# Firmware manual ACS580 standard control program



## List of related manuals

Drive manuals and guides	Code (English)
ACS580 firmware manual	3AXD50000016097
ACS580-01 hardware manual	3AXD50000018826
ACS580-01 quick installation and start-up guide for frames R0 to R3	3AUA0000076332
ACS580-01 quick installation and start-up guide for frame R5	3AXD50000007518
ACS580-01 quick installation and start-up guide for frames R6 to R9	3AXD50000009286
ACS-AP-x assistant control panels user's manual	3AUA0000085685
Option manuals and guides	
CDPI-01 communication adapter module user's manual	3AXD50000009929
DPMP-01 mounting platform for ACS-AP control panel	3AUA0000100140
DPMP-02/03 mounting platform for ACS-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
FPBA-01 PROFIBUS DP adapter module user's manual	3AFE68573271
FSCA-01 RS-485 adapter module user's manual	3AUA0000109533
Tool and maintenance manuals and guides	
Drive composer PC tool user's manual	3AUA0000094606
Converter module capacitor reforming instructions	3BFE64059629
NETA-21 remote monitoring tool user's manual	3AUA00000969391

guide

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,

The QR code below opens an online listing of the manuals applicable to this product.

NETA-21 remote monitoring tool installation and start-up 3AUA0000096881



contact your local ABB representative.

ACS580-01 manuals



1. Introduction to the manual

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



- 3. Control panel
- 4. Settings, I/O and diagnostics on the control panel
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- 7. Parameters
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## Introduction to the manual

## Contents of this chapter

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

## **Applicability**

The manual applies to the ACS580 standard control program (version 1.40).

To check the firmware version of the control program in use, see system information (select Menu - System info) or parameter 07.05 Firmware version (see page 150) on the control panel.

## Safety instructions

Follow all safety instructions.

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

## 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 7) 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 13) 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 33) 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 39) describes the simplified settings and diagnostic functions provided on the assistant control panel.
- Control macros (page 59) 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 85) describes program features with lists of related user settings, actual signals, and fault and warning messages.
- Parameters (page 135) describes the parameters used to program the drive.
- Additional parameter data (page 325) contains further information on the parameters.
- Fieldbus control through the embedded fieldbus interface (EFB) (page 377) describes the communication to and from a fieldbus network using the embedded fieldbus interface of the drive.
- Fieldbus control through a fieldbus adapter (page 405) describes the communication to and from a fieldbus network using an optional fieldbus adapter module
- Fault tracing (page 357) lists the warning and fault messages with possible causes and remedies.
- Control chain diagrams (page 419) describes the parameter structure within the drive.
- Further information (inside of the back cover, page 435) describes how to make product and service inquiries, get information on product training, provide feedback on ABB Drives manuals and find documents on the Internet.

#### **Related documents**

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

## Categorization by frame (size)

The ACS580 is manufactured in several frames (frame sizes), which are denoted as RN, where N is an integer. Some information which only concern certain frames are marked with the symbol of the frame (RN).

The frame is marked on the type designation label attached to the drive, see chapter Operation principle and hardware description, section Type designation label in the Hardware manual of the drive.

## Terms and abbreviations

Term/abbreviation	Explanation			
ACS-AP-x	Assistant control panel, advanced operator keypad for communication with the drive. The ACS580 supports types ACS-AP-I and ACS-AP-S.			
Al	Analog input; interface for analog input signals			
AO	Analog output; interface for analog output signals			
Brake chopper	Conducts the surplus energy from the intermediate circuit of the drive to the brake resistor when necessary. The chopper operates when the DC 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 brake chopper to heat. Essential part of the brake circuit. See chapter <i>Brake chopper</i> in the <i>Hardware manual</i> of the drive.			
Control board	Circuit board in which the control program runs.			
CDPI-01	Communication adapter module			
CCA-01	Configuration adapter			
CEIA-01	Embedded EIA-485 fieldbus adapter module			
CHDI-01	Optional 115/230 V digital input extension module			
CMOD-01	Optional multifunction extension module (external 24 V AC/DC and digital I/O extension)			
CMOD-02	Optional multifunction extension module (external 24 V AC/DC and isolated PTC interface)			
DC link	DC circuit between rectifier and inverter			
DC link capacitors	Energy storage which stabilizes the intermediate circuit DC voltage			
DI	Digital input; interface for digital input signals			
DO	Digital output; interface for digital output signals			
DPMP-01	Mounting platform for ACS-AP control panel (flange mounting)			
DPMP-02/03	Mounting platform for ACS-AP control panel (surface mounting)			
Drive	Frequency converter for controlling AC motors			
EFB	Embedded fieldbus			
FBA	Fieldbus adapter			
FCAN-01	Optional CANopen adapter module			
FCNA-01	ControlNet adapter module			
FDNA-01	Optional DeviceNet adapter module			
FECA-01	Optional EtherCAT adapter module			
FENA-01/-11/-21	Optional Ethernet adapter module for EtherNet/IP, Modbus TCP and PROFINET IO protocols			
FEPL-02	Ethernet POWERLINK adapter module			
FPBA-01	Optional PROFIBUS DP adapter module			

Term/abbreviation	Explanation			
Frame (size)	Refers to drive physical size, for example R0 and R1. The type designation label attached to the drive shows the frame of the drive, see chapter Operation principle and hardware description, section Type designation label in the Hardware manual of the drive.			
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 59.			
NETA-21	Remote monitoring tool			
Network control	With fieldbus protocols based on the Common Industrial Protocol (CIP <sup>TM</sup> ), 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 <a href="www.odva.org">www.odva.org</a> , 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			
R0, R1,	Frame (size)			
RO	Relay output; interface for a digital output signal. Implemented with a relay.			
Rectifier	Converts alternating current and voltage to direct current and voltage.			
STO	Safe torque off. See chapter The Safe torque off function in the Hardware manual of the drive.			

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

## Contents of this chapter



- 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.



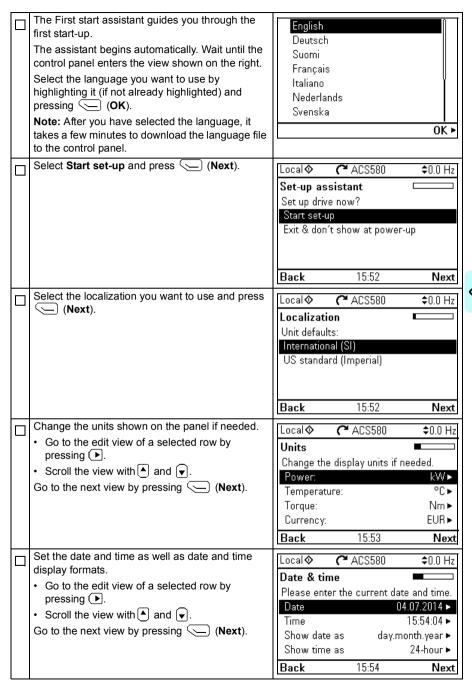
## How to start up the drive

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 <i>Hardware manual</i> of the drive. Ignoring the instructions can cause physical injury or death, or damage 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 macro). The drive will start up automatically command is on and the drive is in the remo Check that the starting of the motor does not cause De-couple the driven machine if  there is a risk of damage in case of an incorrect of a Normal ID run is required during the drive start than 20% or the machinery is not able to withstart the ID run.	at power-up if the external run te control mode. e any danger. direction of rotation, or t-up, when the load torque is higher				
Hints on using the assistant control panel						
	milits on using the assistan	t control panel				
	The two commands at the bottom of the display (Options and Menu in the figure on the right), show the functions of the two softkeys and located below the display. The commands assigned to the softkeys vary depending on the context.  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]).	Local © C* ACS580 \$0.0 Hz  Output frequency 0.00  Hz  Motor current 0.00  Motor torque 0.0  Options 16:00 Menu				
	The two commands at the bottom of the display ( <b>Options</b> and <b>Menu</b> in the figure on the right), show the functions of the two softkeys and located below the display. The commands assigned to the softkeys vary depending on the context.  Use keys ♠, ♠, ♠ and ▼ to move the cursor and/or change values depending on the active view.  Key ♠ shows a context-sensitive help page.  For more information, see <i>ACS-AP-x assistant control panels user's manual</i> (3AUA0000085685	Local © C* ACS580 \$0.0 Hz  Output frequency 0.00  Hz  Motor current 0.00  A  Motor torque 0.0  Options 16:00 Menu				







15:54

Save

Cancel



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:

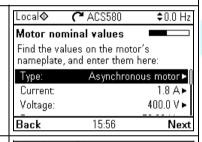
◆ ABB Motors (€ ◆)							
3 ~ motor M2AA 200 MLA 4							
IEC 200 M/L 55						-	
No							
	Ins.cl. F IP 55						
V	Hz	kW	r/min	Α	cos φ	IA/IN	t <sub>E/s</sub>
690 Y	50	30	1475	32.5	0.83		
400 D	50	30	1475	56	0.83		
660 Y	50	30	1470	34	0.83		
380 D	50	30	1470	59	0.83		
415 D	50	30	1475	54	0.83		
440 D	60	35	1770	59	0.83		
Cat. no 3GAA 202 001 - ADA							
6312/C3 <b>a</b> 6210/C3 180 kg							

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.

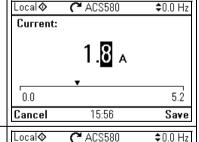
If you have to change the value, go to the edit view of the selected row by pressing ( ) (when this symbol is shown at the end of the row).



Set the correct value:

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

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

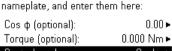


Continue to check/edit the nominal values and select scalar or vector control mode.

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

Roll down with  $[ \mathbf{v} ]$  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).



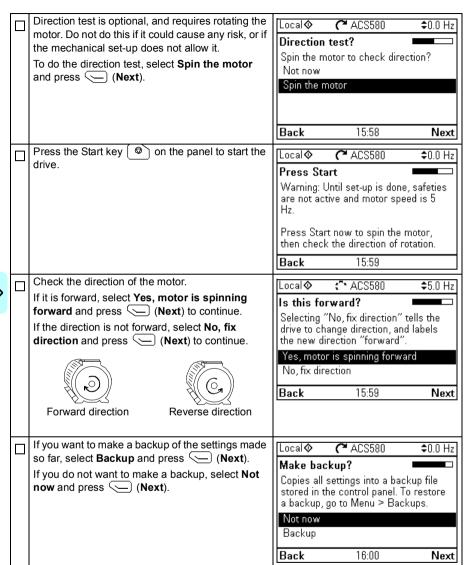
Find the values on the motor's

Motor nominal values

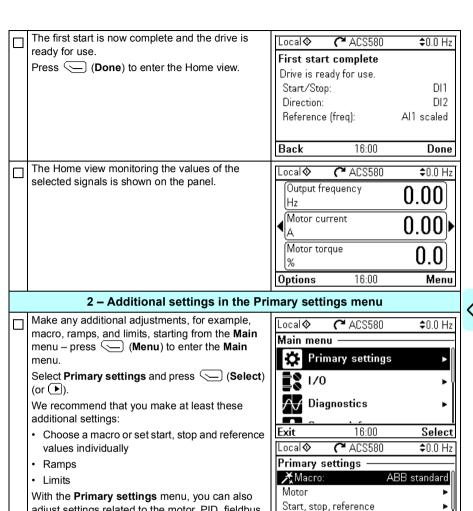
Control mode: Scalar **▶** Back 15:58 Next

0.00 ▶









Ramps

Limits

16:00

Select

Back

adjust settings related to the motor, PID, fieldbus,

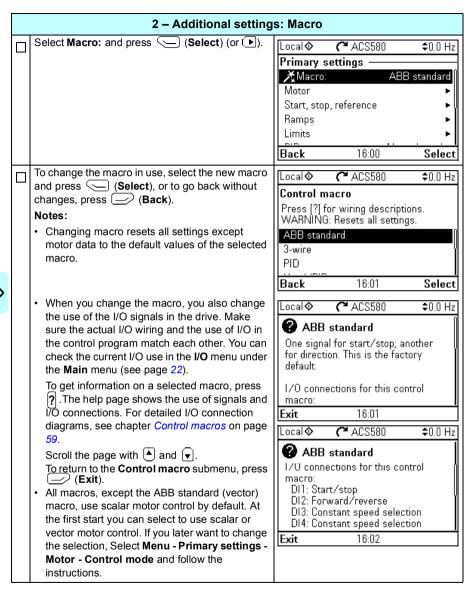
advanced functions and clock, region and display.

In addition, the menu contains an item to reset the

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

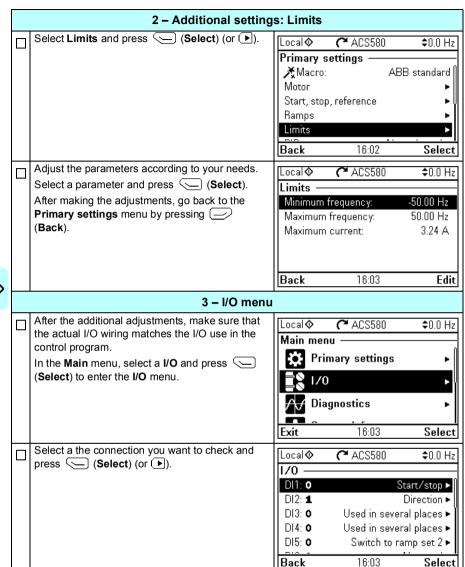
panel Home view.





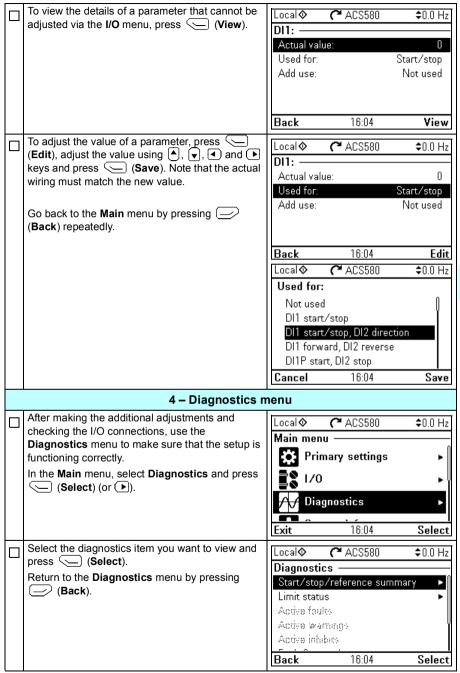




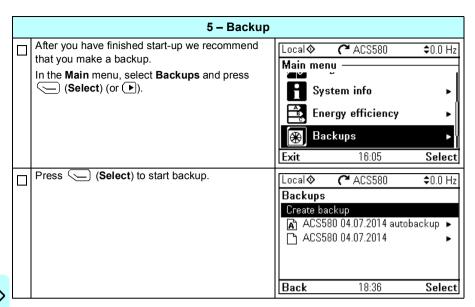














## How to control the drive through the I/O interface

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.

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 **60**.

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 Al1.

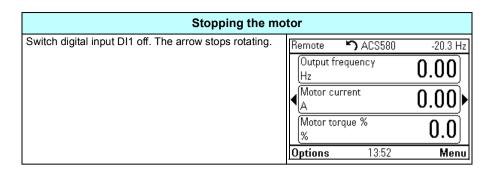
Remote	₹, ACS580	20.2 Hz
Output free	quency	14.20
<b>√</b> Motor curr A	ent	0.39
Motor torq %	ue %	1.4
Options	13:51	Menu

### Changing the direction of the motor rotation

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

Remote 🍱 ACS	580 -20.3 Hz
Output frequency Hz	-14.90
<b>√</b> Motor current A	0.39
Motor torque % %	-0.9
Ontions 14	03 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
- · 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 28) or with parameter 99.13 ID run requested (see page 30).



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.

