-	1 = 1
41.59	Set 2 decrease prevention	Binary src	-	-	1 = 1
41.60	Set 2 PID activation source	Binary src	-	-	1 = 1
41.79	Set 2 units	List	-	-	1 = 1
41.80	Set 2 PID output min source	List	-	-	1 = 1
41.81	Set 2 PID output max source	List	-	-	1 = 1
41.89	Set 2 setpoint multiplier	Real	-200000.00200000.00	-	100 = 1

No.	Name	Type	Range	Unit	FbEq32
41.90	Set 2 feedback multiplier	Real	-200000.00200000.00	-	100 = 1
43 Brak	e chopper				
43.01	Braking resistor temperature	Real	0.0120.0	%	10 = 1%
43.06	Brake chopper function	List	-	-	1 = 1
43.07	Brake chopper run enable	Binary src	-	-	1 = 1
43.08	Brake resistor thermal to	Real	010000	s	1 = 1 s
43.09	Brake resistor Pmax cont	Real	0.0010000.00	kW	100 = 1 kW
43.10	Brake resistance	Real	0.01000.0	Ohm	10 = 1 ohm
43.11	Brake resistor fault limit	Real	0150	%	1 = 1%
43.12	Brake resistor warning limit	Real	0150	%	1 = 1%
44 Mech	nanical brake control				
44.01	Brake control status	PB	0000hFFFFh	-	1 = 1
44.06	Brake control enable	Binary src	-	-	1 = 1
44.08	Brake open delay	Real	0.005.00	s	100 = 1 s
44.13	Brake close delay	Real	0.0060.00	s	100 = 1 s
44.14	Brake close level	Real	0.001000.00	rpm	100 = 1 rpm
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	0.0214748368.0	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
45.09	CO2 reduction in tons	Real	0.0999.9	metric ton	10 = 1 metric ton
45.10	Total saved CO2	Real	0.0214748304.0	metric ton	10 = 1 metric ton
45.11	Energy optimizer	List	-	-	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

No.	Name	Туре	Range	Unit	FbEq32
45.21	Energy calculations reset	List	-	-	1 = 1
45.24	Hourly peak power value	Real	-3000.00 3000.00	kW	1 = 1 kW
45.25	Hourly peak power time	Real			N/A
45.26	Hourly total energy (resettable)	Real	-3000.00 3000.00	kWh	1 = 1 kWh
45.27	Daily peak power value (resettable)	Real	-3000.00 3000.00	kW	1 = 1 kW
45.28	Daily peak power time	Real			N/A
45.29	Daily total energy (resettable)	Real	-30000.00 30000.00	kWh	1 = 1 kWh
45.30	Last day total energy	Real	-30000.00 30000.00	kWh	1 = 1 kWh
45.31	Monthly peak power value (resettable)	Real	-3000.00 3000.00	kW	1 = 1 kW
45.32	Monthly peak power date	Real	1/1/19806/5/2159		N/A
45.33	Monthly peak power time	Real	-		N/A
45.34	Monthly total energy (resettable)	Real	-1000000.00 1000000.00	kWh	1 = 1 kWh
45.35	Last month total energy	Real	-1000000.00 1000000.00	kWh	1 = 1 kWh
45.36	Lifetime peak power value	Real	-3000.00 3000.00	kW	1 = 1 kW
45.37	Lifetime peak power date	Real	1/1/19806/5/2159		N/A
45.38	Lifetime peak power time	Real	-		N/A
46 Moni	toring/scaling settings				
46.01	Speed scaling	Real	0.1030000.00	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	-	10 = 1
46.05	Current scaling	Real	030000	Α	1 = 1 A
46.06	Speed ref zero scaling	Real	0.00 30000.00	rpm	100 = 1 rpm
46.07	Frequency ref zero scaling	Real	0.001000.00	Hz	100 = 1 Hz
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
46.23	At torque hysteresis	Real	0.0300.0	%	1 = 1%
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
46.43	Power decimals	Real	03	-	1 = 1
46.44	Current decimals	Real	03	-	1 = 1

No.	Name	Туре	Range	Unit	FbEq32
47 Data	storage	l.		L	L
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
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	l port communication				
49.01	Node ID number	Real	132	-	1 = 1
49.03	Baud rate	List	-	-	1 = 1
49.04	Communication loss time	Real	0.33000.0	s	10 = 1 s
49.05	Communication loss action	List	-	-	1 = 1
49.06	Refresh settings	List	-	-	1 = 1
49.19	Basic panel home view 1	List	-	-	1 = 1
49.20	Basic panel home view 2	List	-	-	1 = 1
49.21	Basic panel home view 3	List	-	-	1 = 1
49.219	Basic panel home view 4	List	-	-	1 = 1
49.220	Basic panel home view 5	List	-	-	1 = 1
49.221	Basic panel home view 6	List	-	-	1 = 1
50 Field	bus adapter (FBA)				
50.01	FBA A enable	List	-	-	1 = 1
50.02	FBA A comm loss func	List	-	-	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	-	-	1 = 1
50.05	FBA A ref2 type	List	-	-	1 = 1
50.06	FBA A SW sel	List	-	-	1 = 1
50.07	FBA A actual 1 type	List	-	-	1 = 1
50.08	FBA A actual 2 type	List	-	-	1 = 1
50.09	FBA A SW transparent source	Analog src	-	-	1 = 1

No.	Name	Туре	Range	Unit	FbEq32
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	-	-	1 = 1
50.13	FBA A control word	Data	00000000hFFFFFFFh	-	1 = 1
50.14	FBAA reference 1	Real	-2147483648 2147483647	-	1 = 1
50.15	FBAA 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
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	-	-	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	FBAA mapping file ver	Real	065535	-	1 = 1
51.31	D2FBA A comm status	List	-	-	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			•	
58.01	Protocol enable	List	-	-	1 = 1
58.02	Protocol ID	Real	0000hFFFFh	-	1 = 1
58.03	Node address	Real	0255	-	1 = 1
58.04	Baud rate	List	-	-	1 = 1
58.05	Parity	List	-	-	1 = 1
58.06	Communication control	List	-	-	1 = 1
58.07	Communication diagnostics	PB	0000hFFFFh	-	1 = 1

No.	Name	Туре	Range	Unit	FbEq32
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	-	-	1 = 1
58.15	Communication loss mode	List	-	-	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	-	-	1 = 1
58.26	EFB ref1 type	List	-	-	1 = 1
58.27	EFB ref2 type	List	-	-	1 = 1
58.28	EFB act1 type	List	-	-	1 = 1
58.29	EFB act2 type	List	-	-	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	-	-	1 = 1
58.34	Word order	List	-	-	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	-200000.00200000.00	%	100 = 1 PID customer unit
71.02	Feedback act value	Real	-200000.00200000.00	PID customer units	100 = 1 PID customer unit

No.	Name	Type	Range	Unit	FbEq32
71.03	Setpoint act value	Real	-200000.00200000.00	PID customer	100 = 1 PID customer unit
71.04	Deviation act value	Real	-200000.00200000.00	units PID customer units	100 = 1 PID customer unit
71.06	PID status word	PB	0000hFFFFh	-	1 = 1
71.07	PID operation mode	List	-	-	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	-200000.00200000.00	-	100 = 1
71.15	Output scaling	Real	-200000.00200000.00	-	100 = 1
71.16	Setpoint 1 source	Analog src	-	-	1 = 1
71.19	Internal setpoint sel1	Binary src	-	-	1 = 1
71.20	Internal setpoint sel2	Binary src	-	-	1 = 1
71.21	Internal setpoint 1	Real	-200000.00200000.00	PID customer units	100 = 1 PID customer unit
71.22	Internal setpoint 2	Real	-200000.00200000.00	PID customer units	100 = 1 PID customer unit
71.23	Internal setpoint 3	Real	-200000.00200000.00	PID customer units	100 = 1 PID customer unit
71.26	Setpoint min	Real	-200000.00200000.00	-	100 = 1
71.27	Setpoint max	Real	-200000.00200000.00	-	100 = 1
71.31	Deviation inversion	Binary src	-	-	1 = 1
71.32	Gain	Real	0.01100.00	-	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	1000 = 1 s
71.36	Output min	Real	-200000.00200000.00	-	10 = 1
71.37	Output max	Real	-200000.00200000.00	-	10 = 1
71.38	Output freeze enable	Binary src	-	-	1 = 1
71.39	Deadband range	Real	0.0200000.0	-	10 = 1
71.40	Deadband delay	Real	0.03600.0	s	1000 = 1 s
71.58	Increase prevention	Binary src	-	-	1 = 1
71.59	Decrease prevention	Binary src	-	-	1 = 1

No.	Name	Type	Range	Unit	FbEq32
71.62	Internal setpoint actual	Real	-200000.00200000.00	PID customer units	100 = 1 PID customer unit
71.79	External PID units	List	-	-	1 = 1
76 PFC	configuration				
76.01	PFC status	PB	0000hFFFFh	-	1 = 1
76.02	Multipump system status	List	02, 100103, 200202, 300302, 400, 500, 600, 800801, 49	-	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
76.21	Multipump configuration	List	-	-	1 = 1
76.25	Number of motors	Real	16	-	1 = 1
76.26	Min number of motors allowed	Real	06	-	1 = 1
76.27	Max number of motors allowed	Real	16	-	1 = 1
76.30	Start point 1	Real	032767	rpm/Hz	1 = 1 unit
76.31	Start point 2	Real	032767	rpm/Hz	1 = 1 unit
76.32	Start point 3	Real	032767	rpm/Hz	1 = 1 unit
76.33	Start point 4	Real	032767	rpm/Hz	1 = 1 unit
76.34	Start point 5	Real	032767	rpm/Hz	1 = 1 unit
76.41	Stop point 1	Real	032767	rpm/Hz	1 = 1 unit
76.42	Stop point 2	Real	032767	rpm/Hz	1 = 1 unit
76.43	Stop point 3	Real	032767	rpm/Hz	1 = 1 unit
76.44	Stop point 4	Real	032767	rpm/Hz	1 = 1 unit
76.45	Stop point 5	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
76.70	PFC autochange	Binary src	-	-	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 = 1