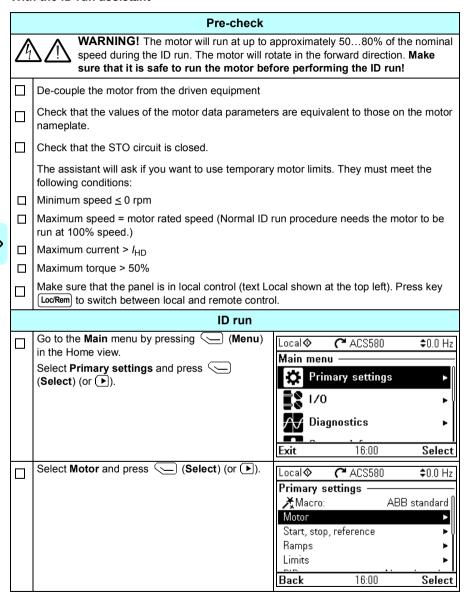
change the control mode to vector with the Control mode assistant (go to Menu -Primary settings - Motor - Control mode) and follow the instructions. The ID run assistant then guides you through the ID run.

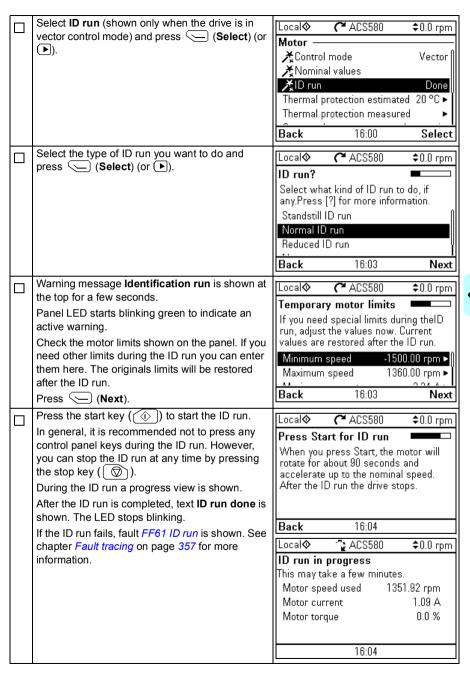
or

- 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

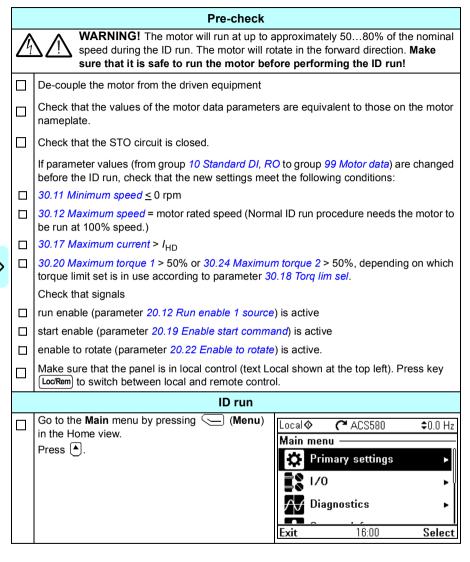
#### With the ID run assistant



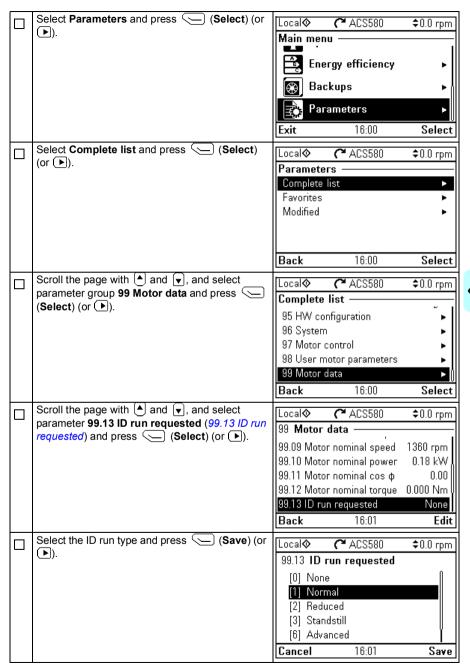




#### With parameter 99.13 ID run requested









		The panel returns to the previous view and warning message <b>Identification run</b> is shown at the top for a few seconds.	A Identification run  99 Motor data  99.09 Motor nominal speed 1360 rpm		
		Panel LED starts blinking green to indicate an active warning ( <i>AFF6</i> ).  The <i>AFF6</i> warning view is shown when no key has been pressed for one minute. Pressing ( <b>How to fix</b> ) shows text informing that the ID run will be done at the next start. You can hide the warning view by pressing ( <b>Hide</b> ).	99.10 Motor	nominal power	0.18 kW
				- nominal cos ф - nominal torque	0.00 0.000 Nm Normal
			Back	16:02	Edit
			Local	C ACS580	\$0.0 rpm
		Press the start key ( ) to start the ID run. In general, it is recommended 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 ( ).	Warning AFF6 Aux code: 0000 0000 Identification run 16:01:53 Motor identification run about to be performed		
			Hide	16:02	How to fix
		During the ID run the arrow is rotating at the top. After the ID run is completed, text <b>ID run done</b> 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>357</i> for more information.	99.10 Motor 99.11 Motor	nominal speed nominal power nominal cos φ nominal torque	0.00
			Back	16:03	Edit





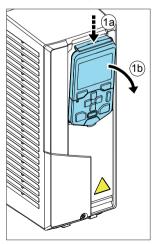
# **Control panel**

# Contents of this chapter

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

# Removing and reinstalling the control panel

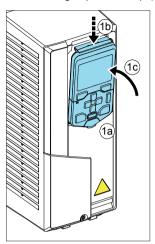
To remove the control panel, press the retaining clip at the top (1a) and pull it forward from the top edge (1b).



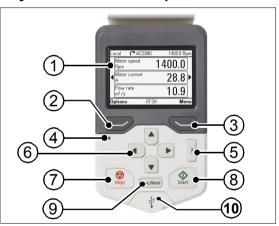




To reinstall the control panel, put the bottom of the container in position (1a), press the retaining clip at the top (1b) and push the control panel in at the top edge (1c).



# Layout of the control panel

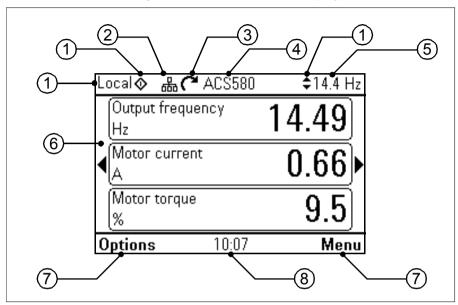


1	Layout of the control panel display
2	Left softkey
3	Right softkey
4	Status LED, see chapter Maintenance and hardware diagnostics, section LEDs in the Hardware manual of the drive.
5	Help

6	The arrow keys
7	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:



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

Text/Icons	Starting from this control panel		Giving reference from this panel
	Not allowed	Not allowed	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	<b></b>	<b>‡</b>	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 $\phi$		Allowed	Allowed	Not allowed
Remote	<b>↑</b>	Not allowed	Allowed	Allowed
Remote 💠	<b>↑</b>	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 <b>Menu - Diagnostics</b> on the control panel
<b>~</b>	Blinking	Faulted
(7'↔	Blinking	Running, at reference, but the reference value is 0
(Y+F)	Rotating	Running, not at reference
G.⇔J	Rotating	Running, at reference

- Drive name: If a name has been given, it is displayed in the top pane. By default, it is "ACS580". You can change the name on the control panel by selecting Menu Primary settings Clock, region, display (see page 53).
- 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 44).
- 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 35 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.
- 8. 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 53).

You can adjust the display contrast and back light functionality on the control panel by selecting **Menu - Primary settings - Clock, region, display** (see page 53).

# **Keys**

The keys of the control panel are described below.

#### Left softkev

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 ( $\overline{\ }$  and  $\overline{\ }$  ) 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 necessary, 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 ( ) and the stop key ( ) ) 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 (+).

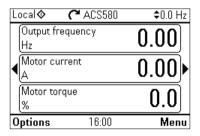
Shortcut	Available in	Effect
+ •	any view	Save a screenshot. Up to fifteen images may be stored in the control panel memory.  To transfer images to PC, connect the assistant control panel to PC with a USB cable and the panel will mount itself as an MTP (media transfer protocol) device.  Pictures are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

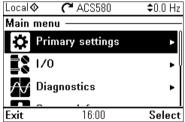
# Settings, I/O and diagnostics on the control panel

# Contents of this chapter

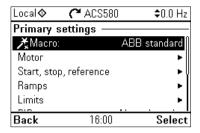
This chapter provides detailed information about the Primary settings, I/O and **Diagnostics** menus on the control panel.

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 settinas.

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, we recommend that you make at least these additional settings:

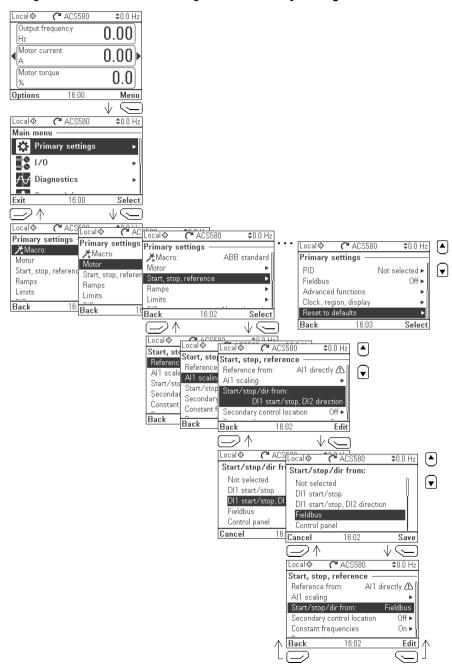
- Select a Macro or set Start, stop, reference values
- Ramps
- Limits

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 135.

In the **Setting** menu, the \(\bigcap\) symbol indicates multiple connected signals/parameters. The \*\mathcal{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 figure below shows how to navigate in the **Primary settings** menu.



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

#### Macro

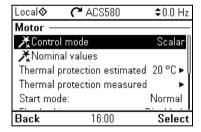


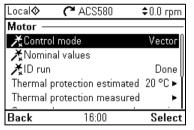
Use the **Macro** submenu to quickly set up drive control and reference source by selecting from a set of predefined wiring configurations.

**Note:** For detailed information about the available macros, see *Control macros* on page 39.

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.

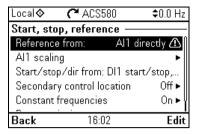
Note that settings that are visible depend on other selections, for example vector or scalar control mode, used motor type or selected start mode.

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>Scalar motor control</i> on page <i>103</i> .	
	For information on vector control mode, see <i>Vector</i> control on page 95.	
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. We recommend checking the values for the protection to function properly.	
	For more information, see <i>Motor thermal protection</i> on page 123.	
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>123</i> .	
Start mode:	Sets how the drive starts the motor (e.g. pre- magnetize 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 105.	97.05 Flux braking
U/f ratio:	The form of voltage to frequency ratio below field weakening point. For more information, see <i>U/f ratio</i> on page 105.	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 <i>103</i> .	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 <b>Off</b> .	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 20.09 Ext2 in2 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 <b>On</b> . For more information, see <i>Constant speeds/frequencies</i> on page 97.	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 Jogging on page 99.	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♦ <b>(*</b> ACS580	<b>\$</b> 0.0 Hz
Ramps —	
Acceleration time:	20.000 s
Deceleration time:	20.000 s
Shape time:	0.100 s
Stop mode:	Coast
☑ Use two ramp sets	
Back 16:02	<u> </u>

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

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
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	Enables 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
Shape time 2:	Sets the shape of ramps in set 2.	23.33 Shape time 2 28.83 Shape time 2

## Limits

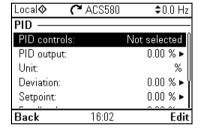
Local♦ 🚰 ACS58	0.0 <b>‡</b> 0.0 Hz
Limits —	
Minimum frequency:	-50.00 Hz
Maximum frequency:	50.00 Hz
Maximum current:	3.24 A
<b>Back</b> 16:03	Edit

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.

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



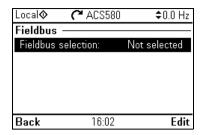
The PID submenu contains settings and actual values for the process PID controller. PID is only used in remote control.

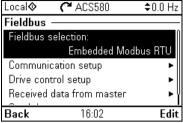
The table below provides detailed information about the available setting items in the PID menu.

Menu item	Description	Corresponding parameter
PID controls:	Sets what to use PID output for:  Not selected: PID not used.	40.07 Process PID 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.	

Menu item	Description	Corresponding parameter
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 normal setpoint.	Source
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
Tuning	<ul> <li>The <b>Tuning</b> submenu contains settings for gain, integration time and derivation time.</li> <li>1. Make sure it is safe to start the motor and run the actual process.</li> <li>2. Start the motor in remote control.</li> <li>3. Change setpoint by a small amount.</li> <li>4. Watch how feedback reacts.</li> <li>5. Adjust gain/integration/derivation.</li> <li>6. Repeat steps 3-5 until feedback reacts as desired.</li> </ul>	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	The sleep function can be used to save energy by stopping the motor during low demand. By default, sleep function is disabled. If enabled, 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 112.	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

#### **Fieldbus**





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

- Modbus (RTU or TCP)
- **PROFIBUS**
- PROFINET
- Ethernet/IP

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 and the other fieldbus modules are optional adapters. For the optional modules, the following adapters are required to enable the needed protocols:

ModbusTCP: FENA-11/-21 PROFIBUS: FBPA-01 PROFINET FENA-11/-21 Ethernet/IP: FENA-11/-21

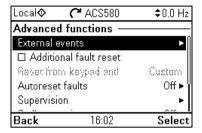
The table below provides detailed information about the available setting items in the Fieldbus menu. Note that some of the items only became active once you have enabled fieldbus.

Menu item		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

Menu item	Description	Corresponding parameter
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
	solosti ippij cominge to normane momme.	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
	and how the drive reacts if the fieldbus	19.11 Ext1/Ext2
	communication fails.	selection
		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
		1
		23.13 Deceleration time 1
		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
	changing these settings, select <b>Apply settings to</b>	53 FBA A data out
	fieldbus module.	51.27 FBA A par refresh
		58.18 EFB control word
		03.09 EFB reference 1
Send data to master	Sets what the drive's fieldbus module sends to the	50.16 FBA A status
	fieldbus master (PLC). After changing these	word
	settings, select Apply settings to fieldbus	52 FBA A data in
	module.	51.27 FBA A par refresh
[		58.19 EFB status word

Menu item		Corresponding parameter
Apply settings to	Applies modified settings to the fieldbus module.	51.27 FBA A par refresh
fieldbus module		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.  A fault can be reset from the fieldbus even if <b>Reset faults manually</b> is unselected.	selection
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
Autoreset faults	Reset faults automatically. For more information, see <i>Automatic fault resets</i> on page 128.	31.12 Autoreset selection 31.14 Number of trials 31.15 Total trials time 31.16 Delay time

Menu item	Description	Corresponding parameter
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 234.	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 32.11 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
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.	hysteresis 31.24 Stall function 31.25 Stall current limit 31.26 Stall speed limit 31.27 Stall frequency limit 31.28 Stall time
Timed functions	Enables using the drive with timed functions. For complete settings, see group 34 Timed functions on page 240.	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 34.411 Extra time activation source 34.112 Extra time duration

Menu item		Corresponding parameter
	about user sets, see User parameter sets on page	96.11 User set save/load 96.10 User set status 96.12 User set I/O mode in1

## 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.	

Menu item		Corresponding parameter
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

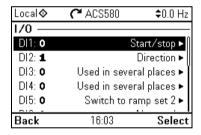


## The Reset to defaults submenu enables you to reset parameters and other settings.

Menu item	Description	Corresponding parameter
Reset fault and event	Clears all events from the drive's fault and event	96.51 Clear fault and
logs	logs.	event logger
Reset home view	Restores the home view layout back to show the	96.06 Parameter
layout	values of the default parameters defined by the control macro in use.	restore, selection Reset home view
Reset non-HW	Restores all editable parameter values to default	96.06 Parameter
parameters	values, except	restore, selection Restore defaults
	motor data and ID run results	r cotoro dordano
	I/O extension module settings	
	<ul> <li>end user texts, such as customized warnings and faults, and the drive name</li> </ul>	
	control panel/PC communication settings	
	fieldbus adapter settings	
	<ul> <li>control macro selection and the parameter defaults implemented by it</li> </ul>	
	<ul> <li>parameter 95.02 HW options word 1 and the differentiated defaults implemented by it.</li> </ul>	
Reset all fieldbus settings	Restores all fieldbus and communication related settings to default values.	96.06 Parameter restore, selection Reset all fieldbus settings
	<b>Note:</b> Fieldbus, control panel and PC tool communication are interrupted during the restore.	an nelabas settings

Menu item	Description	Corresponding parameter
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
Reset all parameters	Restores all editable parameter values to default values, except	96.06 Parameter restore, selection Clear all
	<ul> <li>end user texts, such as customized warnings and faults, and the drive name</li> </ul>	
	<ul> <li>control macro selection and the parameter defaults implemented by it</li> </ul>	
	<ul> <li>parameter 95.02 HW options word 1 and the differentiated defaults implemented by it.</li> </ul>	
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
	<ul> <li>parameter 95.02 HW options word 1 and the differentiated defaults implemented by it.</li> </ul>	,

## 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
- Electrical 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.
DI6	This submenu lists the functions that use DI6 or FI as input. The
	connector can be used as either digital input or frequency input.
Al1	This submenu lists the functions that use Al1 as input.
Al2	This submenu lists the functions that use AI2 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	
	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.	