No.	Name	Type	Range	Unit	FbEq32
76.81	PFC 1 interlock	Binary src	-	-	1 = 1
76.82	PFC 2 interlock	Binary src	-	-	1 = 1
76.83	PFC 3 interlock	Binary src	-	-	1 = 1
76.84	PFC 4 interlock	Binary src	-	-	1 = 1
76.85	PFC 5 interlock	Binary src	-	-	1 = 1
76.86	PFC 6 interlock	Binary src	-	-	1 = 1
76.95	Regulator bypass control	Binary src	-	-	1 = 1
77 PFC	maintenance and monitoring				
77.10	PFC runtime change	List	-	-	1 = 1
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
95 HW (configuration				
95.01	Supply voltage	List	-	-	1 = 1
95.02	Adaptive voltage limits	List	-	-	1 = 1
95.03	Estimated AC supply voltage	Real	065535	V	1 = 1 V
95.04	Control board supply	List	-	-	1 = 1
95.15	Special HW settings	PB	0000hFFFFh	-	1 = 1
95.20	HW options word 1	PB	0000hFFFFh	-	1 = 1
95.21	HW options word 2	PB	0000hFFFFh	-	1 = 1
95.200	Cooling fan mode	List	-	-	1 = 1
96 Syst	em				
96.01	Language	List	-	-	1 = 1
96.02	Pass code	Data	-	-	1 = 1
96.03	Access level status	PB	000b111b	-	1 = 1
96.04	Macro select	List	-	-	1 = 1
96.05	Macro active	List	-	-	1 = 1
96.06	Parameter restore	List	-	-	1 = 1
96.07	Parameter save manually	List	-	-	1 = 1
96.08	Control board boot	List	-	-	1 = 1
96.10	User set status	List	-	-	1 = 1
96.11	User set save/load	List	-	-	1 = 1

No.	Name	Туре	Range	Unit	FbEq32
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
96.20	Time sync primary source	List	-	-	1 = 1
96.51	Clear fault and event logger	Real	01	-	1 = 1
96.54	Checksum action	Binary src	-	-	1 = 1
96.55	Checksum control word	Binary src	-		
96.68	Actual checksumA	Binary src	-	-	1 = 1
96.69	Actual checksumB	Binary src	-	-	1 = 1
96.70	Disable adaptive program	List	01	-	1 = 1
96.71	Approved checksum A	Binary src	-	-	1 = 1
96.72	Approved checksum B	Binary src	-	-	1 = 1
96.78	550 compatibility mode	List	-	-	1 = 1
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
97 Moto	r control				
97.01	Switching frequency reference	List	-	-	1 = 1
97.02	Minimum switching frequency	List	-	-	1 = 1
97.03	Slip gain	Real	0200	%	1 = 1%
97.04	Voltage reserve	Real	-450	%	1 = 1%
97.05	Flux braking	List	-	-	1 = 1
97.08	Optimizer minimum torque	Real	0.0 1600.0	%	10 = 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		-	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	-	-	1 = 1
97.49	Slip gain for scalar	Real	0200	%	1 = 1%
97.94	IR comp max frequency	Real	1.0200.0	%	10 = 1%
98 User	motor parameters				
98.01	User motor model mode	List	-	-	1 = 1
98.02	Rs user	Real	0.00000.50000	p.u.	100000 = 1 p.u.

No.	Name	Type	Range	Unit	FbEq32
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	0.00100000.01	mH	100 = 1 mH
98.12	SigmaL user SI	Real	0.00100000.01	mH	100 = 1 mH
98.13	Ld user SI	Real	0.00100000.01	mH	100 = 1 mH
98.14	Lq user SI	Real	0.00100000.01	mH	100 = 1 mH
99 Moto	r data				
99.03	Motor type	List	-	-	1 = 1
99.04	Motor control mode	List	-	-	1 = 1
99.06	Motor nominal current	Real	0.005.20	Α	10 = 1 A
99.07	Motor nominal voltage	Real	69.2830.0	V	10 = 1 V
99.08	Motor nominal frequency	Real	0.0 500.0	Hz	10 = 1 Hz
99.09	Motor nominal speed	Real	0 30000	rpm	1 = 1 rpm
99.10	Motor nominal power	Real	0.0010000.00 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	-	-	1 = 1
99.14	Last ID run performed	List	-	-	1 = 1
99.15	Motor polepairs calculated	Real	01000	-	1 = 1
99.16	Motor phase order	List	-	-	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 trip the drive and it will continue to operate the motor.

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

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

Pure events

In addition to warnings and faults, there are pure events that are only recorded in the event log of the drive. The codes of these events are included in the *Warning messages* table on page (454).

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 453.

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 each stored fault, the panel shows the fault code, time and values of nine parameters (actual signals and status words) stored at the time of the fault. The values for the latest fault are in parameters 05.80...05.88.

For active faults and warnings, see

- Menu Diagnostics Active faults
- Menu Diagnostics Active warnings
- Options Active faults
- Options Active warnings
- parameters in group 04 Warnings and faults (page 185).

For previously occurred faults and warnings, see

- Menu Diagnostics Fault & event log
- parameters in group 04 Warnings and faults (page 185).

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), 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 Electrical installation, section Checking the insulation of the assembly in the Hardware manual of the drive. If an earth fault is found, fix or change the motor cable and/or motor. If no earth fault can be detected, contact your local ABB representative.

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 <i>95.01 Supply voltage</i>). 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 brake chopper or resistor. Check the supply voltage. If the problem persists, contact your loca ABB representative.
АЗАА	DC not charged	The voltage of the intermediate DC circuit has not yet risen to operating level.	
A490	Incorrect temperature sensor setup	Temperature cannot be supervised due to incorrect adapter setup.	Check the settings of temperature source parameters 35.11 and 35.21.
A491	External temperature 1 (Editable message text)	Measured temperature 1 has exceeded warning limit.	Check the value of parameter 35.02 Measured temperature 1. Check the cooling of the motor (or other equipment whose temperature is being measured). Check the value of 35.13 Temperature 1 warning limit.
A492	External temperature 2 (Editable message text)	Measured temperature 2 has exceeded warning limit.	Check the value of parameter 35.03 Measured temperature 2. Check the cooling of the motor (or other equipment whose temperature is being measured). Check the value of 35.23 Temperature 2 warning limit.
A4A0	Control board temperature	Control unit temperature is too high.	Check the auxiliary code. See actions for each code below.
	(none)	Temperature above warning limit	Check ambient conditions. Check air flow and fan operation. Check heatsink fins for dust pick-up.
	1	Thermistor broken	Contact an ABB service representative for control unit replacement.

Code (hex)	Warning / Aux. code	Cause	What to do
A4A1	IGBT overtemperature	Estimated drive IGBT temperature is excessive.	Check ambient conditions. Check air flow and fan operation. Check heatsink fins for dust pick-up. Check motor power against drive power.
A4A9	Cooling	Drive module temperature is excessive.	Check ambient temperature. If it exceeds 40 °C/104 °F or if it exceeds 50 °C /122 °F, 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.
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. (1: U-phase, 2: V-phase, 3: W-phase, 4: INT board, 6: Air inlet (sensor connected to INT board X10), 7: PCB compartment fan or power supply board, FA: Ambient temperature).
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.
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 295). 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.
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.

Code (hex)	Warning / Aux. code	Cause	What to do
A5F0	Charging feedback	Charging feedback signal missing.	Check the feedback signal coming from the charging system.
A682	Flash erase speed exceeded	The flash memory (in the memory unit) has been erased too frequently, compromising the lifetime of the memory.	Avoid forcing unnecessary parameter saves by parameter 96.07 or cyclic parameter writes (such as user logger triggering through parameters). Check the auxiliary code (format XYYY YZZZ). "X" specifies the source of warning (1: generic flash erase supervision). "ZZZ" specifies the flash subsector number that generated the warning.
A6A4	Motor nominal value	The motor parameters are set incorrectly.	Check the auxiliary code. See actions for each code below.
		The drive is not dimensioned correctly.	
	0001	Slip frequency is too small.	Check the settings of the motor
	0002	Synchronous and nominal speeds differ too much.	configuration parameters in groups 98 and 99. Check that the drive is sized correctly for
	0003	Nominal speed is higher than synchronous speed with 1 pole pair.	the motor.
	0004	Nominal current is outside limits	
	0005	Nominal voltage is outside limits.	
	0006	Nominal power is higher than apparent power.	
	0007	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.
A6A7	System time not set	System time is not set. Timed functions cannot be used and fault log dates are not correct.	Set the system time manually or connect the panel to the drive to synchronize the clock. If basic panel is used, synchronize the clock through the EFB or a fieldbus module. Set parameter 34.10 Timed functions enable to Disabled to disable the timed functions if they are not used.
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 175).