Menu item	Description	
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.	
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.	



# 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.

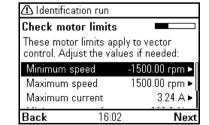
## General

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.

Control macros can be selected in the Primary settings menu: Menu - Primary settings - Macro or with parameter 96.04 Macro select (page 307).

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.

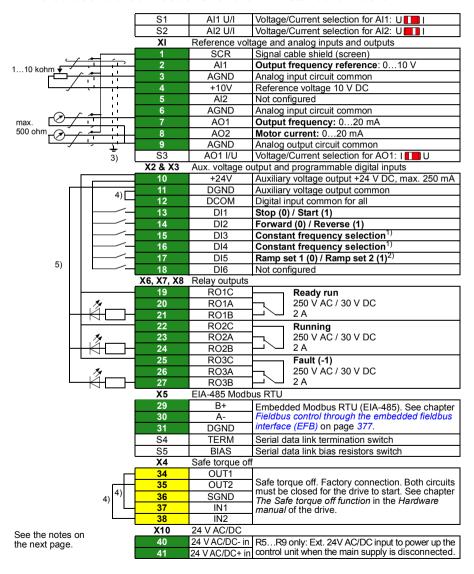


- Change motor control mode to vector: **Menu** 
  - Primary settings Motor Control mode, and follow the instructions (see the figure on the right).

## ABB standard macro

This is the default macro. It provides a general purpose, 2-wire I/O configuration with three constant speeds. 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 (page 62).

## Default control connections for the ABB standard macro



#### Terminal sizes:

R0...R3: 0.2...2.5 mm<sup>2</sup> (terminals +24V, DGND, DCOM, B+. A-) 0.14...1.5 mm<sup>2</sup> (terminals DI, AI, AO, AGND, RO, STO)

R5...R9: 0.14...2.5 mm<sup>2</sup> (all terminals) Tightening torques: 0.5...0.6 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 Al1	
1	0	28.26 Constant frequency 1	
0	1	28.27 Constant frequency 2	
1	1	28.28 Constant frequency 3	

<sup>2)</sup> 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.
- <sup>4)</sup> Connected with jumpers at the factory.
- 5) **Note:** Use shielded twisted-pair cables for digital signals.

#### Input signals

- Analog frequency reference (Al1)
- Start/stop selection (DI1)
- Direction selection (DI2)
- Constant frequency selection (DI3, DI4)
- Ramp set (1 of 2) selection (DI5)

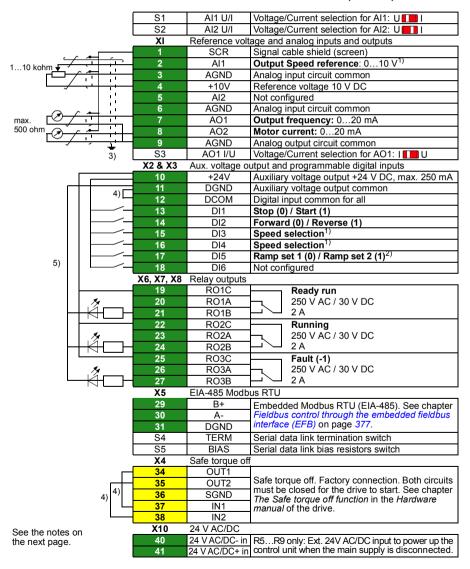
#### **Output signals**

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

# ABB standard (vector) macro

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).

## Default control connections for the ABB standard (vector) macro



#### Terminal sizes:

R0...R3: 0.2...2.5 mm<sup>2</sup> (terminals +24V, DGND, DCOM, B+. A-) 0.14...1.5 mm<sup>2</sup> (terminals DI, AI, AO, AGND, RO, STO)

R5...R9: 0.14...2.5 mm<sup>2</sup> (all terminals)

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

#### Notes:

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

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

<sup>2)</sup> 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.
- <sup>4)</sup> Connected with jumpers at the factory.
- 5) **Note:** Use shielded twisted-pair cables for digital signals.

#### Input signals

- Analog speed reference (Al1)
- Start/stop selection (DI1)
- Direction selection (DI2)
- Constant speed selection (DI3, DI4)
- Ramp set (1 of 2) selection (DI5)

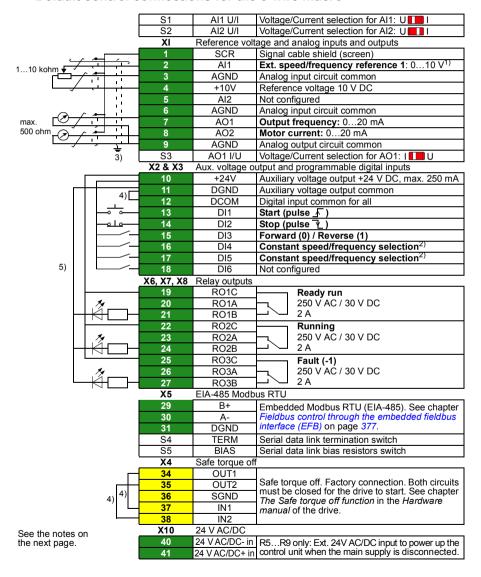
#### **Output signals**

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

## 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



#### Terminal sizes:

R0...R3: 0.2...2.5 mm<sup>2</sup> (terminals +24V, DGND, DCOM, B+, A-) 0.14...1.5 mm<sup>2</sup> (terminals DI, AI, AO, AGND, RO, STO)

R5...R9: 0.14...2.5 mm<sup>2</sup> (all terminals) Tightening torques: 0.5...0.6 N·m (0.4 lbf·ft)

#### Notes:

2) 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.

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	

<sup>3)</sup> 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)

#### **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)

<sup>1)</sup> All is used as a speed reference if vector control is selected.

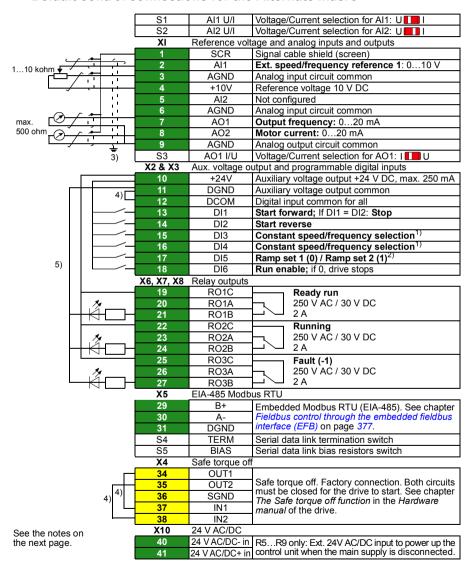
<sup>&</sup>lt;sup>4)</sup> Connected with jumpers at the factory.

<sup>5)</sup> **Note:** 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



#### Terminal sizes:

R0...R3: 0.2...2.5 mm<sup>2</sup> (terminals +24V, DGND, DCOM, B+, A-) 0.14...1.5 mm<sup>2</sup> (terminals DI. AI. AO. AGND. RO. STO)

R5...R9: 0.14...2.5 mm<sup>2</sup> (all terminals) Tightening torques: 0.5...0.6 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 Al1	
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	

<sup>2)</sup> 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

<sup>&</sup>lt;sup>3)</sup> 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)

#### **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)

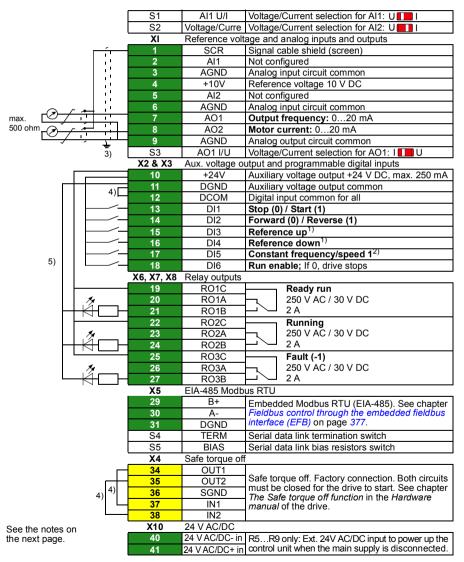
<sup>4)</sup> Connected with jumpers at the factory.

<sup>5)</sup> **Note:** 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 costeffective 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**



#### Terminal sizes:

```
R0...R3: 0.2...2.5 mm<sup>2</sup> (terminals +24V, DGND, DCOM, B+. A-)
           0.14...1.5 mm<sup>2</sup> (terminals DI. AI. AO. AGND. RO. STO)
R5...R9: 0.14...2.5 mm<sup>2</sup> (all terminals)
```

Tightening torques: 0.5...0.6 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.
- <sup>4)</sup> Connected with jumpers at the factory.
- 5) **Note:** 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)

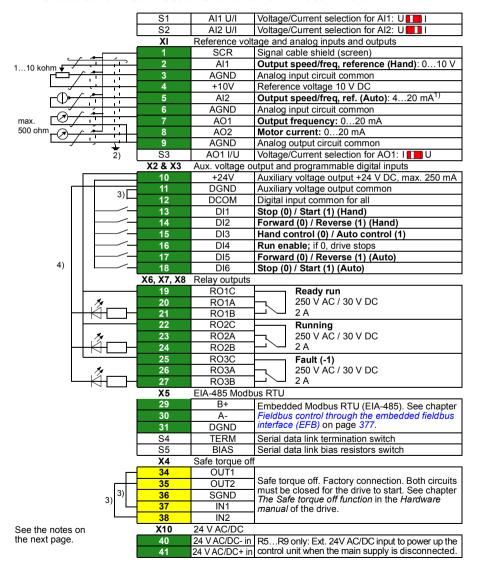
#### **Output signals**

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

# Hand/Auto macro

This macro can be used when switching between two external control devices is needed. Both 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



#### Terminal sizes:

```
R0...R3: 0.2...2.5 mm<sup>2</sup> (terminals +24V, DGND, DCOM, B+. A-)
           0.14...1.5 mm<sup>2</sup> (terminals DI, AI, AO, AGND, RO, STO)
R5...R9: 0.14...2.5 mm<sup>2</sup> (all terminals)
```

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.
- <sup>2)</sup> 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) **Note:** 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)

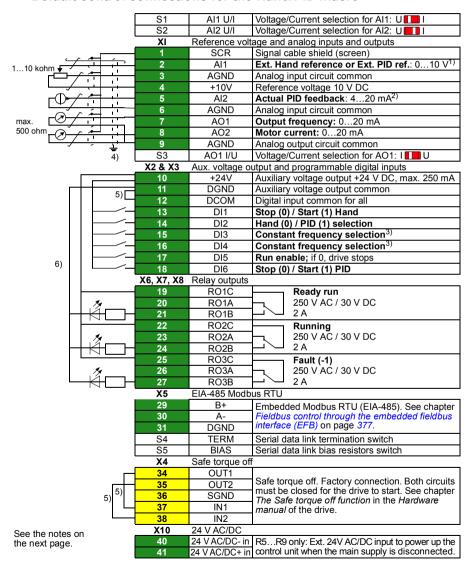
#### **Output signals**

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

# 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



#### Terminal sizes:

R0...R3: 0.2...2.5 mm<sup>2</sup> (terminals +24V, DGND, DCOM, B+. A-) 0.14...1.5 mm<sup>2</sup> (terminals DI. AI. AO. AGND. RO. STO) R5...R9: 0.14...2.5 mm<sup>2</sup> (all terminals)

Tightening torques: 0.5...0.6 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 aux. 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)					
		Scalar control (default)					
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) **Note:** Use shielded twisted-pair cables for digital signals.

## Input signals

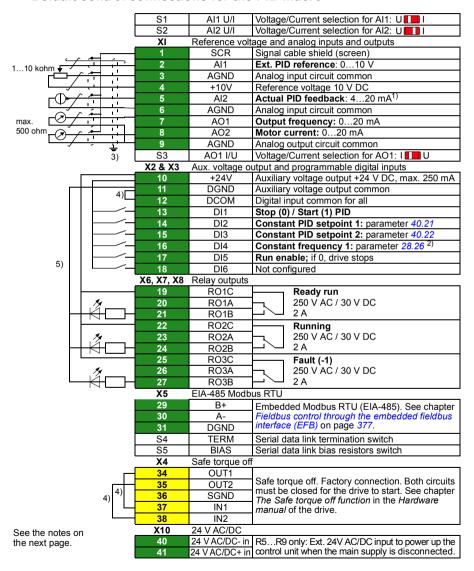
- Analog reference (AI1)
- Actual feedback from PID (Al2)
- Control location (Hand or PID) selection (DI2)
- Start/stop selection, Hand (DI1)
- Start/stop selection, PID (DI6)
- Constant frequency selection (DI3, DI4)
- Run enable (DI5)

# **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)

This macro is suitable for applications where the drive is always controlled by PID and the reference comes from analog input AI1. 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



#### Terminal sizes:

```
R0...R3: 0.2...2.5 mm<sup>2</sup> (terminals +24V, DGND, DCOM, B+. A-)
           0.14...1.5 mm<sup>2</sup> (terminals DI, AI, AO, AGND, RO, STO)
R5...R9: 0.14...2.5 mm<sup>2</sup> (all terminals)
```

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.
- <sup>2)</sup> 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.
- <sup>4)</sup> Connected with jumpers at the factory.
- 5) **Note:** Use shielded twisted-pair cables for digital signals.

#### Input signals

- Analog reference (AI1)
- 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)

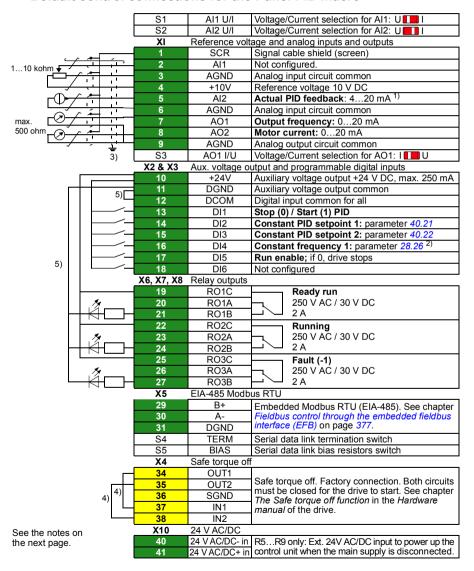
#### **Output signals**

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

# 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



#### Terminal sizes:

```
R0...R3: 0.2...2.5 mm<sup>2</sup> (terminals +24V, DGND, DCOM, B+. A-)
           0.14...1.5 mm<sup>2</sup> (terminals DI. AI. AO. AGND. RO. STO)
R5...R9: 0.14...2.5 mm<sup>2</sup> (all terminals)
```

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.
- <sup>2)</sup> 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.
- <sup>4)</sup> Connected with jumpers at the factory.
- 5) **Note:** Use shielded twisted-pair cables for digital signals.