Code (hex)	Warning / Aux. code	Cause	What to do
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 175).
A6D1	FBA A parameter conflict	The drive does not have a functionality requested by a PLC, or requested functionality has not been activated.	Check PLC programming. Check settings of parameter groups 50 Fieldbus adapter (FBA).
A6E5	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 unit reboot (either by cycling the power or through parameter 96.08 Control board boot) is required to validate any changes in the hardware settings.
A6E6	ULC configuration	User load curve configuration error.	Check the auxiliary code (format XXXX ZZZZ). "ZZZZ" indicates the problem (see actions for each code below).
	0000	Speed points inconsistent.	Check that each speed point (parameters 37.1137.15) has a higher value than the previous point.
	0001	Frequency points inconsistent.	Check that each frequency point (37.2037.16) has a higher value than the previous point.
	0002	Underload point above overload point. Overload point below underload point.	Check that each overload point (37.3137.35) has a higher value than the corresponding underload point (37.2137.25).
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.
A783	Motor overload	Motor current is too high.	Check for overloaded motor. Adjust the parameters used for the motor overload function (35.5135.53) and 35.5535.56.
A792	Brake resistor wiring	Brake resistor short circuit or brake chopper control fault. For drive frames R6 or larger.	Check brake chopper and brake resistor connection. Ensure brake resistor is not damaged.
A793	BR excess temperature	Brake resistor temperature has exceeded warning limit defined by parameter 43.12 Brake resistor warning limit.	Stop drive. Let resistor cool down. Check resistor overload protection function settings (parameter group 43 Brake chopper). Check warning limit setting, parameter 43.12 Brake resistor warning limit. Check that the resistor has been dimensioned correctly. Check that braking cycle meets allowed limits.

Code (hex)	Warning / Aux. code	Cause	What to do
A794	BR data	Brake resistor data has not been given.	One or more of the resistor data settings (parameters 43.0843.10) is incorrect. The parameter is specified by the auxiliary code.
	0000 0001	Resistance value too low.	Check value of 43.10.
	0000 0002	Thermal time constant not given.	Check value of 43.08.
	0000 0003	Maximum continuous power not given.	Check value of 43.09.
A79C	BC IGBT excess temperature	Brake chopper IGBT temperature has exceeded internal warning limit.	Let chopper cool down. Check for excessive ambient temperature. Check for cooling fan failure. Check for obstructions in the air flow. Check the dimensioning and cooling of the cabinet. Check resistor overload protection function settings (parameters 43.0643.10). Check minimum allowed resistor value for the chopper being used. Check that braking cycle meets allowed limits. Check that drive supply AC voltage is not excessive.
A7A2	Mechanical brake opening failed	Status of mechanical brake acknowledgement is not as expected during brake open.	Check mechanical brake connection. Check mechanical brake settings in parameter group 44 Mechanical brake control. Check that acknowledgement signal matches the actual status of brake.
A7AB	Extension I/O configuration failure	I/O module is not connected to the device or parameterization conflict with connected I/O module.	Check that the I/O module is connected to the device. Check that no parameters are connected to non-existing I/O parameters.
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.

Code (hex)	Warning / Aux. code	Cause	What to do
A7EE	Panel loss Programmable warning: 49.05 Communication loss action	Control panel or PC tool selected as active control location for drive has ceased communicating.	Check PC tool or control panel connection. Check control panel connector. Check mounting platform if being used. Disconnect and reconnect the control panel.
A88F	Cooling fan	Maintenance timer limit exceeded.	Consider changing the cooling fan. Parameter 05.04 Fan on-time counter shows the running time of the cooling fan.
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 AI.
A8A1	RO life warning	The relay has changed states more than the recommended number of times.	Change the control unit or stop using the relay output.
	0001	Relay output 1	Change the control unit or stop using relay output 1.
	0002	Relay output 2	Change the control unit or stop using relay output 2.
	0003	Relay output 3	Change the control unit or stop using relay output 3.
A8A2	RO toggle warning	The relay output is changing states faster than recommended, e.g. 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	ABB 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	ABB 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	ABB 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).

Code (hex)	Warning / Aux. code	Cause	What to do
A8B3	ABB 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	ABB 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	ABB 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).
A8BE	ULC overload warning Programmable fault: 37.03 ULC overload actions	Selected signal has exceeded the user overload curve.	Check for any operating conditions increasing the monitored signal (for example, the loading of the motor if the torque or current is being monitored). Check the definition of the load curve (parameter group 37 User load curve).
A8BF	ULC underload warning Programmable fault: 37.04 ULC underload actions	Selected signal has fallen below the user underload curve.	Check for any operating conditions decreasing the monitored signal (for example, loss of load if the torque or current is being monitored). Check the definition of the load curve (parameter group 37 User load curve).
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.

Code (hex)	Warning / Aux. code	Cause	What to do
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.
AF90	Speed controller autotuning	The speed controller autotune routine did not complete successfully.	Check the auxiliary code (format XXXX YYYY). "YYYY" indicates the problem (see actions for each code below).
	0000	The drive was stopped before the autotune routine finished.	Repeat autotune until successful.
	0001	The drive was started but was not ready to follow the autotune command.	Make sure the prerequisites of the autotune run are fulfilled. See section Before activating the autotune routine (page 125).
	0002	Required torque reference could not be reached before the drive reached maximum speed.	Decrease torque step (parameter 25.38) or increase speed step (25.39).
	0003	Motor could not accelerate/decelerate to maximum/minimum speed.	Increase torque step (parameter 25.38) or decrease speed step (25.39).
	0005	Motor could not decelerate with full autotune torque.	Decrease torque step (parameter 25.38) or speed step (25.39).
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.
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.
AFEB	Run enable missing	No run enable signal is received.	Check setting of parameter 20.12 Run enable 1 source. Switch signal on (e.g. in the fieldbus Control Word) or check wiring of selected source.
AFED	Enable to rotate	Signal to rotate has not been received within a fixed time delay of 120 s.	Switch enable to rotate signal on (e.g. in digital inputs). Check the setting of (and source selected by) parameter 20.22 Enable to rotate.
AFF6	Identification run	Motor ID run will occur at next start.	Informative warning.

Code (hex)	Warning / Aux. code	Cause	What to do
AFF8	Motor heating active	Pre-heating is being performed	Informative warning. Motor pre-heating is active. Current specified by parameter 21.16 Pre-heating current is being passed through the motor.
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.	Informative warning. 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 295).
D501	No more available PFC motors	No more PFC motors can be started because they can be interlocked or in the Hand mode.	Check that there are no interlocked PFC motors, see parameters: 76.8176.84. If all motors are in use, the PFC system is not adequately dimensioned to handle the demand.
D502	All motors interlocked	All the motors in the PFC system are interlocked.	Check that there are no interlocked PFC motors, see parameters 76.8176.84.
D503	VSD controlled PFC motor interlocked	The motor connected to the drive is interlocked (unavailable).	Motor connected to the drive is interlocked and thus cannot be started. Remove the corresponding interlock to start the drive controlled PFC motor. See parameters 76.8176.84.

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.
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.
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	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.

Code (hex)	Fault / Aux. code	Cause	What to do
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 brake chopper and resistor (if present). Check deceleration time. Use coast-to-stop function (if applicable). Retrofit drive with brake chopper and brake resistor. Check that the brake resistor is dimensioned properly and the resistance is between acceptable range for the drive.
3220	DC link undervoltage	Intermediate circuit DC voltage is not sufficient because of a missing supply phase, blown fuse or fault in the rectifier bridge.	Check supply cabling, fuses and switchgear.
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 unit temperature is too high.	Check proper cooling of the drive. Check the auxiliary cooling fan.
4210	IGBT overtemperature	Estimated drive IGBT temperature is excessive.	Check ambient conditions. Check air flow and fan operation. Check heatsink fins for dust pick-up. Check motor power against drive power.
4290	Cooling	Drive module temperature is excessive.	Check ambient temperature. If it exceeds 40 °C/104 °F or if it exceeds 50 °C /122 °F, 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.	See A4B0 Excess temperature (page 456).

Code (hex)	Fault / Aux. code	Cause	What to do
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).
5090	STO hardware failure	STO hardware diagnostics has detected hardware failure.	Contact your local ABB representative for hardware replacement.
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 295). 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 e.g. 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.
5089	SMT circuit malfunction	Safe motor temperature fault is generated and STO event/fault/warning is not generated. Note: If only one STO channel is opened, fault 5090 STO hardware failure is generated.	Check connection between the relay output of the module and the STO terminal.
5098	I/O communication loss	Communication failure to standard I/O.	Try resetting the fault or cycle the power to the drive.
50A0	Fan	Cooling fan stuck or disconnected.	Check fan operation and connection. Replace fan if faulty.
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.
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.

Code (hex)	Fault / Aux. code	Cause	What to do
5697	Charging feedback	Charging feedback signal missing.	Check the feedback signal coming from the charging system
5698	Unknown PU fault	The power unit logic has generated a fault which is not known by the software.	Check the logic and software compatibility.
6181	FPGA version incompatible	Firmware and FPGA versions are incompatible.	Reboot the control unit (using parameter 96.08 Control board boot) or by cycling power. If the problem persists, contact your local ABB representative
6306	FBA A mapping file	Fieldbus adapter A mapping file read error.	Contact your local ABB representative.
6481	Task overload	Internal fault.	Reboot the control unit (using parameter 96.08 Control board boot) or by cycling power. If the problem persists, contact your local ABB representative
6487	Stack overflow	Internal fault.	Reboot the control unit (using parameter 96.08 Control board boot) or by cycling power. If the problem persists, contact your local ABB representative
64A1	Internal file load	File read error.	Reboot the control unit (using parameter 96.08 Control board boot) or by cycling power. If the problem persists, contact your local ABB representative
64A4	Rating ID fault	Rating ID load error.	Contact your local ABB representative.
64A6	Adaptive program	Error running the adaptive program.	Check the auxiliary code (format XXYY ZZZZ). "XX" specifies the number of the state (00=base program) and "YY" specifies the number of the function block (0000=generic error). "ZZZZ" indicates the problem.
	000A	Program corrupted or block non-existent	Restore the template program or download the program to the drive.
	000C	Required block input missing	Check the inputs of the block.
	000E	Program corrupted or block non-existent	Restore the template program or download the program to the drive.
	0011	Program too large.	Remove blocks until the error stops.
	0012	Program is empty.	Correct the program and download it to the drive.
	001C	A non-existing parameter or block is used in the program.	Edit the program to correct the parameter reference, or to use an existing block.
	001D	Parameter type invalid for selected pin.	Edit the program to correct the parameter reference.
	001E	Output to parameter failed because the parameter was write-protected.	Check the parameter reference in the program. Check for other sources affecting the target parameter.
	0023 0024	Program file incompatible with current firmware version.	Adapt the program to current block library and firmware version.