#### Input signals

- PID setpoint given from the control panel
- 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)

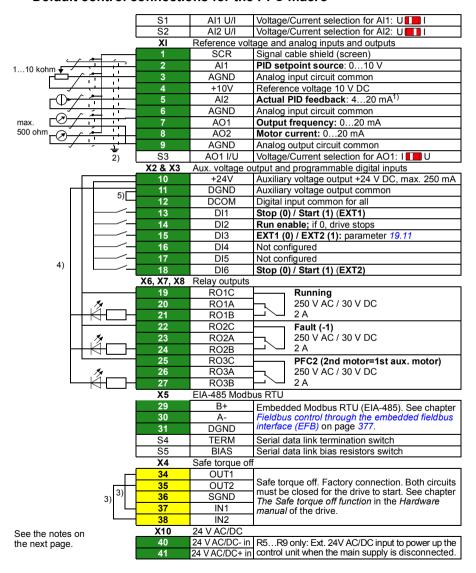
#### **Output signals**

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

# PFC macro

Pump and fan control logic for controlling multiple pumps or fans through the drive's 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



#### Terminal sizes:

```
R0...R3: 0.2...2.5 mm<sup>2</sup> (terminals +24V, DGND, DCOM, B+. A-)
           0.14...1.5 mm<sup>2</sup> (terminals DI, AI, AO, AGND, RO, STO)
R5...R9: 0.14...2.5 mm<sup>2</sup> (all terminals)
```

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.
- <sup>2)</sup> 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) **Note:** Use shielded twisted-pair cables for digital signals.

#### Input signals

- Setpoint for PID (AI1)
- Actual feedback from PID (AI2)
- Start/Stop selection, EXT1 (DI1)
- Run enable (DI2)
- EXT1/EXT2 selection (DI3)
- Start/Stop selection, EXT2 (DI6)

#### **Output signals**

- 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 135 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	50.0	1500.0	50.0	50.0	50.0
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	3 = In1 Start fwd; In2 Start	2 = In1 Start; In2 Dir
20.03	Ext1 in1 source	2 = DI1	2 = <i>DI1</i>	2 = DI1	2 = DI1	2 = DI1
20.04	Ext1 in2 source	3 = DI2	0 = Not selected	3 = DI2	3 = DI2	3 = <i>Dl2</i>
20.05	Ext1 in3 source	0 = Not selected	0 = Not selected	4 = DI3	0 = Not selected	0 = Not selected
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 = Not selected	0 = Not selected	0 = Not selected	0 = Not selected	0 = Not selected
20.09	Ext2 in2 source	0 = Not selected	0 = Not selected	0 = Not selected	0 = Not selected	0 = Not selected
20.12	Run enable 1 source	1 = Selected	1 = Selected	1 = Selected	7 = DI6	7 = DI6
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 = DI3	4 = <i>DI3</i>	5 = DI4	4 = DI3	6 = <i>DI5</i>
22.23	Constant speed sel2	5 = <i>DI4</i>	5 = DI4	6 = <i>DI5</i>	5 = DI4	0 = Not selected

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)	44 = PFC2
12.20	Al1 scaled at Al1 max	50.0	50.0	50.0	50.0	50.0
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 = DI3
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 = DI1
20.04	Ext1 in2 source	3 = DI2	0 = Not selected	0 = Not selected	0 = Not selected	0 = Not selected
20.05	Ext1 in3 source	0 = Not selected	0 = Not selected	0 = Not selected	0 = Not selected	0 = Not selected
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 = Not selected	0 = Not selected	7 = DI6
20.09	Ext2 in2 source	6 = <i>DI5</i>	0 = Not selected	0 = Not selected	0 = Not selected	0 = Not selected
20.12	Run enable 1 source	5 = DI4	6 = <i>DI5</i>	6 = <i>DI5</i>	6 = <i>DI5</i>	3 = <i>DI2</i>
22.11	Ext1 speed ref1	1 = Al1 scaled	1 = Al1 scaled	16 = <i>PID</i>	16 = <i>PID</i>	16 = <i>PID</i>
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 = Not selected	4 = DI3	5 = DI4	5 = DI4	0 = Not selected
22.23	Constant speed sel2	0 = Not selected	5 = <i>DI4</i>	0 = Not selected	0 = Not selected	0 = Not selected

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 power- up)
22.73	Motor potentiometer up source	0 = Not selected	0 = Not selected	0 = Not selected	0 = Not selected	4 = D/3
22.74	Motor potentiometer down source	0 = Not selected	0 = Not selected	0 = Not selected	0 = Not selected	5 = DI4
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 = <i>DI3</i>	4 = <i>DI3</i>	5 = <i>DI4</i>	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 = Not selected
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	PFC configuration	0 = <i>Off</i>	0 = <i>Off</i>	0 = <i>Off</i>	0 = <b>O</b> ff	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

96.04	Macro select	2 = Hand/Auto	3 = Hand/PID	14 = PID	15 = Panel PID	16 = PFC
22.71	Motor potentiometer function	0 = Disabled	0 = Disabled	0 = Disabled	0 = Disabled	0 = Disabled
22.73	Motor potentiometer up source	0 = Not selected	0 = Not selected	0 = Not selected	0 = Not selected	0 = Not selected
22.74	Motor potentiometer down source	0 = Not selected	0 = Not selected	0 = Not selected	0 = Not selected	0 = Not selected
28.11	Ext1 frequency ref1	1 = Al1 scaled	1 = Al1 scaled	16 = <i>PID</i>	16 = <i>PID</i>	16 = <i>PID</i>
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 = Not selected	4 = DI3	5 = <i>DI4</i>	5 = <i>DI4</i>	0 = Not selected
28.23	Constant frequency sel2	0 = Not selected	5 = <i>DI4</i>	0 = Not selected	0 = Not selected	0 = Not selected
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 = DI2	0 = Not selected	0 = Not selected
40.20	Set 1 internal setpoint sel2	0 = Not selected	0 = Not selected	4 = DI3	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	PFC configuration	0 = <i>Off</i>	0 = <i>Off</i>	0 = <i>Off</i>	0 = <i>Off</i>	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

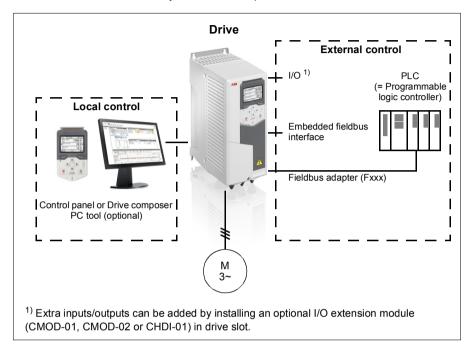
# **Program features**

# 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 AC580 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 modes are available in vector motor control mode: frequency mode is available when scalar motor control mode is used (see parameter 19.16 Local control mode).

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 Local control disable.

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

#### External control

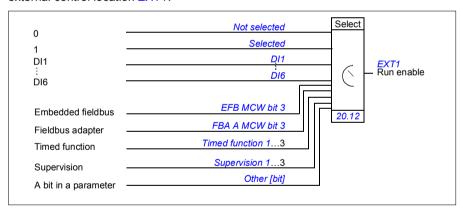
When the drive is in external control, control commands are given through

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

Two external control locations, EXT1 and EXT2, are available. The user can select the sources of the start and stop commands separately for each location in the Primary settings menu (Menu - Primary settings - Start, stop, reference) or setting parameters 20.01...20.10. The operating mode can be selected separately for each location, which enables guick 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 Ext1/Ext2 selection). The source of reference is selectable for each operating mode separately.

## 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

- Menu Primary settings Start, stop, reference Secondary control location; Menu - Primary settings - Start, stop, reference
- Parameters 19.11 Ext1/Ext2 selection (page 173); 20.01...20.10 (page 174).

# Motor potentiometer

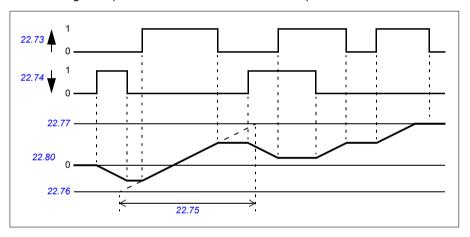
The motor potentiometer is, in effect, a counter whose value can be adjusted up and down using two digital signals selected by parameters 22.73 Motor potentiometer up source and 22.74 Motor potentiometer down source.

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

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

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

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

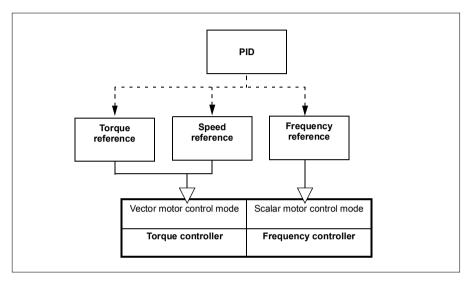


#### Settings

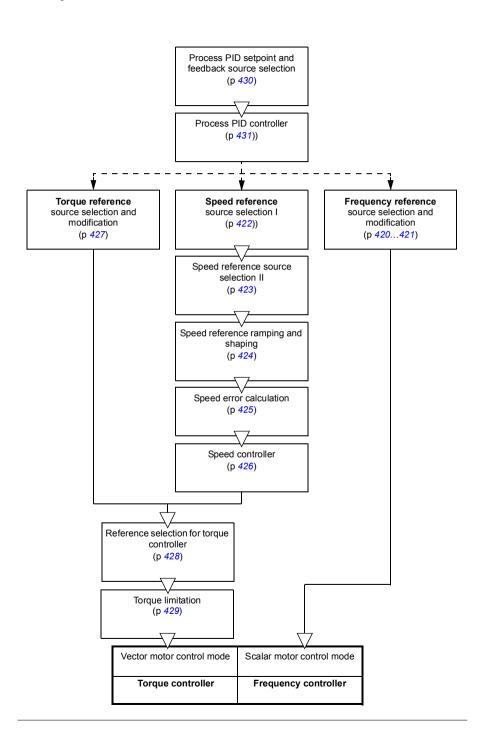
Parameters 22.71...22.80 (page 198).

# 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.

# **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.

# 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.

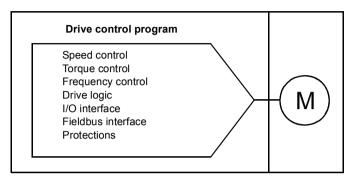
# Special control modes

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) 111).
- · 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 99).
- Pre-magnetization: DC magnetization of the motor before start. For more information, see section Pre-magnetization (page 106).
- DC hold: Locking the rotor at (near) zero speed in the middle of normal operation. For more information, see section *DC hold* (page 107).
- Pre-heating (motor heating): Keeping the motor warm when the drive is stopped. For more information, see section *Pre-heating (Motor heating)* (page 107).

# 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, it is highly recommended to force a save by using parameter 96.07 Parameter save manually before powering down the control unit after any parameter changes have been made.

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

# Control interfaces

# Programmable analog inputs

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

## **Settings**

Parameter group 12 Standard AI (page 156).

# Programmable analog outputs

The control unit has two current (0...20 mA) analog outputs. Each output can be filtered, inverted and scaled.

## Settings

Parameter group 13 Standard AO (page 160).

# Programmable digital inputs and outputs

The control unit has six digital inputs.

Digital input DI6 can be used as a frequency input.

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

# Settings

Parameter groups 10 Standard DI, RO (page 150) and 11 Standard DIO, FI, FO (page 154).

# Programmable frequency input and output

Digital input (DI6) can be configured as a frequency input. A frequency output can be implemented with a CMOD-01 multifunction extension module.

# Settings

Parameter groups 10 Standard DI, RO (page 150) and 11 Standard DIO, FI, FO (page 154).

# Programmable relay outputs

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

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

## Settings

Parameter group 10 Standard DI, RO (page 150).

# Programmable I/O extensions

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

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

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

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

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

#### Settings

Parameter group 15 I/O extension module (page 166).

#### 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 377) and *Fieldbus control through a fieldbus adapter* (page 405).

#### Settings

Parameter groups 50 Fieldbus adapter (FBA) (page 284), 51 FBA A settings (page 288), 52 FBA A data in (page 290), and 53 FBA A data out (page 290) and 58 Embedded fieldbus (page 291).

# Motor control

# Motor types

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

#### Motor identification

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

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

In demanding applications a separate Identification run (ID run) can be performed.

## Settings

99.13 ID run requested (page 319)

# Power loss ride-through

See section Undervoltage control (power loss ride-through) on page 119.

## **Vector control**

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

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

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

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

See also section Speed control performance figures (page 102).

- Menu Primary settings Motor Control mode
- Parameters 99.04 Motor control mode (page 317) and 99.13 ID run requested (page 319).

# 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 Speed scaling or 46.02 Frequency scaling. The user can switch between two preset ramp sets using a binary source such as a digital input. For speed 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 Nominal torque scale).

# 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.

Variable slope is only supported in remote control.

#### Settings

Parameters 23.28 Variable slope enable (page 202) and 23.29 Variable slope rate (page 202).

## Special acceleration/deceleration ramps

The acceleration/deceleration times for the jogging function can be defined separately; see section *Jogging* (page 99).

The change rate of the motor potentiometer function (page 102) is adjustable. The same rate applies in both directions.

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

# Settinas

- Speed reference ramping: Parameters 23.11...23.15 and 46.01 (pages 200 and 279).
- Torque reference ramping: Parameters 01.30, 26.18 and 26.19 (pages 140 and 212).
- Frequency reference ramping: Parameters 28.71...28.75 and 46.02 (pages 220 and 280).
- Jogging: Parameters 23.20 and 23.21 (page 201).
- Motor potentiometer: Parameter 22.75 (page 199).
- Emergency stop ("Off3" mode): Parameter 23.23 Emergency stop time (page 201).

# 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.

# Settinas

- Menu Primary settings Start, stop, reference Constant frequencies. Menu - Primary settings - Start, stop, reference - Constant speeds
- Parameter groups 22 Speed reference selection (page 192) and 28 Frequency reference chain (page 213).

# **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.

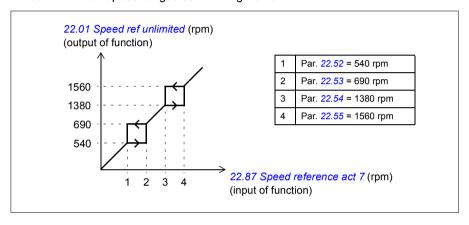
When the drive is limiting the allowed output speeds/frequencies, it limits to the absolutely lowest critical speed (critical speed low or critical frequency low) when accelerating from standstill, unless the speed reference is over the upper critical speed/ frequency limit.

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 to 690 rpm and 1380 to 1560 rpm. To make the drive avoid these speed ranges.

- enable 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.

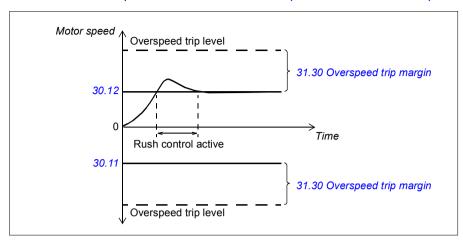


## Settings

- Critical speeds: parameters 22.51...22.57 (page 197)
- Critical frequencies: parameters 28.51...28.57 (page 219).

#### 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 program sets the proportional gain to 10.0 and integration time to 2.0 s.

# **Jogging**

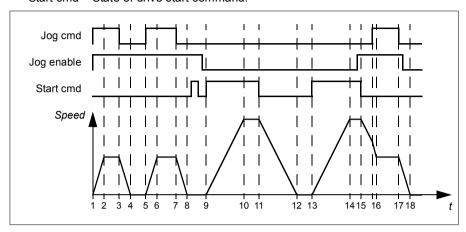
The jogging function enables the use of a momentary switch to briefly rotate the motor. The logging function is typically used during servicing or commissioning to control the machinery locally.

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 enable = State of source set by 20.25 Jogging enable Start cmd = State of drive start command.



Phase	Jog cmd	Jog enable	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 enable signal is on, start commands are ignored. After jog enable 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).
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).

Phase	Jog cmd	Jog enable	Start cmd	Description
14-15	х	0->1	1	Drive follows the speed reference. As long as the start command is on, the jog enable signal is ignored. If the jog enable 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 424.

#### 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 enabled. Starting the drive after the jog enable 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.

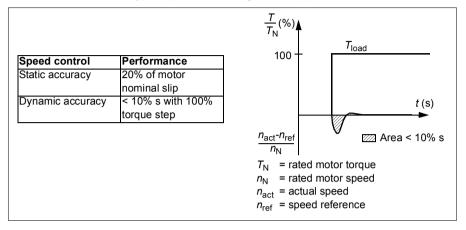
- If both jogging functions are activated, the one that was activated first has priority.
- Jogging uses vector control.
- The inching functions activated through fieldbus (see 06.01 Main control word, bits 8...9) use the references and ramp times defined for jogging, but do not require the jog enable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

# Settings

- Menu Primary settings Start, stop, reference Jogging
- Parameters 20.25 Jogging enable (page 182), 20.26 Jogging 1 start source (page 183), 20.27 Jogging 2 start source (page 183), 22.42 Jogging 1 ref (page 197), 22.43 Jogging 2 ref (page 197), 23.20 Acc time jogging (page 201) and 23.21 Dec time jogging (page 201).

# Speed control performance figures

The table below shows typical performance figures for speed control.



# 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.

		T <sub>N</sub> (%)	
Torque control	Performance	Ι Ι ΙΤ.	
Non-linearity	± 5% with nominal	90· / 'act	
	torque		
	(± 20% at the most	1 1 /:	
	demanding operating	/;	
	point)	1 1/:	
Torque step rise time	< 10 ms with nominal		
	torque		
		10·	<i>t</i> (s)
		$T_{\rm N}$ = rated motor torque	
		$T_{\text{ref}}$ = torque reference	
		$T_{act}$ = actual torque	

#### Scalar motor control

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

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

- If the exact nominal motor values are not available or the drive needs to run different motor after the commissioning phase
- If a short commissioning time is needed or no ID run is wanted
- In multimotor drives: 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.

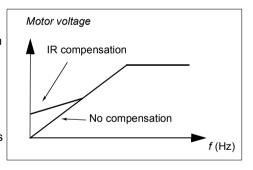
In scalar control, some standard features are not available.

See also section Operating modes of the drive (page 89).

# 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 that require a high break-away torque.

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



## Settings

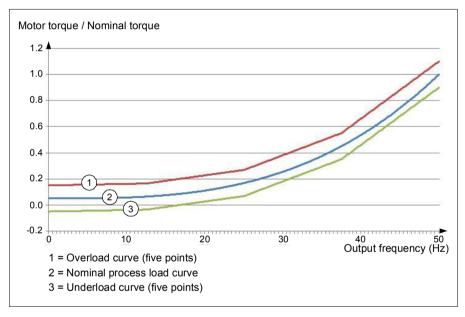
- Menu Primary settings Motor IR compensation
- Parameters 97.13 IR compensation (page 314) and 99.04 Motor control mode (page 317)
- Parameter group 28 Frequency reference chain (page 213).

#### 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**

Parameter group 37 User load curve (page 258).

#### 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.

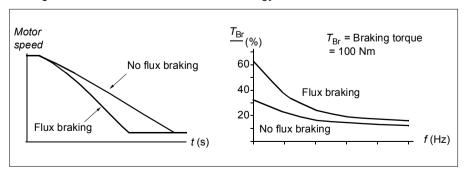
The *U*/f function cannot be used with energy optimization; if parameter 45.11 Energy optimizer is set to Enable, parameter 97.20 U/F ratio is ignored.

## Settings

- Menu Primary settings Motor U/f ratio
- Parameter 97.20 U/F ratio (page 314).

# 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 313).

# DC magnetization

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

#### Pre-magnetization

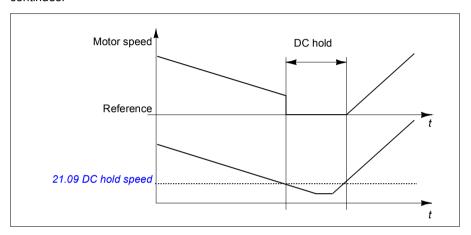
Pre-magnetization refers to DC magnetization of the motor before start. Depending on the selected start mode (21.01 Vector start mode or 21.19 Scalar start mode), pre-magnetization can be applied to guarantee the highest possible breakaway torque, up to 200% of the nominal torque of the motor. By adjusting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

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

#### DC hold

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



#### Settings

Parameters 21.08 DC current control and 21.09 DC hold speed

### Post-magnetization

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

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

#### Settings

Parameters 21.01 Vector start mode, 21.02 Magnetization time and 21.08...21.11 (page 188).

## 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 activated when the drive is in the stopped state, and starting the drive stops the heating.

The heating is started 60 seconds after zero speed has been reached or modulation has been stopped to prevent excessive current if coast stop is used.

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

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

#### Notes:

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

#### Settings

- Menu Primary settings Motor Pre-heating
- Parameters 21.14 Pre-heating input source and 21.16 Pre-heating current (page 188)

# 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 a permanent magnet motor, energy optimization is always enabled.

#### Settings

- Menu Energy efficiency
- Parameter 45.11 Energy optimizer (page 278)

# Switching frequency

The drive has two switching frequencies: reference switching frequency and minimum switching frequency. The drive tries to keep the highest allowed switching frequency (= reference switching frequency) if thermally possible, and then adjusts dynamically between the reference and minimum switching frequencies depending on the drive temperature. When the drive reaches the minimum switching frequency

(= lowest allowed switching frequency), it starts to limit output current as the heating up continues.

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

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

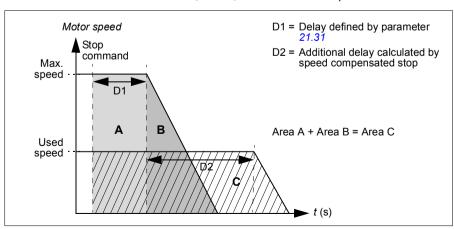
**Example 2:** If the reference switching frequency is set to 12 kHz and the minimum switching frequency is set to 1.5 kHz, the drive maintains the highest possible switching frequency to reduce motor noise and only when the drive heats it will decrease the switching frequency. This is useful, for example, in applications where low noise is necessary but higher noise can be tolerated when the full output current is needed.

#### Settings

Parameter 97.01 Switching frequency reference and 97.02 Minimum switching frequency (page 305).

## 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.



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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

Parameters 21.30 Speed compensated stop mode (page 191), 21.31 Speed compensated stop delay (page 191) and 21.32 Speed comp stop threshold (page 191).

# **Application control**

#### Control macros

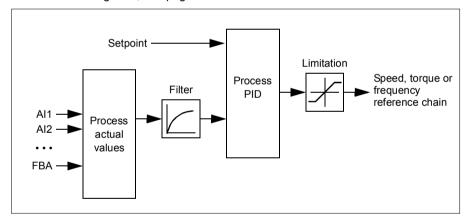
Control macros are predefined parameter edits and I/O configurations. See chapter Control macros (page 59).

#### **Process PID control**

There is a built-in process PID controller in the drive. The controller can be used to control process 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 430 and 431.



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 86).

### Quick configuration of the process PID controller

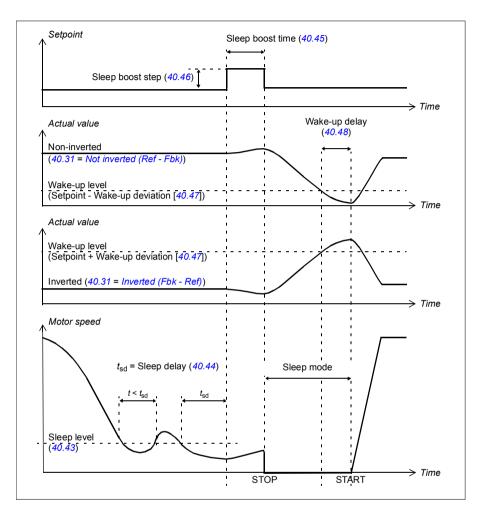
- Activate the process PID controller: Menu Primary settings PID PID controls
- 2. Select a feedback source: Menu Primary settings PID Feedback
- 3. Select a setpoint source: Menu Primary settings PID Setpoint
- Set the gain, integration time, derivation time: Menu Primary settings PID -Tuning
- 5. Set the PID output limits: Menu Primary settings PID PID output
- 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

- Menu Primary settings PID
- Parameter 96.04 Macro select (macro selection)
- Parameter groups 40 Process PID set 1 (page 261) and 41 Process PID set 2 (page 272).

# 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.

#### 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 118).

#### 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).

#### Settinas

- Parameter 96.04 Macro select (macro selection)
- Parameter group 10 Standard DI, RO (page 150)
- Parameter group 40 Process PID set 1 (page 261)
- Parameter groups 76 PFC configuration (page 299) and 77 PFC maintenance and monitoring (page 305).

#### 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 116. The tables below the state diagram detail the states and transitions. The timing diagram on page 117 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

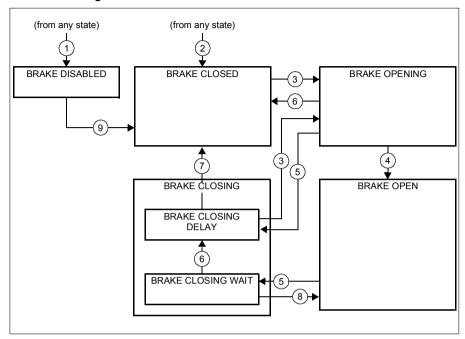
The mechanical brake is to be controlled by bit 0 of parameter 44.01 Brake control status. This bit should be selected as the source of a relay output (or a digital input/output in output mode) which is then wired to the brake actuator through a relay. See the wiring example on page 118.

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

Parameter group 44 Mechanical brake control (page 275).

# Brake state diagram



# State descriptions

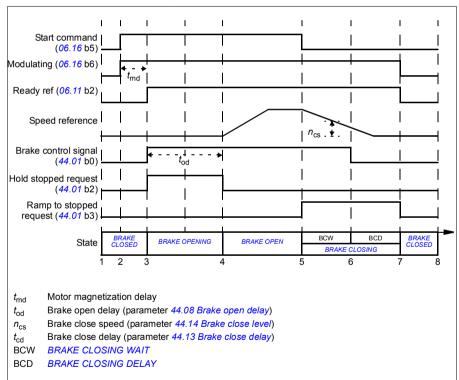
State name	Description			
BRAKE DISABLED	Brake control is disabled (parameter 44.06 Brake control enable = 0, and 44.01 Brake control status b4 = 0). The open signal is active (44.01 Brake control status b0 = 1).			
BRAKE OPENING:	Brake has been requested to open. (44.01 Brake control status b2 = 1). 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.			
BRAKE CLOSING:	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 → 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.
- Brake has been requested to open.
- Brake control enabled (parameter 44.06 Brake control enable → 1).

# Timing diagram

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

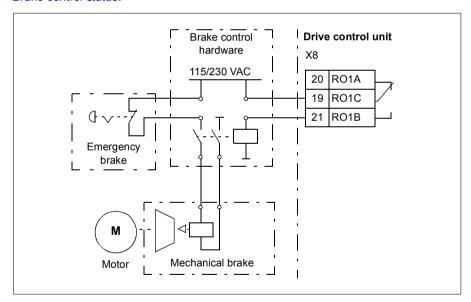


### Wiring example

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.



#### Timed functions

**TBA** 

#### Settings

Parameter group 34 Timed functions (page 240).

# DC voltage control

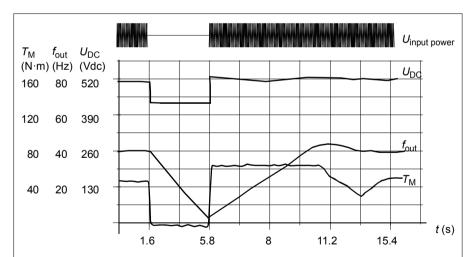
# Overvoltage control

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.

# Undervoltage control (power loss ride-through)

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

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



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

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

### Implementing the undervoltage control (power loss ride-through)

Implement the undervoltage control function as follows:

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

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



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

#### **Automatic restart**

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

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

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

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

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

# Voltage control and trip limits

The control and trip limits of the intermediate DC voltage regulator are relative to the supply voltage as well as drive/inverter type. The DC voltage ( $U_{\rm DC}$ ) 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 bus voltage levels in volts. All voltages are relative to the supply voltage range selected in parameter 95.01 Supply voltage.

	Supply voltage range [V] (see 95.01 Supply voltage)			
Level	200240	380415	440480	575600
Overvoltage fault limit	421	842	842	1053
Overvoltage control limit	390	780	780	974
Internal brake chopper at 100% pulse width	390	780	780	974
Internal brake chopper at 0% pulse width	378	760	760	949
Overvoltage warning limit	373	745	745	932
DC voltage at upper bound of supply voltage range $(U_{DCmax})$	324	560	648	810
DC voltage at lower bound of supply voltage range $(U_{\rm DCmin})$	230	513	594	709
Undervoltage warning limit	239	436	505	60
Undervoltage control limit	211	385	446	532
Charging activation/standby limit	183	334	386	461
Undervoltage fault limit	126	231	267	319

## Settings

Parameters 01.11 DC voltage (page 139), 30.30 Overvoltage control (page 228), 30.31 Undervoltage control (page 228), 95.01 Supply voltage (page 305) and 95.02 Adaptive voltage limits (page 306).

# 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 operates on the pulse width modulation principle.

The internal brake choppers in the drive (in frames R0...R3) start conducting when the DC link voltage reaches approximately 1.15  $\times$   $U_{DCmax}$ . 100% maximum pulse width is reached at approximately  $1.2 \times U_{DCmax}$ . ( $U_{DCmax}$  is the DC voltage corresponding to the maximum of the AC supply voltage range.) For information on external brake choppers, refer to their documentation.

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

#### Settings

Parameter 01.11 DC voltage (page 139); parameter group 43 Brake chopper (page 273).

# 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 119.

#### DC undervoltage

See section *Undervoltage control* (power loss ride-through) on page 119.

#### **Drive temperature**

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

#### Short circuit

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

# Emergency stop

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

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

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

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

#### Notes:

 The installer of the equipment is responsible for installing the emergency stop devices and all additional devices needed for the emergency stop function to fulfill the required emergency stop categories. For more information, contact your local ABB representative.

- After an emergency stop signal is detected, the emergency stop function cannot be canceled even though the signal is canceled.
- If the minimum (or maximum) torque limit is set to 0%, the emergency stop function may not be able to stop the drive.

#### Settinas

- · Menu Primary settings Start, stop, reference Run permissions
- Parameters 21.04 Emergency stop mode (page 185), 21.05 Emergency stop source (page 185), 23.23 Emergency stop time (page 201), 31.32 Emergency ramp supervision (page 233) and 31.33 Emergency ramp supervision delay (page 234).

## 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:

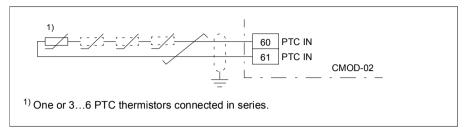
- 1. When power is applied to the drive for the first time, the motor is assumed to be at ambient temperature (defined by parameter 35.50 Motor ambient temperature). After this, when power is applied to the drive, the motor is assumed to be at the estimated temperature.
- 2. Motor temperature is calculated using the user-adjustable motor thermal time and motor load curve. The load curve should be adjusted in case the ambient temperature exceeds 30 °C.

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

# Temperature monitoring using PTC sensors

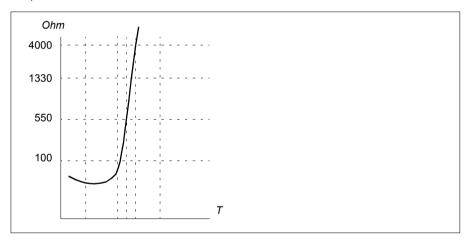
PTC sensors are connected through a CMOD-02 multifunction module (see chapter Optional I/O extension modules, section CMOD-02 multifunction extension module

(external 24 V AC/DC and isolated PTC interface) in the Hardware manual of the drive).



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

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



# 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.

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

#### Temperature monitoring using Pt1000 sensors

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

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

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

#### Temperature monitoring using 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.

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

#### Temperature monitoring using KTY84 sensors

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

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

The figure and table on page 126 show typical KTY84 sensor resistance values as a function of the motor operating temperature.