Code (hex)	Fault / Aux. code	Cause	What to do
	Other	_	Contact your local ABB representative, quoting the auxiliary code.
64B1	Internal SSW fault	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.
64B2	User set fault	Loading of user parameter set failed because requested set does not exist set is not compatible with control program drive was switched off during loading.	Ensure that a valid user parameter set exists. Reload if uncertain.
64B3	Macro parameterization error	Macro parameterization failed, eg. because parameter default value that cannot be changed has been attempted to write.	
64E1	Kernel overload	Operating system error.	Reboot the control unit (using parameter 96.08 Control board boot) or by cycling power. If the problem persists, contact your local ABB representative.
64B1	Fault reset	A fault has been reset. The cause of the fault no longer exists and the fault reset has been requested and completed.	Informative fault.
6581	Parameter system	Parameter load or save failed.	Try forcing a save using parameter 96.07 Parameter save manually. Retry.
6591	Backup/Restore timeout	During backup creating or restoring operation a panel or PC-tool has failed to communicate with the drive as part this operation.	Check panel or PC-tool communication and if it is still in backup or restore state.
65A1	FBA A parameter conflict	The drive does not have a functionality requested by PLC, or requested functionality has not been activated.	Check PLC programming. Check settings of parameter groups 50 Fieldbus adapter (FBA) and 51 FBA A settings.
6681	EFB comm loss Programmable fault: 58.14 Communication loss action	Communication break in embedded fieldbus (EFB) communication.	Check the status of the fieldbus master (online/offline/error etc.). Check cable connections to the EIA-485/X5 terminals 29, 30 and 31 on the control unit.
6682	EFB config file	Embedded fieldbus (EFB) configuration file could not be read.	Contact your local ABB representative.
6683	EFB invalid parameterization	Embedded fieldbus (EFB) parameter settings inconsistent or not compatible with selected protocol.	Check the settings in parameter group 58 Embedded fieldbus.

Code (hex)	Fault / Aux. code	Cause	What to do
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.
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.
7085	Incompatible option module	Fieldbus option module not supported.	Replace the module with a supported type.
7086	I/O module AI Overvoltage	Overvoltage detected in Al. Al is changed to voltage mode. Al will return automatically back to mA mode when the Al signal level is in accepted limits.	Check Al signal levels.
7121	Motor stall Programmable fault: 31.24 Stall function Motor is operating in stall region because of e.g. excessive load or insufficient motor power.		Check motor load and drive ratings. Check fault function parameters.
7122	Motor overload Motor current is too high.		Check for overloaded motor. Adjust the parameters used for the motor overload function (35.5135.53) and 35.5535.56.
7183	BR excess temperature	Brake resistor temperature has exceeded fault limit defined by parameter 43.11 Brake resistor fault limit.	Stop drive. Let resistor cool down. Check resistor overload protection function settings (parameter group 43 Brake chopper). Check fault limit setting, parameter 43.11 Brake resistor fault limit. Check that braking cycle meets allowed limits.

Code (hex)	Fault / Aux. code	Cause	What to do
7192	BC IGBT excess temperature	Brake chopper IGBT temperature has exceeded internal fault limit.	Let chopper cool down. Check for excessive ambient temperature. Check for cooling fan failure. Check for obstructions in the air flow. Check resistor overload protection function settings (parameter group 43 Brake chopper). Check that braking cycle meets allowed limits. Check that drive supply AC voltage is not excessive.
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 need for brake chopper and resistor(s).
73B0	Emergency ramp failed	Emergency stop did not finish within expected time.	Check the predefined ramp times (23.1123.15 for mode Off1, 23.23 for mode Off3).
73F0	Overfrequency	Maximum allowed output frequency exceeded.	Check the auxiliary code.
	0xFA	Motor is turning faster than the highest allowed frequency due to incorrectly set minimum/maximum frequency or the motor rushes because of too high supply voltage or incorrect supply voltage selection in parameter 95.01 Supply voltage.	Check minimum/maximum frequency settings, parameters 30.13 Minimum frequency and 30.14 Maximum frequency. Check used supply voltage and voltage selection parameter 95.01 Supply voltage.
	Other	-	Contact your local ABB representative, quoting the auxiliary code.
7510	FBA A communication Programmable fault: 50.02 FBA A comm loss func	Cyclical communication between drive and fieldbus adapter module A or between PLC and fieldbus adapter module A is lost.	Check status of fieldbus communication. See user documentation of fieldbus interface. Check settings of parameter groups 50 Fieldbus adapter (FBA), 51 FBA A settings, 52 FBA A data in and 53 FBA A data out. Check cable connections. Check if communication master is able to communicate.
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.

Code (hex)	Fault / Aux. code	Cause	What to do
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/stop (page 295). Check the value of parameter 95.04 Control board supply.
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 • 30.12 Maximum speed • 99.07 Motor nominal voltage • 99.08 Motor nominal frequency • 99.09 Motor nominal speed. Make sure that • 30.12 > (0.55 × 99.09) > (0.50 × synchronous speed) • 30.11 ≤ 0, and • supply voltage ≥ (0.66 × 99.07).
	0003	Maximum torque limit too low.	Check settings of parameter 99.12 Motor nominal torque, and the torque limits in group 30 Limits. Make sure that the maximum torque limit in force is greater than 100%.

Code (hex)	Fault / Aux. code	Cause	What to do
	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.
	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.
FF63	STO diagnostics failure.	SW internal malfunction.	Reboot the control unit (using parameter 96.08 Control board boot) or by cycling power.
FF81	FB A force trip	A fault trip command has been received through fieldbus adapter A.	Check the fault information provided by the PLC.
FF8E	EFB force trip	A fault trip command has been received through the embedded fieldbus interface.	Check the fault information provided by the PLC.

Fieldbus control through the embedded fieldbus interface (EFB)

What this chapter contains

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

System overview

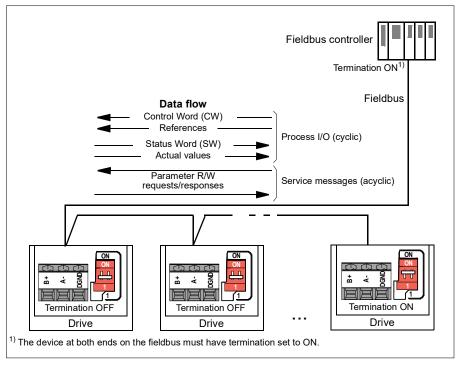
The drive can be connected to an external control system through a communication link using either a fieldbus adapter or the embedded fieldbus interface.

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

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

Connecting EIA-485 Modbus RTU terminal to the drive

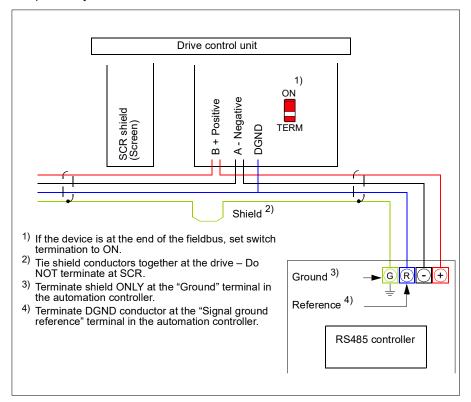
Connect the fieldbus to the EIA-485 Modbus RTU terminal on the RIIO-01 module which is attached on the control unit of the drive. The connection diagram is shown below.



Connecting the drive to the fieldbus

Connect terminal block on the control unit of the drive to the fieldbus. The connection diagram is shown below.

Use preferably three conductors and a shield for the connection.



Setting up the embedded fieldbus interface

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

	· · · · · · · · · · · · · · · · · · ·				
Parameter		Setting for fieldbus control	Function/Information		
COMM	UNICATION INITIA	LIZATION			
58.01	Protocol enable	Modbus RTU	Initializes embedded fieldbus communication.		
EMBED	DDED MODBUS C	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 481).		
58.26 58.27	EFB ref1 type EFB ref2 type	Speed or frequency (default for 58.26), Transparent, General, Torque (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	ter	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 Embedded fieldbus commands		Selects fieldbus as the source for the start and stop commands when EXT1 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.

TORQUE REFERENCE SELECTION		
26.11 Torque ref1 source	EFB ref1	Selects a reference received through the embedded fieldbus interface as torque reference 1.
26.12 Torque ref2 source	EFB ref1	Selects a reference received through the embedded fieldbus interface as torque reference 2.