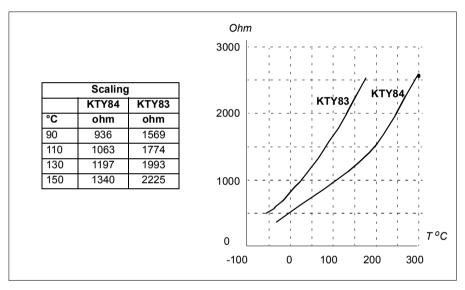
For the wiring of the sensor, see chapter Electrical installation, Al1 and Al2 as Pt100. Pt1000, Ni1000, KTY83 and KTY84 sensor inputs (X1) in the Hardware manual of the drive.

### Temperature monitoring using KTY83 sensors

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

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

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



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

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

#### Settings

- Menu Primary settings Motor Thermal protection estimated,
   Menu Primary settings Motor Thermal protection measured
- Parameter group 35 Motor thermal protection (page 247).

# **Programmable protection functions**

## External events (parameters 31.01...31.10)

Five different event signals from the process can be connected to selectable inputs to generate trips and warnings for the driven equipment. When the signal is lost, an external event (fault, warning, or a mere log entry) is generated. The contents of the messages can be edited on the control panel by selecting Menu - Primary settings -Advanced functions - External events.

#### Motor phase loss detection (parameter 31,19)

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

### Earth (Ground) fault detection (parameter 31.20)

#### Note that

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

# Supply phase loss detection (parameter 31.21)

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

## Safe torque off detection (parameter 31.22)

The drive monitors the status of the Safe torque off input, and this parameter selects which indications are given when the signals are lost. (The parameter does not affect the operation of the Safe torque off function itself). For more information on the Safe torque off function, see chapter Planning the electrical installation, section Implementing the Safe torque off function in the Hardware manual of the drive.

## Swapped supply and motor cabling (parameter 31.23)

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

#### Stall protection (parameters 31.24...31.28)

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

### Overspeed protection (parameter 31.30)

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

#### Local control loss detection (parameter 49.05)

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

## Al supervision (parameters 12.03...12.04)

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

#### Automatic fault resets

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

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

#### Settings

- Menu Primary settings Advanced functions Autoreset faults
- Parameters 31.12...31.16 (page 230).

# **Diagnostics**

# Signal supervision

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

The supervised signal is low-pass filtered.

#### Settings

Parameter group 32 Supervision (page 234).

# **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 129).

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

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

## Settings

- Menu Energy efficiency
- Parameter group 45 Energy efficiency (page 276).
- Parameters 01.50 Current hour kWh. 01.51 Previous hour kWh. 01.52 Current day kWh and 01.53 Previous day kWh on page 140.

# Load analyzer

#### Peak value logger

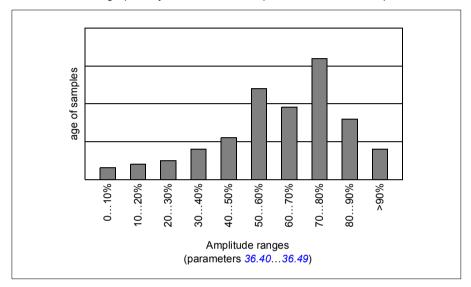
The user can select a signal to be monitored by a peak value logger. The logger records the peak value of the signal along with the time the peak occurred, as well as motor current, DC voltage and motor speed at the time of the peak. The peak value is sampled at 2 ms intervals.

## **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 ( $I_{max}$ ). The measured current is logged continuously. The distribution of samples is shown by parameters 36.20...36.29.

#### Settings

- Menu Diagnostics Load profile
- Parameter group 36 Load analyzer (page 255).

## 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
- 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 enable pop-up views showing information on inhibits when you try to start the drive but it is prevented.

#### Settings

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

## Miscellaneous

## Backup and restore

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

#### **Backup**

#### Manual backup

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

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

#### Automatic backup

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

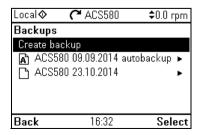
You cannot adjust the delay time or disable the automatic backup function.

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

#### Restore

The backups are shown on the panel. Automatic backups are marked with icon A and manual backups with  $\Box$ . To restore a backup, select it and press (F). 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.





### Settinas

- Menu Backups
- Parameter 96.07 Parameter save manually (page 309).

## 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

- I/O extension module settings (group 15)
- data storage parameters (group 47)
- fieldbus communication settings (groups 50...53 and 58).

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

## Settings

- Menu Primary settings Advanced functions User sets
- Parameters 96.10...96.13 (page 310).

## Data storage parameters

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

#### Settings

Parameter group 47 Data storage (page 282).

# **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 322, 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 59).
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 325).
Other	The value is taken from another parameter.  Choosing "Other" displays a parameter list in which the user can specify the source parameter.
Other [bit]	The value is taken from a specific bit in another parameter.  Choosing "Other" displays a parameter list in which the user can specify the source parameter and bit.
Parameter	Either a user-adjustable operating instruction for the drive, or an <i>actual</i> signal.
p.u.	Per unit
[parameter number]	Value of the parameter

# Summary of parameter groups

Group	Contents	Page
01 Actual values	Basic signals for monitoring the drive.	139
03 Input references	Values of references received from various sources.	141
04 Warnings and faults	Information on warnings and faults that occurred last.	142
05 Diagnostics	Various run-time-type counters and measurements related to drive maintenance.	143
06 Control and status words	Drive control and status words.	144
07 System info	Drive hardware and firmware information.	150
10 Standard DI, RO	Configuration of digital inputs and relay outputs.	150
11 Standard DIO, FI, FO	Configuration of the frequency input.	154
12 Standard AI	Configuration of standard analog inputs.	156
13 Standard AO	Configuration of standard analog outputs.	160
15 I/O extension module	Configuration of the I/O extension module installed in slot 2.	166
19 Operation mode	Selection of local and external control location sources and operating modes.	173
20 Start/stop/direction	Start/stop/direction and run/start/jog enable signal source selection; positive/negative reference enable signal source selection.	174
21 Start/stop mode	Start and stop modes; emergency stop mode and signal source selection; DC magnetization settings.	184
22 Speed reference selection	Speed reference selection; motor potentiometer settings.	192
23 Speed reference ramp	Speed reference ramp settings (programming of the acceleration and deceleration rates for the drive).	200
24 Speed reference conditioning	Speed error calculation; speed error window control configuration; speed error step.	204
25 Speed control	Speed controller settings.	204
26 Torque reference chain	Settings for the torque reference chain.	209
28 Frequency reference chain	Settings for the frequency reference chain.	213
30 Limits	Drive operation limits.	223
31 Fault functions	Configuration of external events; selection of behavior of the drive upon fault situations.	228
32 Supervision	Configuration of signal supervision functions 16.	234
34 Timed functions	Configuration of the timed functions.	240
35 Motor thermal protection	Motor thermal protection settings such as temperature measurement configuration, load curve definition and motor fan control configuration.	247
36 Load analyzer	Peak value and amplitude logger settings.	255
37 User load curve	Settings for user load curve.	258
40 Process PID set 1	Parameter values for process PID control.	261
41 Process PID set 2	A second set of parameter values for process PID control.	272
43 Brake chopper	Settings for the internal brake chopper.	273
44 Mechanical brake control	Configuration of mechanical brake control.	275
45 Energy efficiency	Settings for the energy saving calculators.	276

# 138 Parameters

Group	Contents	Page
46 Monitoring/scaling settings	Speed supervision settings; actual signal filtering; general scaling settings.	
47 Data storage	Data storage parameters that can be written to and read from using other parameters' source and target settings.	282
49 Panel port communication	Communication settings for the control panel port on the drive.	283
50 Fieldbus adapter (FBA)	Fieldbus communication configuration.	284
51 FBA A settings	Fieldbus adapter A configuration.	288
52 FBA A data in	Selection of data to be transferred from drive to fieldbus controller through fieldbus adapter A.	290
53 FBA A data out	Selection of data to be transferred from fieldbus controller to drive through fieldbus adapter A.	290
58 Embedded fieldbus	Configuration of the embedded fieldbus (EFB) interface.	291
71 External PID1	Configuration of external PID.	297
76 PFC configuration	PFC (Pump and fan control) and Autochange configuration parameters. See also section Pump and fan control (PFC) on page 114.	299
77 PFC maintenance and monitoring	PFC (Pump and fan control) and Autochange configuration parameters. See also section Pump and fan control (PFC) on page 114.	305
95 HW configuration	Various hardware-related settings.	305
96 System	Language selection; access levels; macro selection; parameter save and restore; control unit reboot; user parameter sets; unit selection.	
97 Motor control	Switching frequency; slip gain; voltage reserve; flux braking; anticogging (signal injection); IR compensation.	312
98 User motor parameters	Motor values supplied by the user that are used in the motor model.	315
99 Motor data	Motor configuration settings.	316

# **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.	See par. 46.01
01.06	Output frequency	Estimated drive output frequency in Hz. A filter time constant for this signal can be defined by parameter 46.12 Filter time output frequency.	-
	-500.00500.00 Hz	Estimated output frequency.	See par. 46.02
01.07	Motor current	Measured (absolute) motor current in A.	-
	0.0030000.00 A	Motor current.	1 = 1 A
01.08	Motor current % of motor nom	Motor current (drive output current) in percent of the nominal motor current.	-
	0.01000.0%	Motor current.	1 = 1%
01.09	Motor current % of drive nom	Motor current (drive output current) in percent of the nominal drive current.	-
	0.01000.0%	Motor current.	1 = 1%
01.10	Motor torque	Motor torque in percent of the nominal motor torque. See also parameter 01.30 Nominal torque scale.  A filter time constant for this signal can be defined by parameter 46.13 Filter time motor torque.	-
	-1600.01600.0%	Motor torque.	See par. 46.03
01.11	DC voltage	Measured DC link voltage.	-
	0.002000.00 V	DC link voltage.	10 = 1 V
01.13	Output voltage	Calculated motor voltage in V AC.	-
	02000 V	Motor voltage.	1 = 1 V

No.	Name/Value	Description	Def/FbEq16
01.14	Output power	Drive output power. The unit is selected by parameter 96.16 Unit selection. A filter time constant for this signal can be defined by parameter 46.14 Filter time power.	-
	-32768.00 32767.00 kW or hp	Output power.	1 = 1 unit
01.15	Output power % of motor nom	Output power in percent of the nominal motor power.	-
	-300.00 300.00%	Output power.	1 = 1%
01.16	Output power % of drive nom	Output power in percent of the nominal drive power.	-
	-300.00 300.00%	Output power.	1 = 1%
01.17	Motor shaft power	Estimated mechanical power at motor shaft.	-
	-32768.00 32767.00 kW or hp	Motor shaft power.	1 = 1 unit
01.18	Inverter GWh counter	Amount of energy that has passed through the drive (in either direction) in full gigawatt-hours. The minimum value is zero.	-
	065535 GWh	Energy in GWh.	1 = 1 GWh
01.19	Inverter MWh counter	Amount of energy that has passed through the drive (in either direction) in full megawatt-hours. Whenever the counter rolls over, 01.18 Inverter GWh counter is incremented. The minimum value is zero.	-
	01000 MWh	Energy in MWh.	1 = 1 MWh
01.20	Inverter kWh counter	Amount of energy that has passed through the drive (in either direction) in full kilowatt-hours. Whenever the counter rolls over, 01.19 Inverter MWh counter is incremented. The minimum value is zero.	-
	01000 kWh	Energy in kWh.	10 = 1 kWh
01.24	Flux actual %	Used flux reference in percent of nominal flux of motor.	-
	0200%	Flux reference.	1 = 1%
01.30	Nominal torque scale	Torque that corresponds to 100% of nominal motor torque. The unit is selected by parameter 96.16 Unit selection.  Note: This value is copied from parameter 99.12 Motor nominal torque if entered. Otherwise the value is calculated from other motor data.	-
	0.0004000000 N·m or lb·ft	Nominal torque.	1 = 100 unit
01.50	Current hour kWh	Current hour energy consumption. This is the energy of the last 60 minutes (not necessarily continuous) the drive has been running, not the energy of a calendar hour. The value is set to the value before the power cycle when the drive is again up and running.	-
	0.00 1000000.00 kWh	Energy.	1 = 1 kWh
01.51	Previous hour kWh	Previous hour energy consumption. The value 01.50 Current hour kWh is stored here when its values has been cumulated for 60 minutes. The value is set to the value before the power cycle when the drive is again up and running.	-
	0.00 1000000.00 kWh	Energy.	1 = 1 kWh

No.	Name/Value	Description	Def/FbEq16
01.52	Current day kWh	Current day energy consumption. This is the energy of the last 24 hours (not necessarily continuous) the drive has been running, not the energy of a calendar day. The value is set to the value before the power cycle when the drive is again up and running.	-
	0.00 1000000.00 kWh	Energy.	1 = 1 kWh
01.53	Previous day kWh	Previous day energy consumption. The value 01.52 Current day kWh is stored here when its value has been cumulated for 24 hours. The value is set to the value before the power cycle when the drive is again up and running.	-
	0.00 1000000.00 kWh	Energy.	1 = 1 kWh
01.61	Abs motor speed used	Absolute value of parameter 01.01 Motor speed used.	-
	0.00 30000.00 rpm		1 = 1 rpm
01.62	Abs motor speed %	Absolute value of parameter 01.03 Motor speed %.	-
	0.00 1000.00%		1 = 1%
01.63	Abs output frequency	Absolute value of parameter 01.06 Output frequency.	-
	0.00500.00 Hz		1 = 1 Hz
01.64	Abs motor torque	Absolute value of parameter 01.10 Motor torque.	-
	0.01600.0%		1 = 1%
01.65	Abs output power	Absolute value of parameter 01.14 Output power.	-
	0.00 32767.00 kW or hp		1 = 1 kW
01.66	Abs output power % mot nom	Absolute value of parameter 01.15 Output power % of motor nom.	-
	0.00 300.00%		1 = 1%
01.67	Abs output power % drive nom	Absolute value of parameter 01.16 Output power % of drive nom.	-
	0.00 300.00%		1 = 1%
01.68	Abs motor shaft power	Absolute value of parameter 01.17 Motor shaft power.	-
	0.00 30000.00 kW or hp		1 = 1 kW
03 Inp	out references	Values of references received from various sources.	
		All parameters in this group are read-only unless otherwise	

03 Input references		Values of references received from various sources. All parameters in this group are read-only unless otherwise noted.	
03.01 Panel reference		Reference 1 given from the control panel or PC tool.	-
	-100000.00 100000.00 rpm, Hz or %	Control panel or PC tool reference.	1 = 10 unit

No. Name/Value		Description	Def/FbEq16
03.02	Panel reference remote	Reference 2 given from the control panel or PC tool.	-
	-100000.00 100000.00 rpm, Hz or %	Control panel or PC tool reference.	1 = 10 unit
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 405).	-
	-100000.00 100000.00	Reference 1 from fieldbus adapter A.	1 = 10
03.06	FB A reference 2	Reference 2 received through fieldbus adapter A.	-
	-100000.00 100000.00	Reference 2 from fieldbus adapter A.	1 = 10
03.09	EFB reference 1	Scaled reference 1 received through the embedded fieldbus interface.	1 = 10
	-30000.00 30000.00	Scaled reference 1 received through the embedded fieldbus interface.	1 = 10
03.10	EFB reference 2	Scaled reference 2 received through the embedded fieldbus interface.	1 = 10
	-30000.00 30000.00	Scaled reference 2 received through the embedded fieldbus interface.	1 = 10

04 Wa	rnings and faults	Information on warnings and faults that occurred last. For explanations of individual warning and fault codes, see chapter <i>Fault tracing</i> . All parameters in this group are read-only unless otherwise noted.	
04.01	Tripping fault	Code of the 1st active fault (the fault that caused the current trip).	-
	0000hFFFFh	1st active fault.	1 = 1
04.02	Active fault 2	Code of the 2nd active fault.	-
	0000hFFFFh	2nd active fault.	1 = 1
04.03	Active fault 3	Code of the 3rd active fault.	-
	0000hFFFFh	3rd active fault.	1 = 1
04.06	Active warning 1	Code of the 1st active warning.	-
	0000hFFFFh	1st active warning.	1 = 1
04.07	Active warning 2	Code of the 2nd active warning.	-
	0000hFFFFh	2nd active warning.	1 = 1
04.08	Active warning 3	Code of the 3rd active warning.	-
	0000hFFFFh	3rd active warning.	1 = 1
04.11	Latest fault	Code of the 1st stored (non-active) fault.	-
	0000hFFFFh	1st stored fault.	1 = 1
04.12	2nd latest fault	Code of the 2nd stored (non-active) fault.	-
	0000hFFFFh	2nd stored fault.	1 = 1
04.13	3rd latest fault	Code of the 3rd stored (non-active) fault.	-
	0000hFFFFh	3rd stored fault.	1 = 1