FREQUENCY REFERENCE 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

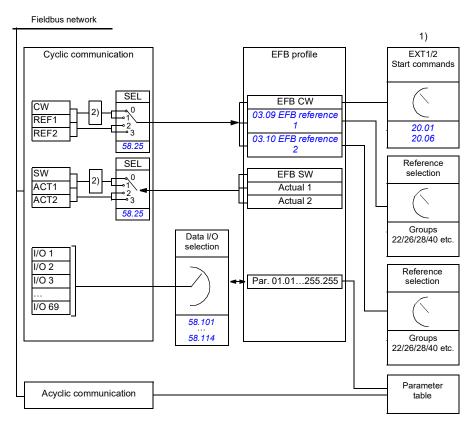
EFB references can be selected as the source at virtually any signal selector parameter by selecting *Other*, then either 03.09 EFB reference 1 or 03.10 EFB reference 2.

SYSTEM CONTROL INPUTS		
96.07 Parameter save manually	`	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.

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



- 1. See also other parameters which can be controlled through fieldbus.
- 2. Data conversion if parameter 58.25 Control profile is set to ABB Drives. See section About the control profiles (page 484).

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 484).

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 484).

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, torque 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 484).

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 484).

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

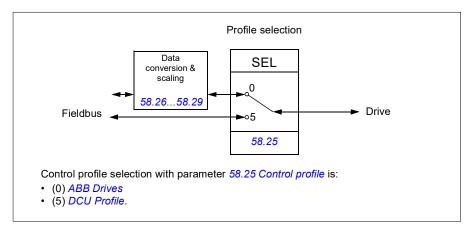
A control profile defines the rules for data transfer between the drive and the fieldbus master, for example:

- · 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.



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 492.

Bit	Name	Value	STATE/Description
0	OFF1_	1	Proceed to READY TO OPERATE.
	CONTROL		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 ENABLED.
	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. See also parameter <i>06.18 Start inhibit status word</i> (page 193).
		0	Inhibit operation. Proceed to OPERATION INHIBITED .
4	RAMP_OUT_ ZERO	1	Normal operation. Proceed to RAMP FUNCTION GENERATOR: OUTPUT ENABLED.
		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 ENABLED.
		0	Halt ramping (Ramp Function Generator output held).
6	RAMP_IN_	1	Normal operation. Proceed to OPERATING .
	ZERO		Note: This bit is effective only if the fieldbus interface is set as the source for this signal by drive parameters.
		0	Force Ramp Function Generator input to zero.

Bit	Name	Value	STATE/Description
7	RESET	0=>1	Fault reset if an active fault exists. Proceed to SWITCH-ON INHIBITED .
			Note: This bit is effective only if the fieldbus interface is set as the source for this signal by drive parameters.
		0	Continue normal operation.
8	JOGGING_1	1	Request running at Jogging 1 speed.
			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.
9	JOGGING_2	1	Request running at Jogging 2 speed.
			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.
10	REMOTE_ CMD	1	Fieldbus control d.
		0	Control Word <> 0 or Reference <> 0: Retain last Control Word and Reference.
			Control Word = 0 and Reference = 0: Fieldbus control d. Reference and deceleration/acceleration ramp are locked.
11	EXT_CTRL_ LOC	1	Select External Control Location EXT2. Effective if the control location is parameterized to be selected from the fieldbus.
		0	Select External Control Location EXT1. Effective if the control location is parameterized to be selected from the fieldbus.
12	USER_0		Writable control bits that can be combined with drive logic
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	STOP	1	Stop according to the Stop Mode parameter or the stop mode request bits (bits 79).
		0	(no op)
1	START	1	Start the drive.
		0	(no op)

Bit	Name	Value	State/Description
2	REVERSE	1	Reverse direction of motor rotation.
		0	Direction of motor rotation depends on the sign of reference:
			Positive reference: Forward
_			Negative reference: Reverse.
3	Reserved		
4	RESET	0=>1	Fault reset if an active fault exists.
		0	(no op)
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	Select ramp set 2 (Acceleration time 2 / Deceleration time 2) when parameter 23.11 Ramp set selection is set to EFB DCU CW bit 10.
		0	Select ramp set 1 (Acceleration time 1 / Deceleration time 1) when parameter 23.11 Ramp set selection is set to EFB DCU CW bit 10.
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 CK	1	Drive does not switch to local control mode (see parameter 19.17 Local control disable).
		0	Drive can switch between local and remote control modes.

Bit	Name	Value	State/Description
15	TORQ_LIM_PAIR _2	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)
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 492.

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 ENABLED.
		0	OPERATION INHIBITED.
			See also parameter 06.18 Start inhibit status word (page 193).
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		\exists
14	USER_3		

Bit	Name	Value	STATE/Description
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.

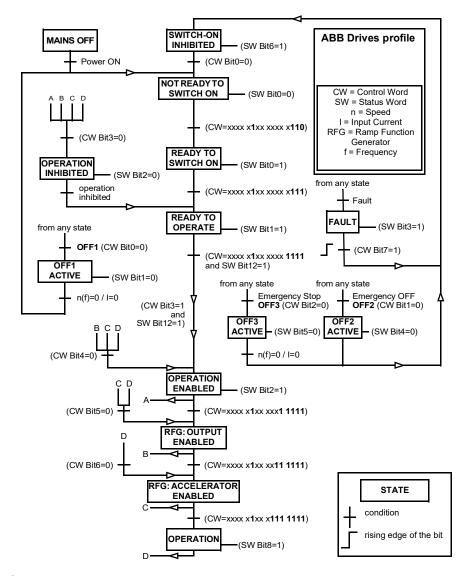
Bit	Name	Value	State/Description
0	READY	1	Drive is ready to receive the start command.
		0	Drive is not ready.
1	ENABLED	1	External run enable signal is active.
		0	External run enable signal is not active.
2	STARTED	1	Drive has received start command.
		0	Drive has not received start command.
3	RUNNING	1	Drive is modulating.
		0	Drive is not modulating.
4	ZERO_SPEED	1	Drive is at zero speed.
		0	Drive is not at zero speed.
5	ACCELERATING	1	Drive speed is increasing.
		0	Drive speed is not increasing.
6	DECELERATING	1	Drive speed is decreasing.
		0	Drive speed is not decreasing.
7	AT_SETPOINT	1	Drive is at setpoint.
		0	Drive is not at setpoint.
8	LIMIT	1	Drive operation is limited.
		0	Drive operation is not limited.
9	SUPERVISION	1	Actual value (speed, frequency or torque) is above a limit. Limit is set with parameters 46.3146.33.
		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.
İ	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.

Bit	Name	Value	State/Description
15	FAULT	1	Drive is faulted.
		0	Drive is not faulted.
16	ALARM	1	Warning/Alarm is active.
		0	No warning/alarm.
17	Reserved		
18	DIRLOCK	1	Direction lock is ON. (Direction change is locked out.)
		0	Direction lock is OFF.
19	LOCALLOCK	1	Local mode lock is ON. (Local mode is locked out.)
		0	Local mode lock is OFF.
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 has been granted to this channel.
		0	Control has not been granted to this channel.
27	REQ_REF	1	Reference has been granted to this channel.
		0	Reference has not been granted to this channel.
28 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 485 and Status Word for the ABB Drives profile on page 489.



Start sequence:

- 476h → NOT READY TO SWITCH ON
- If MSW bit 0 = 1 then
 - 477h → READY TO SWITCH ON (Stopped)
 - 47Fh → OPERATION (Running)

Stop sequence:

- 477h = Stop according to 21.03 Stop mode
- 47Eh = OFF1 ramp stop (Note: uninterruptable ramp stop)

Fault reset:

· Rising edge of MCW bit 7

Start after STO:

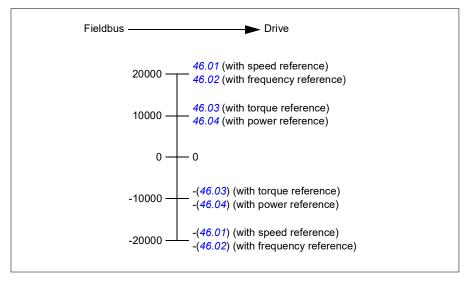
• If 31.22 STO indication run/stop is not Fault/ Fault, check that 06.18 Start inhibit status word, bit 7 STO = 0 before giving a start command.

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 376).



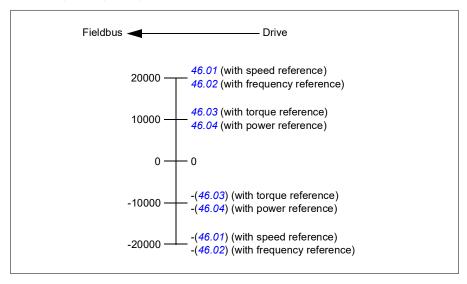
The scaled references are shown by parameters 03.09 EFB reference 1 and 03.10 EFB reference 2.

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 376).



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 485) and Control Word for the DCU Profile (page 486).	
	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 489) and Status Word for the DCU Profile (page 490).	
	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 registe 400090400100)</i> (page 504).	
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 0Eh Return Slave Message Count 0Fh Return Slave No Response Count 10h Return Slave NAK (negative acknowledge) Count 11h Return Slave Busy Count 12h Return Bus Character Overrun Count 14h Clear Overrun Counter and Flag
0Bh	Get Comm Event Counter	Returns a status word and an event count.
0Fh	Write Multiple Coils	Forces a sequence of coils (0X references) to 0 or 1.
10h	Write Multiple Registers	Writes the contents of a contiguous block of holding registers (4X references).
16h	Mask Write Register	Modifies the contents of a 4X register using a combination of an AND mask, an OR mask, and the register's current contents.
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, "ASCDx")
		02h: Major Minor Revision (combination of contents of parameters 07.05 Firmware version and 58.02 Protocol ID).
		03h: Vendor URL ("www.abb.com")
		04h: Product name: ("ACS480").

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 504.

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.

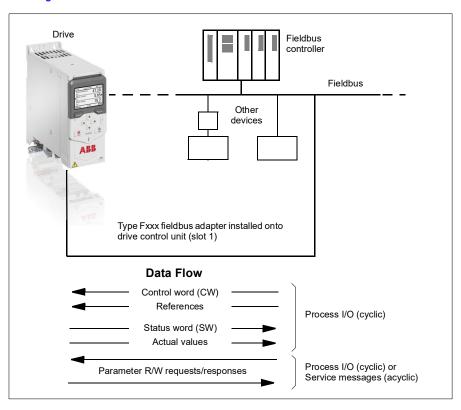
System overview

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

- CANopen (FCAN-01 adapter)
- · ControlNet (FCNA-01 adapter)
- DeviceNetTM (FDNA-01 adapter)
- Ethernet POWERLINK (FEPL-02 adapter)
- EtherCAT (FECA-01 adapter)
- EtherNet/IPTM (FENA-21 adapter)
- Modbus/TCP (FMBT-21, FENA-21 adapter)
- PROFINET IO (FENA-21 adapter)
- PROFIBUS DP (FPBA-01 adapter)

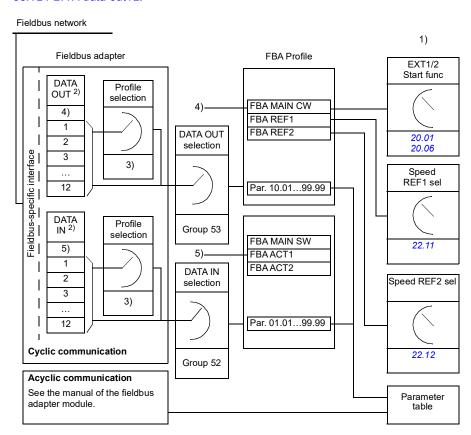
Note: The text and examples in this chapter describe the configuration of one fieldbus adapter (FBAA) by parameters 50.01...50.18 and parameter groups 51 FBA A settings...53 FBA A data out.



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.

For the ABB Drives communication profile, the contents of the Control word and the Status word are detailed on pages 511 and 513 respectively. The drive states are presented in the state diagram (page 514). For other fieldbus-specific communication profiles, see the manual of the fieldbus adapter.

The contents of the Control word and the Status word are detailed on pages 511 and 513 respectively. The drive states are presented in the state diagram (page 514).

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, 26 Torque reference chain and 28 Frequency reference chain.

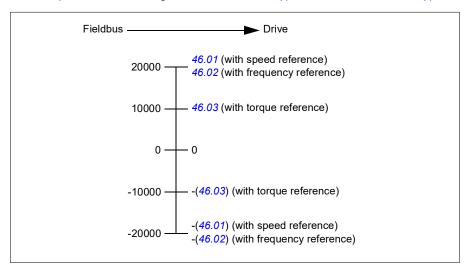
Debugging the network words

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

Note: The scalings described below are for the ABB Drives communication profile. Fieldbus-specific communication profiles may use different scalings. For more information, see the manual of the fieldbus adapter.

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.

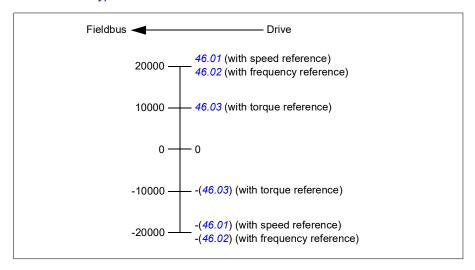
Debugging the network words

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

Note: The scalings described below are for the ABB Drives communication profile. Fieldbus-specific communication profiles may use different scalings. For more information, see the manual of the fieldbus adapter.

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 (ABB Drives profile)

The upper case boldface text refers to the states shown in the state diagram (page *514*).

Bit	Name	Value	STATE/Description	
0	Off1 control	1	Proceed to READY TO OPERATE.	
		0	Stop along currently active deceleration ramp. Proceed to OFF1 ACTIVE ; proceed to READY TO SWITCH ON unless other interlocks (OFF2, OFF3) are active.	
1	Off2 control	1	Continue operation (OFF2 inactive).	
		0	Emergency OFF, coast to a stop. Proceed to OFF2 ACTIVE, proceed to SWITCH-ON INHIBITED.	
2	Off3 control	1	Continue operation (OFF3 inactive).	
		0	Emergency stop, stop within time defined by drive parameter. Proceed to OFF3 ACTIVE; proceed to SWITCH-ON INHIBITED. MARNING: Ensure motor and driven machine can be	
			zing this stop mode.	
3	Run	1	Proceed to OPERATION ENABLED.	
			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.	
			See also parameter 06.18 Start inhibit status word (page 193).	
4	Ramp out zero	1	Normal operation. Proceed to RAMP FUNCTION GENERATOR: OUTPUT ENABLED.	
		0	Force Ramp function generator output to zero. The drive will immediately decelerate to zero speed (observing the torque limits).	
5	Ramp hold	1	ramp function. Proceed to RAMP FUNCTION GENERATOR: ACCELERATOR ENABLED.	
		0	Halt ramping (Ramp Function Generator output held).	
6	Ramp in zero	1	Normal operation. Proceed to OPERATING . Note: This bit is effective only if the fieldbus interface is set as the source for this signal by drive parameters.	
		0	Force Ramp function generator input to zero.	
7	Reset	0=>1	Fault reset if an active fault exists. Proceed to SWITCH-ON	
			INHIBITED.	
			Note: This bit is effective only if the fieldbus interface is set as the source of the reset signal by drive parameters.	
_		0	Continue normal operation.	
8	Inching 1	1	Accelerate to inching (jogging) setpoint 1. Notes:	
			• Bits 46 must be 0.	
			• See also section <i>Rush control</i> (page 150).	
		0	Inching (jogging) 1 disabled.	
9	Inching 2	1	Accelerate to inching (jogging) setpoint 2.	
			See notes at bit 8.	
		0	Inching (jogging) 2 disabled.	
10	Remote cmd	1	Fieldbus control enabled.	
		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.	

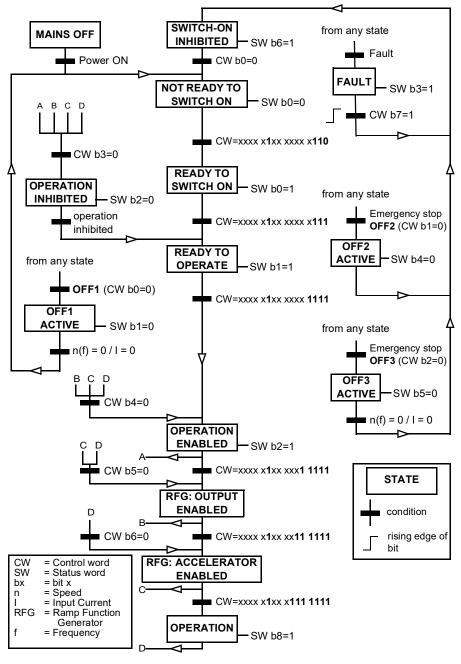
Bit	Name	Value	STATE/Description
12	User bit 0	1	
13	User bit 1	1	
14	User bit 2	1	
15	User bit 3	1 0	

Contents of the fieldbus Status word (ABB Drives profile)

The upper case boldface text refers to the states shown in the state diagram (page *514*).

Bit	Name	Value	STATE/Description	
0	Ready to switch	1	READY TO SWITCH ON.	
	ON	0	NOT READY TO SWITCH ON.	
1	Ready run	1	READY TO OPERATE.	
		0	OFF1 ACTIVE.	
2	Ready ref	1	OPERATION ENABLED.	
		0	OPERATION INHIBITED.	
			See also parameter 06.18 Start inhibit status word (page 193).	
3	Tripped	1	FAULT.	
		0	No fault.	
4	Off 2 inactive	1	OFF2 inactive.	
		0	OFF2 ACTIVE.	
5	Off 3 inactive	1	OFF3 inactive.	
		0	OFF3 ACTIVE.	
6	Switch-on inhibited	1	SWITCH-ON INHIBITED.	
		0	-	
7	Warning	1	Warning active.	
		0	No warning active.	
8	At setpoint	1	OPERATING. Actual value equals reference = is within tolerance	
			limits (see parameter 46.21).	
		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 (ABB Drives profile)



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. Select the macro ABB limited 2-wire from the primary settings or with parameter 96.04 Macro select. This removes the I/O settings that are as default with I/O module.
- 4. Enable the communication between the drive and the fieldbus adapter module with parameter 50.01 FBA A enable.
- 5. 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.
- 6. With 50.03 FBA A comm loss t out, define the time between communication break detection and the selected action.
- 7. 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.
- 8. 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.
- 9. 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.
- 10. Save the valid parameter values to permanent memory by setting parameter 96.07 Parameter save manually to Save.
- 11. Validate the settings made in parameter groups 51, 52 and 53 by setting parameter 51.27 FBA A par refresh to Configure.
- 12. 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) with ABB Drives profile

This example shows how to configure a basic speed control application that uses the ABB Drives communication profile with PPO Type 2. The start/stop commands and reference are according to the ABB Drives 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	: 1
In	Status word	Speed actual value	Motor cu	rrent	DC volta	ge

The table below gives the recommended drive parameter settings.