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

05 Diagnostics		Various run-time-type counters and measurements related to drive maintenance.  All parameters in this group are read-only unless otherwise noted.	
05.01	On-time counter	On-time counter. The counter runs when the drive is powered.	-
	065535 d	On-time counter.	1 = 1 d
05.02	Run-time counter	Motor run-time counter. The counter runs when the inverter modulates.	-
	065535 d	Motor run-time counter.	1 = 1 d
05.04	Fan on-time counter	Running time of the drive cooling fan. Can be reset from the control panel by keeping Reset down for over 3 seconds.	-
	065535 d	Cooling fan run-time counter.	1 = 1 d
05.10	Control board temperature	Measured temperature of the control board	-
	-100 300 °C or °F	Control board temperature in degrees Celsius or Fahrenheit.	1 = unit
05.11	Inverter temperature	Estimated drive temperature in percent of fault limit. The fault limit varies according to the type of the drive.  0.0% = 0 °C (32 °F)  100.0% = Fault limit	-
	-40.0160.0%	Drive temperature in percent.	1 = 1%
05.22	Diagnostic word 3	Diagnostic word 3. For possible causes and remedies, see chapter Fault tracing.	-

Bit	Name Value				
80	Reserved				
9	kWh pulse	1 = kWh pulse is active.			
10	Reserved				
11	Fan command	1 = Drive fan is rotating above idle speed.			
1215	Reserved				

0000hFFFFh Diagnostic word 3.	1 = 1
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No. Name/Value	Descri	iption	Def/FbEq16	
06 Control and status words	Drive o	Drive control and status words.		
06.01 Main control word	control as digi progra For the and sta respec	e bit descriptions see page 411. The related status word ate diagram are presented on pages 413 and 414	-	
	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		
			1	
0000hFFFFh	Main c	control word.	1 = 1	

No.	Name/Value	Descr	ription	Def/FbEq16		
06.11	Main status word	Main status word  Main status word of the drive.  For the bit descriptions see page 413. The related control word and state diagram are presented on pages 411 and 414 respectively.  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	status word.	1 = 1		

0000h...FFFFh

o. Name/Value Desc			Desc	ription	Def/FbEq16
16	Drive status word 1 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 (are present. <b>Note:</b> This bit is not affected by the present	
	1	Inhibited		1 = Start inhibited. To start the drive, the inhibiting signal 06.18) must be removed and the start signal cycled.	al (see par.
	2	DC charged	t	1 = DC circuit has been charged	
	3	Ready to st	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 controlle	d)
	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 <i>11</i> ).	
	10	Ext1 active		1 = Control location EXT1 active	
	11	Ext2 active		1 = Control location EXT2 active	
	12	Reserved			
	13	Start reques	st	1 = Start requested. 0 = When parameter 20.22 Enable (rotating of the motor is disabled).	to rotate is 0
	1415	Reserved		•	

1 = 1

Drive status word 1.

1 = 1

No.	Name/V	alue	Description	n	Def/FbEq16	
06.17	Drive sta	atus word 2	Drive statu	s word 2.	-	
			This param	neter is read-only.		
	Bit	Name		Description		
	0	Identificatio	n run done	1 = Motor identification (ID) run has been performe	d	
	1	Magnetized		1 = The motor has been magnetized		
	2	Torque con	trol	1 = Torque control mode active		
	3	Speed cont	rol	1 = Speed control mode active		
	4	Reserved				
	5	Safe reference active		1 = A "safe" reference is applied by functions such as parameters 49.05 and 50.02		
	6	Last speed active		1 = A "last speed" reference is applied by functions such as parameters 49.05 and 50.02		
	7	Loss of refe	erence	1 = Reference signal lost		
	8	Emergency	stop failed	1 = Emergency stop failed (see parameters 31.32 and 31.33)		
	9	Jogging act	ive	1 = Jogging enable signal is on		
	10	Above limit		1 = Actual speed, frequency or torque equals or excee (defined by parameters 46.3146.33). Valid in both directation.		
	1112	Reserved				
	13	Start delay	active	1 = Start delay (par. 21.22) active.		
	1415	Reserved		•		

Drive status word 2.

0000h...FFFFh

	Name/	Value	Description	on	Def/FbEq16	
5.18	Start in word	hibit status	inhibiting s The condit the start of inhibiting of 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. Sparameter 06.16 Drive status word 1, bit 1. In the interior is read-only.	-	
	Bit	Bit Name		Description		
	0	Not ready i	un	1 = DC voltage is missing or drive has not been par correctly. Check the parameters in groups 95 and 9		
	1	Ctrl location	n changed	* 1 = Control location has changed		
	2	SSW inhibi	t	1 = Control program is keeping itself in inhibited sta	ate	
	3	Fault reset		* 1 = A fault has been reset		
	4	Lost start e	nable	1 = Start enable signal missing		
	5	Lost run er	able	1 = Run enable signal missing		
	6	Reserved				
	7	STO		1 = Safe torque off function active		
	8	Current cal ended	ibration	* 1 = Current calibration routine has finished		
	9	ID run ende	ed	* 1 = Motor identification run has finished		
	10	Reserved		•		
	11	Em Off1		1 = Emergency stop signal (mode off1)		
	12	Em Off2		1 = Emergency stop signal (mode off2)		
	13	Em Off3		1 = Emergency stop signal (mode off3)		
	14	Auto reset	inhibit	1 = The autoreset function is inhibiting operation		
	15	Jogging ac	ive 1 = The jogging enable signal is inhibiting operation			
			T		T	
			Start inhibit status word.			
		FFFFh			1 = 1	
6.19	Speed	control	Speed cor	ntrol status word.	1 = 1	
5.19		control	Speed cor			
5.19	Speed status	control word	Speed cor This parar	ntrol status word. neter is read-only.  Description		
5.19	Speed status	control word	Speed cor This parar	ntrol status word. neter is read-only.    Description	-	
5.19	Speed status	control word	Speed cor This parar	Description   1 = Drive is running at zero speed   1 = Drive is running in forward direction above zero (par. 21.06)	ro speed limit	
5.19	Speed status  Bit	control word  Name Zero speed	Speed cor This parar	ntrol status word. neter is read-only.    Description	ro speed limit	
5.19	Speed status  Bit 0 1	Name Zero speed Forward	Speed cor This parar	Description  1 = Drive is running in forward direction above zer (par. 21.06)  1 = Drive is running in reverse direction above zer	ro speed limit	
5.19	Speed status  Bit 0 1	control word  Name Zero speed Forward Reverse	Speed cor This parar	Description  1 = Drive is running in forward direction above zer (par. 21.06)  1 = Drive is running in reverse direction above zer	ro speed limit	
5.19	Speed status  Bit 0 1 2 36	control word  Name Zero speed Forward Reverse Reserved Any consta	Speed cor This parar	Description  1 = Drive is running at zero speed  1 = Drive is running in forward direction above zero (par. 21.06)  1 = Drive is running in reverse direction above zero (par. 21.06)  1 = A constant speed or frequency has been selected.	ro speed limit	
55.19	Speed status     Bit   0   1     2     36     7	Name Zero speed Forward Reverse Reserved Any constarequest	Speed cor This parar	Description  1 = Drive is running at zero speed  1 = Drive is running in forward direction above zero (par. 21.06)  1 = Drive is running in reverse direction above zero (par. 21.06)  1 = A constant speed or frequency has been selected.	ro speed limit	

No.	Name/Value	Description	Def/FbEq16
06.20	Constant speed status word	Constant speed/frequency status word. Indicates which constant speed or frequency is active (if any). See also parameter 06.19 Speed control status word, bit 7, and section Constant speeds/frequencies (page 97).  This parameter is read-only.	-

Bit	Name	Description
0	Constant speed 1	1 = Constant speed or frequency 1 selected
1	Constant speed 2	1 = Constant speed or frequency 2 selected
2	Constant speed 3	1 = Constant speed or frequency 3 selected
3	Constant speed 4	1 = Constant speed or frequency 4 selected
4	Constant speed 5	1 = Constant speed or frequency 5 selected
5	Constant speed 6	1 = Constant speed or frequency 6 selected
6	Constant speed 7	1 = Constant speed or frequency 7 selected
715	Reserved	

		0000hFFFFh	Constant speed/frequency status word.	1 = 1
ĺ	06.21	Drive status word 3	Drive status word 3.	-
			This parameter is read-only.	

Bit	Name	Description
0	DC hold active	1 = DC hold is active
1	Post-magnetizing active	1 = Post-magnetizing is active
2	Motor pre-heating active	1 = Motor pre-heating is active
315	Reserved	

	0000hFFFFh	Drive status word 1.	1 = 1
06.30	MSW bit 11 selection	Selects a binary source whose status is transmitted as bit 11 (User bit 0) of 06.11 Main status word.	Ext ctrl loc
	False	0.	0
	True	1.	1
	Ext ctrl loc	Bit 11 of 06.01 Main control word (see page 145).	2
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page <i>136</i> ).	-
06.31	MSW bit 12 selection	Selects a binary source whose status is transmitted as bit 12 (User bit 1) of 06.11 Main status word.	Ext run enable
	False	0.	0
	True	1.	1
	Ext run enable	Status of the external run enable signal (see parameter 20.12 Run enable 1 source).	2
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page <i>136</i> ).	-
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 136).	-

No.	Name/Va	lue	Description	Def/FbEq16	
06.33	MSW bit 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 [bi	t]	Source selection (see <i>Terms and abbreviations</i> on page 136).	-	
07 System info			Drive hardware and firmware information. All parameters in this group are read-only.		
07.03	Drive rati	ng id	Type of the drive/inverter unit.	-	
07.04	Firmware	name	Firmware identification.	-	
07.05	Firmware	eversion	Version number of the firmware.	-	
07.06	Loading <sub>I</sub>	oackage	Name of the firmware loading package.	-	
07.07	Loading   version	oackage	Version number of the firmware loading package.	-	
07.11	Cpu usag	ge	Microprocessor load in percent.	-	
	0100%	)	Microprocessor load.	1 = 1%	
10 Sta	ndard DI	, RO	Configuration of digital inputs and relay outputs.		
10.02	DI delaye	ed status	Displays the status of digital inputs DI1DI6. Bits 05 reflect the delayed status of DI1DI6.  This word is updated only after a 2 ms activation/deactivation delay. When the value of a digital input changes, it must remain the same in two consecutive samples, that is for 2 ms, for the new value to be accepted.  This parameter is read-only.	-	
	0000hl	FFFh	Delayed status of digital inputs.	1 = 1	
10.03			The electrical statuses of the digital inputs can be overridden for eg. testing purposes. A bit in parameter 10.04 DI forced data is provided for each digital input, and its value is applied whenever the corresponding bit in this parameter is 1.  Note: Boot and power cycle reset the force selections (parameters 10.03 and 10.04).	0000h	
	Bit	Value			
	0	1 = Force D	II1 to value of bit 0 of parameter 10.04 DI forced data.		
	1	1 = Force D	12 to value of bit 1 of parameter 10.04 DI forced data.		
	2		l3 to value of bit 2 of parameter 10.04 DI forced data.		
	3		14 to value of bit 3 of parameter 10.04 DI forced data.		
	4		Il5 to value of bit 4 of parameter 10.04 DI forced data.		
	5		16 to value of bit 5 of parameter 10.04 DI forced data.		
	615	Reserved			
	0000hI	FFFFh	Override selection for digital inputs.	1 = 1	
	0000111			l · · ·	

11

12

13 14

15

16

17

No.	Name/V	/alue	Description	Def/FbEq16	
10.04	DI force	d data	Allows the data value of a forced digital input to be changed from 0 to 1. It is only possible to force an input that has been selected in parameter 10.03 DI force selection.  Bit 0 is the forced value for DI1; bit 5 is the forced value for	0000h	
			the DI6.		
	0000h	.FFFFh	Forced values of digital inputs.	1 = 1	
10.21	RO stat	us	Status of relay outputs RO3RO1. Example: 00000001b = RO1 is energized, RO2RO3 are de-energized.	-	
	0000h	.FFFFh	Status of relay outputs.	1 = 1	
10.22	RO forc	e selection	The signals connected to the relay outputs can be overridden for eg. testing purposes. A bit in parameter 10.23 RO forced data is provided for each relay output, and its value is applied whenever the corresponding bit in this parameter is 1.  Note: Boot and power cycle reset the force selections (parameters 10.22 and 10.23).		
	Bit	Value			
	1 = Force RO1 to value of bit 0 of parameter 10.23 RO forced data.				
	1				
	2	1 = Force RO3 to value of bit 2 of parameter 10.23 RO forced data.			
	37 Reserved				
	0000h	TTTTh.	Override colection for relevants	1 = 1	
40.00			Override selection for relay outputs.	1=1	
10.23	RO forc	ed data	Contains the values of relay outputs that are used instead of the connected signals if selected in parameter 10.22 RO force selection. Bit 0 is the forced value for RO1.		
	0000h	.FFFFh	Forced RO values.	1 = 1	
10.24	RO1 so	urce	Selects a drive signal to be connected to relay output RO1.	Ready run	
	Not ene	rgized	Output is not energized.	0	
	Energiz	ed	Output is energized.	1	
	Ready r	un	Bit 1 of 06.11 Main status word (see page 145).	2	
	Enabled	1	Bit 0 of 06.16 Drive status word 1 (see page 146).	4	
	Started		Bit 5 of 06.16 Drive status word 1 (see page 146).	5	
	Magneti	zed	Bit 1 of 06.17 Drive status word 2 (see page 147).	6	
	Running	)	Bit 6 of 06.16 Drive status word 1 (see page 146).	7	
	Ready r	ef	Bit 2 of 06.11 Main status word (see page 145).	8	
	At setpo	oint	Bit 8 of 06.11 Main status word (see page 145).	9	
	Reverse	<del></del>	Bit 2 of 06.19 Speed control status word (see page 148).	10	

Bit 0 of 06.19 Speed control status word (see page 148).

Inverted bit 3 of 06.11 Main status word (see page 145).

Bit 3 of 06.11 Main status word OR bit 7 of 06.11 Main status

Bit 10 of 06.17 Drive status word 2 (see page 147).

Bit 7 of 06.11 Main status word (see page 145).

Bit 3 of 06.11 Main status word (see page 145).

Fault 2310 Overcurrent has occurred.

word (see page 145).