	Teconiniended drive	
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	1 = ABB Drives	Selects the Control word according to the ABB Drives 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)

Drive parameter	Setting for ACX580	Description
	drives	
53.03 FBA data out3	23.12 ²⁾	Acceleration time 1
53.05 FBA data out5	23.13 ²⁾	Deceleration time 1
51.27 FBA A par refresh	1 = Configure	Validates the configuration parameter settings.
19.12 Ext1 control mode	2 = Speed	Selects speed control as the control mode 1 for external control location EXT1.
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

Start sequence:

- 476h → NOT READY TO SWITCH ON
- If MSW bit 0 = 1 then
 - 477h → READY TO SWITCH ON (Stopped)
 - 47Fh → OPERATION (Running)

Stop sequence:

- 477h = Stop according to 21.03 Stop mode
- 47Eh = OFF1 ramp stop (Note: uninterruptable ramp stop)

Fault reset:

· Rising edge of MCW bit 7

Start after STO:

If 31.22 STO indication run/stop is not Fault/ Fault, check that 06.18 Start inhibit status word, bit 7 STO = 0 before giving a start command.

²⁾ Example

Automatic drive configuration for fieldbus control

The parameters set on module detection are shown in the table below. See also parameters 07.35 Drive configuration and 07.36 Drive configuration 2.

Option	10.24 RO1 source	10.27 RO2 source	10.30 RO3 source	20.01 Ext1 commands	20.03 Ext1 in1 source	20.04 Ext1 in2 source
BIO-01	-	-	-	2 (In1 Start, In2 Dir)	2 (DI1)	3 (DI2)
RIIO-01	-		-	2 (In1 Start, In2 Dir)	2 (DI1)	3 (DI2)
FENA-21	-	-	-	-	-	-
FECA-01	-	-	-	-	-	-
FPBA-01	-	-	-	-	-	-
FCAN-01	-	-	-	-	-	-
FSCA-01	-	-	-	-	-	-
FEIP-21	-	-	-	-	-	-
FMBT-21	-	-	-	-	-	-
FPNO-21	-	-	-	-	-	-
FEPL-02	-	-	-	-	-	-
FDNA-01	-	-	-	-	-	-
FCNA-01	-	-	-	-	-	-

Option	22.11 Ext1 speed ref1	22.22 Constant speed sel1	22.23 Constant speed sel2
BIO-01	1 (AI1 scaled)	4 (DI3)	5 (DI4)
RIIO-01	1 (AI1 scaled)	4 (DI3)	5 (DI4)
FENA-21	-	-	-
FECA-01	-	-	-
FPBA-01	-	-	-
FCAN-01	-	-	-
FSCA-01	-	-	-
FEIP-21	-	-	-
FMBT-21	-	-	-
FPNO-21	-	-	-
FEPL-02	-	-	-
FDNA-01	-	-	-
FCNA-01	-	-	-

Option	23.11 Ramp set selection	28.11 Ext1 frequency ref1	28.22 Constant frequency sel1	28.23 Constant frequency sel2
BIO-01	6 (DI5)	1 (AI1 scaled)	4 (DI3)	5 (DI4)

Option	23.11 Ramp set selection	28.11 Ext1 frequency ref1	28.22 Constant frequency sel1	28.23 Constant frequency sel2
RIIO-01	6 (DI5)	1 (AI1 scaled)	4 (DI3)	5 (DI4)
FENA-21	-	-	-	-
FECA-01	-	-	-	-
FPBA-01	-	-	-	-
FCAN-01	-	-	-	-
FSCA-01	-	-	-	-
FEIP-21	-	-	-	-
FMBT-21	-	-	-	-
FPNO-21	-	-	-	-
FEPL-02	-	-	-	-
FDNA-01	-	-	-	-
FCNA-01	-	-	-	-

Option	28.71 Freq ramp set selection	31.11 Fault reset selection
BIO-01	6 (DI5)	0
RIIO-01	6 (DI5)	0
FENA-21	-	-
FECA-01	-	-
FPBA-01	-	-
FCAN-01	-	-
FSCA-01	-	-
FEIP-21	-	-
FMBT-21	-	-
FPNO-21	-	-
FEPL-02	-	-
FDNA-01	-	-
FCNA-01	-	-

Option	50.01 FBA A enable	50.02 FBA A comm loss func	51.02 FBA A Par2	51.04 FBA A Par4
BIO-01	0	0	-	-
RIIO-01	0	0	-	-
FENA-21	1 (Enable)	0	11	0
FECA-01	1 (Enable)	0	0	-
FPBA-01	1 (Enable)	0	-	-
FCAN-01	1 (Enable)	0	-	-
FSCA-01	1 (Enable)	0	-	-
FEIP-21	1 (Enable)	0	100	0

Option	50.01 FBA A enable	50.02 FBA A comm loss func	51.02 FBA A Par2	51.04 FBA A Par4
FMBT-21	1 (Enable)	0	0	0
FPNO-21	1 (Enable)	0	11	0
FEPL-02	1 (Enable)	0	-	-
FDNA-01	1 (Enable)	0	-	-
FCNA-01	1 (Enable)	0	-	-

Option	51.05 FBA A Par5	51.06 FBA A Par6	51.07 FBA A Par7	51.21 FBA A Par21	51.23 FBA A Par23	51.24 FBA A Par24
BIO-01	-	-	-	-	-	-
RIIO-01	-	-	-	-	-	-
FENA-21	-	-	-	-	-	-
FECA-01	-	-	-	-	-	-
FPBA-01	1	-	-	-	-	-
FCAN-01	0	-	-	-	-	-
FSCA-01	-	10	1	-	-	-
FEIP-21	-	-	-	-	128	128
FMBT-21	-	-	-	1	-	-
FPNO-21	-	-	-	-	-	-
FEPL-02	-	-	-	-	-	-
FDNA-01	-	-	-	-	-	-
FCNA-01	-	•	-	-	•	-

Option	52.01 FBA data in1	52.02 BA data in2	53.01 FBA data out1	53.02 FBA data out2	58.01 Protocol enable
BIO-01	-	-	-	-	-
RIIO-01	-	-	-	-	-
FENA-21	4	5	1	2	0
FECA-01	-	-	-	-	0
FPBA-01	4	5	1	2	0
FCAN-01	-	-	-	-	0
FSCA-01	-				0
FEIP-21	-	-	-	-	0
FMBT-21	-	-	-	-	0
FPNO-21	4	5	1	2	0
FEPL-02	-	-	-	-	0
FDNA-01	-	-	-	-	0
FCNA-01	-	-	-	-	0



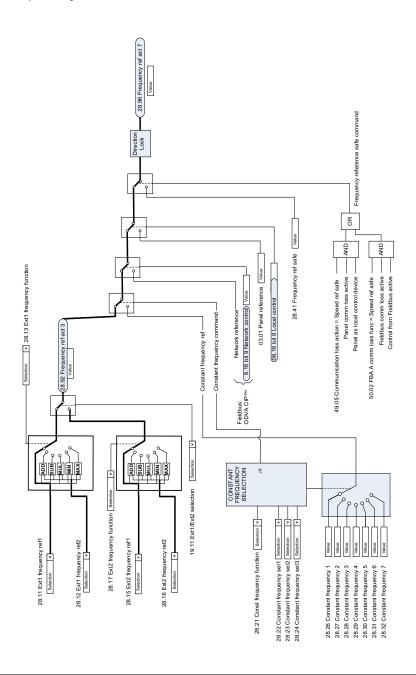
Control chain diagrams

Contents of this chapter

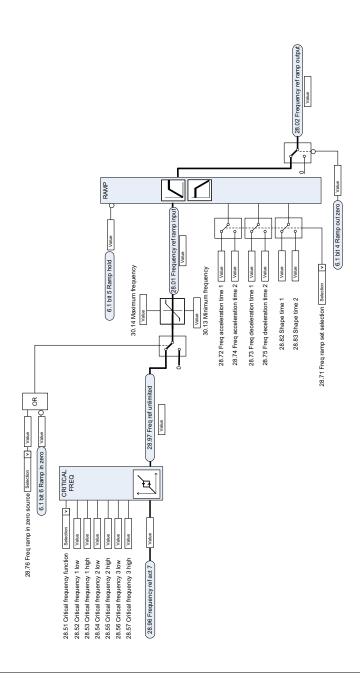
The chapter presents the reference chains of the drive. The control chain diagrams can be used to trace how parameters interact and where parameters have an effect within the drive parameter system.

For a more general diagram, see section Operating modes of the drive (page 110).

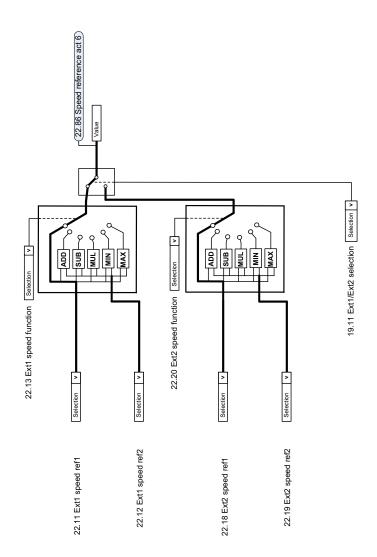
Frequency reference selection



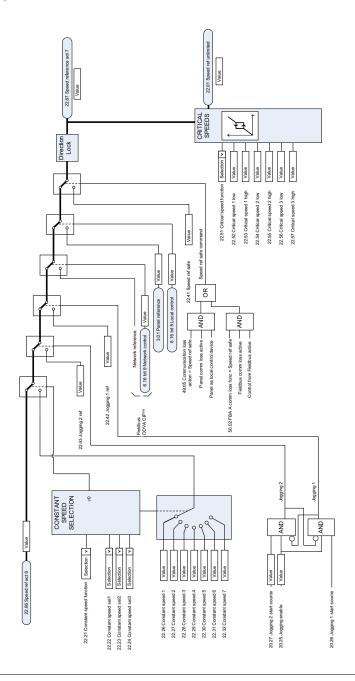
Frequency reference modification



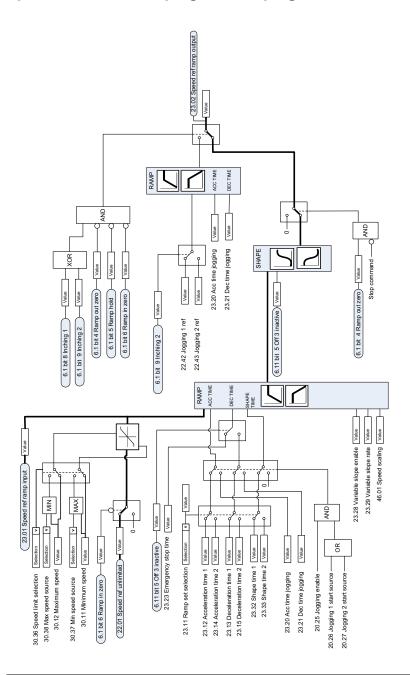
Speed reference source selection I



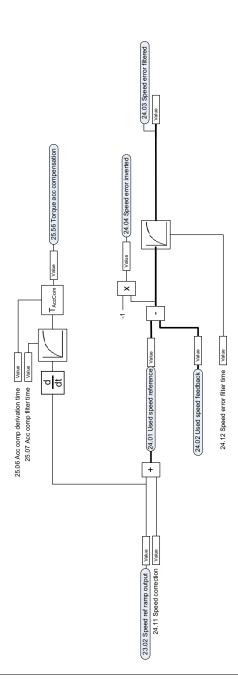
Speed reference source selection II



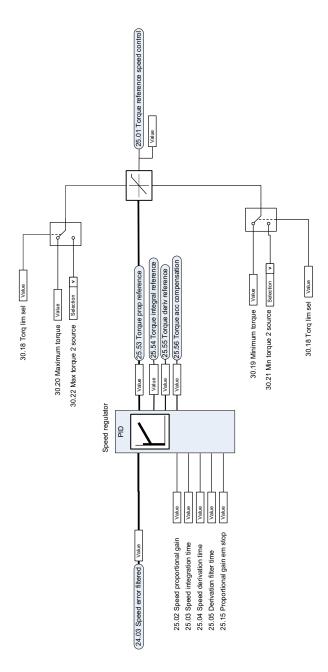
Speed reference ramping and shaping



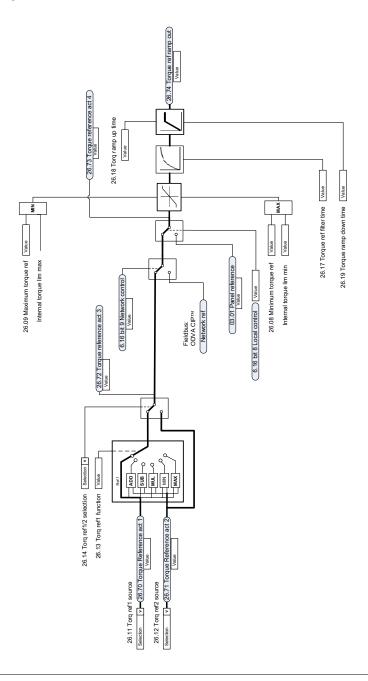
Speed error calculation

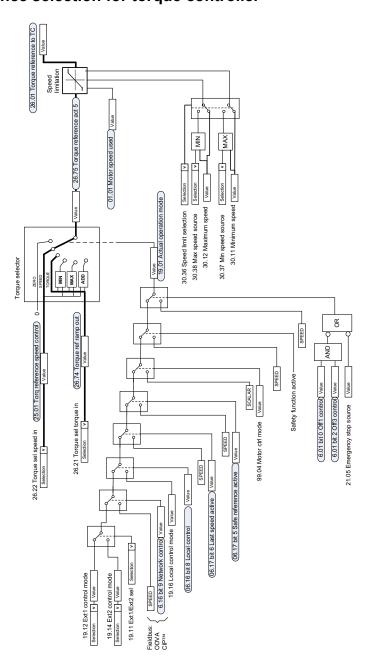


Speed controller

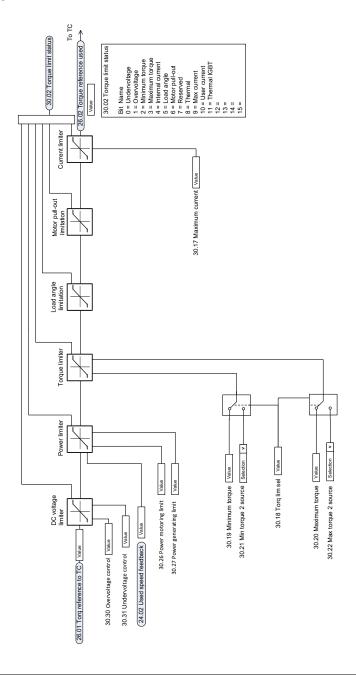


Torque reference source selection and modification

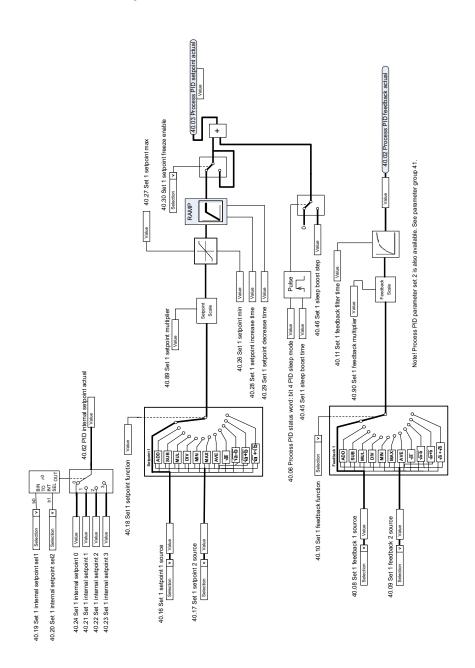




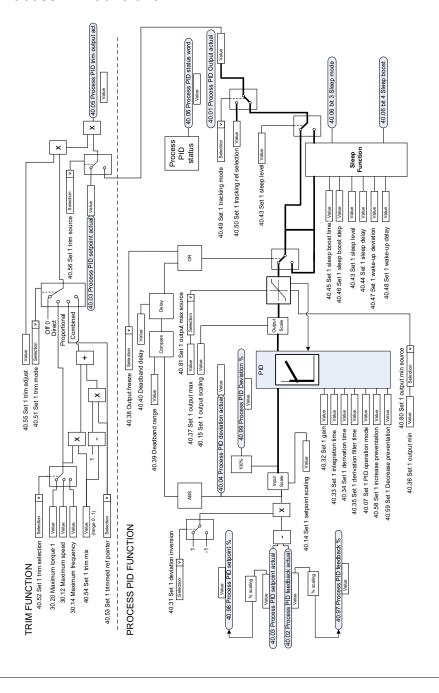
Torque limitation



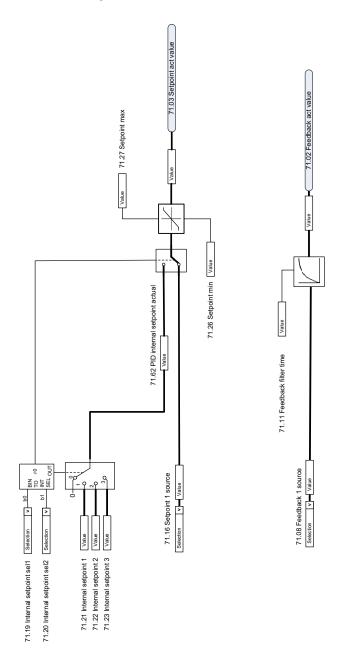
Process PID setpoint and feedback source selection



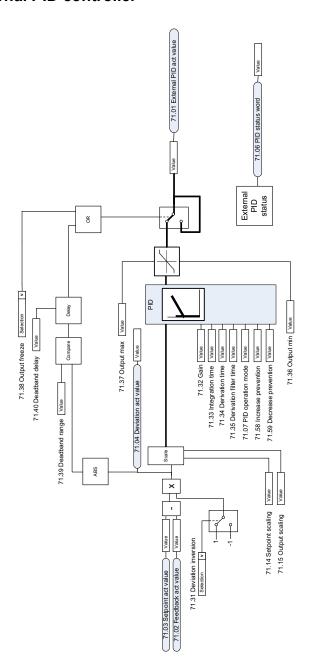
Process PID controller



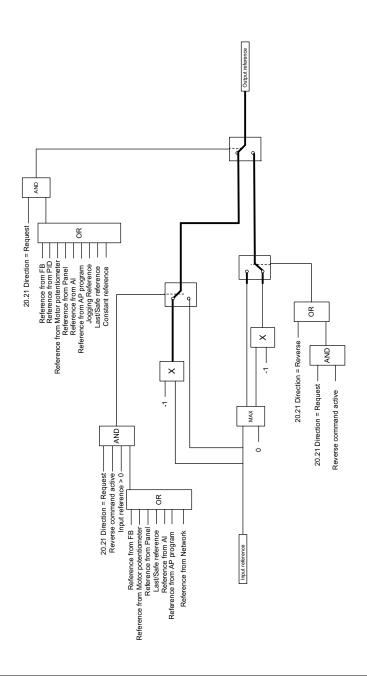
External PID setpoint and feedback source selection



External PID controller



Direction lock



Further information

Product and service inquiries

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

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