Zero speed

Above limit

Warning

Fault (-1)

Fault/Warning

Overcurrent

Fault

No.	Name/Value	Description	Def/FbEq16
	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 275).	22
	Ext2 active	Bit 11 of 06.16 Drive status word 1 (see page 146).	23
	Remote control	Bit 9 of 06.11 Main status word (see page 145).	24
	MCB	Reserved	25
	Timed function 1	Bit 0 of 34.01 Combined timer status (see page 240).	27
	Timed function 2	Bit 1 of 34.01 Combined timer status (see page 240).	28
	Timed function 3	Bit 2 of 34.01 Combined timer status (see page 240).	29
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 234).	33
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 234).	34
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 234).	35
	Start delay	Bit 13 of 06.17 Drive status word 2 (see page 147).	39
	RO/DIO control word bit0	Bit 0 of 10.99 RO/DIO control word (see page 154).	40
	RO/DIO control word bit1	Bit 1 of 10.99 RO/DIO control word (see page 154).	41
	RO/DIO control word bit2	Bit 2 of 10.99 RO/DIO control word (see page 154).	42
	PFC1	Bit 0 of 76.01 PFC status (see page 299).	43
	PFC2	Bit 1 of 76.01 PFC status (see page 299).	44
	PFC3	Bit 2 of 76.01 PFC status (see page 299).	45
	PFC4	Bit 3 of 76.01 PFC status (see page 299).	46
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page <i>136</i> ).	-
10.25	RO1 ON delay	Defines the activation delay for relay output RO1.	0.0 s
	Status of selected source		1 0 1 1
	t <sub>On</sub> = 10.25 RO1 ON del t <sub>Off</sub> = 10.26 RO1 OFF de		
	0.0 3000.0 s	Activation delay for RO1.	10 = 1 s

No.	Name/Value	Description	Def/FbEq16
10.26	RO1 OFF delay	Defines the deactivation delay for relay output RO1. See parameter 10.25 RO1 ON delay.	0.0 s
	0.0 3000.0 s	Deactivation delay for RO1.	10 = 1 s
10.27	RO2 source	Selects a drive signal to be connected to relay output RO2. For the available selections, see parameter 10.24 RO1 source.	Running
10.28	RO2 ON delay	Defines the activation delay for relay output RO2.	0.0 s
	Status of selected source		1 0 1
	RO status — — —		──── 0 ────────────────────────────────
	t <sub>On</sub> = 10.28 RO2 ON de t <sub>Off</sub> = 10.29 RO2 OFF de		
	0.0 3000.0 s	Activation delay for RO2.	10 = 1 s
10.29	RO2 OFF delay	Defines the deactivation delay for relay output RO2. See parameter 10.28 RO2 ON delay.	0.0 s
	0.0 3000.0 s	Deactivation delay for RO2.	10 = 1 s
10.30	RO3 source	Selects a drive signal to be connected to relay output RO3. For the available selections, see parameter 10.24 RO1 source.	Fault (-1)
10.31	RO3 ON delay	Defines the activation delay for relay output RO3.	0.0 s
	Status of selected source		0
	RO status — —		1
	$t_{\rm On}$ = 10.31 RO3 ON de $t_{\rm Off}$ = 10.32 RO3 OFF de	$t_{ m On}$ $t_{ m Off}$ $t_{ m On}$ $t_{ m Off}$	
	0.0 3000.0 s	Activation delay for RO3.	10 = 1 s
10.32	RO3 OFF delay	Defines the deactivation delay for relay output RO3. See parameter 10.31 RO3 ON delay.	0.0 s
	0.0 3000.0 s	Deactivation delay for RO3.	10 = 1 s

No.	Name/\	/alue	Description	Def/FbEq16
10.99	RO/DIO control word		Storage parameter for controlling the relay outputs eg. through the embedded fieldbus interface. To control the relay outputs (RO) of the drive, send a control word with the bit assignments shown below as Modbus I/O data. Set the target selection parameter of that particular data (58.10158.114) to RO/DIO control word. In the source selection parameter of the desired output, select the appropriate bit of this word.	0000h
	Bit	Name	Description	
	0	RO1	Source bits for relay outputs RO1RO3 (see parameters	3 10.24, 10.27
	1	RO2	and 10.30) and RO4RO5 (with an extension module).	,
	2	RO3		
	3	RO4		
	4	RO5		
	515	Reserved		
			<u></u>	
	0000h.	FFFFh	RO control word.	1 = 1
10.101	RO1 to	ggle counter	Displays the number of times relay output RO1 has changed states.	-
	0429	4967000	State change count.	1 = 1
10.102	RO2 to	ggle counter	Displays the number of times relay output RO2 has changed states.	-
	0429	4967000	State change count.	1 = 1
10.103	RO3 to	ggle counter	Displays the number of times relay output RO3 has changed states.	-
	0429	4967000	State change count.	1 = 1
44.04-		VO 51 50	Confirmation of the formation to	
		010, FI, FO	Configuration of the frequency input.	
11.25	DI6 cor	nfiguration	Selects how digital input 6 is used.	Digital input
	Digital i	nput	DI6 is used as a digital input.	0
	Freque	ncy input	DI6 is used as a frequency input.	1
11.38	Freq in value	1 actual	Displays the value of frequency input 1 (via DI6 when it is used as a frequency input) before scaling. See parameter 11.42 Freq in 1 min.  This parameter is read-only.	-
	0 16	000 Hz	Unscaled value of frequency input 1.	1 = 1 Hz
11.39	Freq in value	1 scaled	Displays the value of frequency input 1 (via DI6 when it is used as a frequency input) after scaling. See parameter 11.42 Freq in 1 min.  This parameter is read-only.	-

Scaled value of frequency input 1.

-32768.000... 32767.000 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 (DI6 when it is used as a frequency input). The incoming frequency signal (11.38 Freq in 1 actual value) is scaled into an internal signal (11.39 Freq in 1 scaled value) by parameters 11.4211.45 as follows:  11.45  11.44  11.44  11.44  11.45  11.48	0 Hz
	0 16000 Hz	Minimum frequency of frequency input 1 (DI6).	1 = 1 Hz
11.43	Freq in 1 max	Defines the maximum for the frequency actually arriving at frequency input 1 (DI6 when it is used as a frequency input). See parameter 11.42 Freq in 1 min.	16000 Hz
	0 16000 Hz	Maximum frequency for frequency input 1 (DI6).	1 = 1 Hz
11.44	Freq in 1 at scaled min	Defines the value that is required to correspond internally to the minimum input frequency defined by parameter 11.42 Freq in 1 min. See diagram at parameter 11.42 Freq in 1 min.	0.000
	-32768.000 32767.000	Value corresponding to minimum of frequency input 1.	1 = 1
11.45	Freq in 1 at scaled max	Defines the value that is required to correspond internally to the maximum input frequency defined by parameter 11.43  Freq in 1 max. See diagram at parameter 11.42 Freq in 1 min.	1500.000
	-32768.000 32767.000	Value corresponding to maximum of frequency input 1.	1 = 1

No.	Name/Value Description			Def/FbEq16
12 Standard AI		ļ	Configuration of standard analog inputs.	
12.02	Al force selection		The true readings of the analog inputs can be overridden for eg. testing purposes. A forced value parameter is provided for each analog input, and its value is applied whenever the corresponding bit in this parameter is 1.  Note: Al filter times (parameters 12.16 Al1 filter time and 12.26 Al2 filter time) have no effect on forced Al values (parameters 12.13 Al1 forced value and 12.23 Al2 forced value).  Note: Boot and power cycle reset the force selections (parameters 12.02 and 12.03).	0000h
	Bit	Value		
	0	1 = Force A	I11 to value of parameter 12.13 Al1 forced value.	
	1	1 = Force A	xl2 to value of parameter 12.23 Al2 forced value.	
	27	Reserved		
	00001		I	
	0000h	FFFFh	Forced values selector for analog inputs Al1 and Al2.	1 = 1
12.03 Al supervision function		vision	Selects how the drive reacts when an analog input signal moves out of the minimum and/or maximum limits specified for the input.  The inputs and the limits to be observed are selected by parameter 12.04 Al supervision selection.	No action
	No action		No action taken.	0
	Fault		Drive trips on 80A0 AI supervision.	1
	Warning Last speed Speed ref safe		Drive generates an A8A0 AI supervision warning.	2
			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
			Drive generates a warning (A8A0 Al supervision) and sets the speed to the speed defined by parameter 22.41 Speed ref safe (or 28.41 Frequency ref safe when frequency reference is being used).  WARNING! Make sure that it is safe to continue operation in case of a communication break.	4
12.04	Al super selection		Specifies the analog input limits to be supervised. See parameter 12.03 Al supervision function.	0000h
	Bit	Name	Description	
	0	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	Al2 > MAX	1 = Maximum limit supervision of Al2 active.	
	415	Reserved	. Maximum mine daporviolon or 742 douve.	
	710	i resei ven		
	0000hFFFFh		Activation of analog input supervision.	1 = 1

No.	Name/Value	Description	Def/FbEq16
12.11	Al1 actual value	Displays the value of analog input Al1 in mA or V (depending on whether the input is set to current or voltage by a hardware setting).  This parameter is read-only.	-
		, ,	1000 1 11
	0.00020.000 mA or 0.00010.000 V	Value of analog input Al1.	1000 = 1 unit
12.12	Al1 scaled value	Displays the value of analog input Al1 after scaling. See parameters 12.19 Al1 scaled at Al1 min and 12.20 Al1 scaled at Al1 max.  This parameter is read-only.	-
	-32768.000 32767.000	Scaled value of analog input Al1.	1 = 1
12.13	Al1 forced value	Forced value that can be used instead of the true reading of the input. See parameter 12.02 Al force selection.	-
	0.00020.000 mA or 0.00010.000 V	Forced value of analog input Al1.	1000 = 1 unit
12.15	Al1 unit selection	Selects the unit for readings and settings related to analog input A11.  Note: This setting must match the corresponding hardware setting on the drive control unit. See chapter Electrical installation, section Switches in the Hardware manual of the drive and the default control connections for the macro in use in chapter Control macros (page 59). Control board reboot (either by cycling the power or through parameter 96.08 Control board boot) is required to validate any changes in the hardware settings.	V
	V	Volts.	2
	mA	Milliamperes.	10
12.16	Al1 filter time	Defines the filter time constant for analog input Al1.	0.100 s
		Unfiltered signal  Filtered signal	
		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.	

No.	Name/Value	Description	Def/FbEq16
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.	4.000 mA or 0.000 V
	0.00020.000 mA or 0.00010.000 V	Minimum value of Al1.	1000 = 1 unit
12.18	Al1 max	Defines the maximum site value for analog input AI1. Set the value actually sent to the drive when the analog signal from plant is wound to its maximum setting.	20.000 mA or 10.000 V
	0.00020.000 mA or 0.00010.000 V	Maximum value of AI1.	1000 = 1 unit
12.19	Al1 scaled at Al1 min	Defines the real internal value that corresponds to the minimum analog input Al1 value defined by parameter 12.17 Al1 min. (Changing the polarity settings of 12.19 and 12.20 can effectively invert the analog input.)  Al <sub>scaled</sub> (12.12)  12.20   12.17  12.18	0.000
	-32768.000 32767.000	Real value corresponding to minimum Al1 value.	1 = 1
12.20	Al1 scaled at Al1 max	Defines the real internal value that corresponds to the maximum analog input Al1 value defined by parameter 12.18 Al1 max. See the drawing at parameter 12.19 Al1 scaled at Al1 min.	50.000
	-32768.000 32767.000	Real value corresponding to maximum Al1 value.	1 = 1
12.21	Al2 actual value	Displays the value of analog input Al2 in mA or V (depending on whether the input is set to current or voltage by a hardware setting).  This parameter is read-only.	-
	0.00020.000 mA or 0.00010.000 V	Value of analog input 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 AI force selection.	-

No.	Name/Value	Description	Def/FbEq16		
	0.00020.000 mA or 0.00010.000 V	Forced value of analog input AI2.	1000 = 1 unit		
12.25	Selects the unit for readings and settings related to analog input AI2.  Note: This setting must match the corresponding hardware setting on the drive control unit. chapter Electrical installation section Switches in the Hardware manual of the drive and the default control connections for the macro in use in chapter Control macros (page 59). Control board reboot (either by cycling the power or through parameter 96.08 Control board boot) is required to validate any changes in the hardware settings.				
	V	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		
12.27	AI2 min	Defines the minimum site value for analog input Al2. Set the value actually sent to the drive when the analog signal from plant is wound to its minimum setting.	4.000 mA or 0.000 V		
	0.00020.000 mA or 0.00010.000 V	Minimum value of Al2.	1000 = 1 unit		
12.28	Defines the maximum site value for analog input Al2.  Set the value actually sent to the drive when the analog sit from plant is wound to its maximum setting.		20.000 mA or 10.000 V		
	0.00020.000 mA or 0.00010.000 V	Maximum value of AI2.	1000 = 1 unit		
12.29	Al2 scaled at Al2 min	Defines the real value that corresponds to the minimum analog input Al2 value defined by parameter 12.27 Al2 min. (Changing the polarity settings of 12.29 and 12.101 can effectively invert the analog input.)  Al <sub>scaled</sub> (12.22)  12.101	0.000		
	-32768.000 32767.000	Real value corresponding to minimum Al2 value.	1 = 1		

No.	Name/Va	alue	Description	Def/FbEq16		
12.30	AI2 scale max	ed at AI2	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		
	-32768.0 32767.00		Real value corresponding to maximum Al2 value.	1 = 1		
12.101	Al1 perce	ent value	Value of analog input Al1 in percent of Al1 scaling (12.18 Al1 max - 12.17 Al1 min).	-		
	0.00 10	00.00%	Al1 value	100 = 1%		
12.102	AI2 perce	ent value	Value of analog input Al2 in percent of Al2 scaling (12.28 Al2 max - 12.27 Al2 min).	-		
	0.00 10	00.00%	Al2 value	100 = 1%		
13 Sta	ndard A	)	Configuration of standard analog outputs.			
13.02	AO force	selection	The source signals of the analog outputs can be overridden for eg. testing purposes. A forced value parameter is provided for each analog output, and its value is applied whenever the corresponding bit in this parameter is 1.  Note: Boot and power cycle reset the force selections (parameters 13.02 and 13.11).	0000h		
	Bit	Value				
	0	1 = Force A	O1 to value of parameter 13.13 AO1 forced value.			
	1		AO2 to value of parameter 13.23 AO2 forced value.			
	27	Reserved				
	0000hl	FFFFh	Forced values selector for analog outputs AO1 and AO2.	1 = 1		
13.11	AO1 actu	ual value	Displays the value of AO1 in mA. This parameter is read-only.	-		
	0.0002	2.000 mA	Value of AO1.	1 = 1 mA		
13.12	AO1 source		Selects a signal to be connected to analog output AO1.	Output frequency		
	Zero		None.	0		
	Motor sp	eed used	01.01 Motor speed used (page 139).	1		
	Output fr	equency	01.06 Output frequency (page 139).	3		
	Motor cu	rrent	01.07 Motor current (page 139).	4		
	Motor cu motor no	rrent % of minal	01.08 Motor current % of motor nom (page 139).	5		
	Motor tor	que	01.10 Motor torque (page 139).	6		
	DC volta	ge	01.11 DC voltage (page 139).	7		
	Output p	ower	01.14 Output power (page 140).	8		
	Speed re	f ramp in	23.01 Speed ref ramp input (page 200).	10		
	Speed re	f ramp out	23.02 Speed ref ramp output (page 200).	11		
	Speed re	f used	24.01 Used speed reference (page 204).	12		
	Freq ref	used	28.02 Frequency ref ramp output (page 213).	14		
	Process	PID out	40.01 Process PID output actual (page 261).	16		

No.	Name/Value	Description	Def/FbEq16
	Temp sensor 1 excitation	The output is used to feed an excitation current to the temperature sensor 1, see parameter 35.11 Temperature 1 source. See also section Motor thermal protection (page 123).	20
	Temp sensor 2 excitation	The output is used to feed an excitation current to the temperature sensor 2, see parameter 35.21 Temperature 2 source. See also section Motor thermal protection (page 123).	21
	Abs motor speed used	01.61 Abs motor speed used (page 141).	26
	Abs motor speed % 01.62 Abs motor speed % (page 141).		27
	Abs output frequency	01.63 Abs output frequency (page 141).	28
	Abs motor torque	01.64 Abs motor torque (page 141).	30
	Abs output power	01.65 Abs output power (page 141).	31
	Abs motor shaft power	01.68 Abs motor shaft power (page 141).	32
	External PID1 out	71.01 External PID act value ((page 297).	33
	AO1 data storage	13.91 AO1 data storage (page 166).	37
	AO2 data storage	13.92 AO2 data storage (page 166).	38
	Other	Source selection (see <i>Terms and abbreviations</i> on page <i>136</i> ).	-
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 or 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.  Note: This setting must match the corresponding hardware setting on the drive control unit. See chapter <i>Electrical installation</i> , section <i>Switches</i> in the <i>Hardware manual</i> of the drive and the default control connections for the macro in use in chapter <i>Control macros</i> (page 59). Control board reboot (either by cycling the power or through parameter 96.08 <i>Control board boot</i> ) is required to validate any changes in the hardware settings.	mA
	V	Volts.	2
	mA	Milliamperes.	10

No.	Name/Value	Description	Def/FbEq16
13.16	AO1 filter time	Defines the filtering time constant for analog output AO1.  Unfiltered signal  Filtered signal  T  O = I × (1 - e <sup>-t/T</sup> )  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)  13.19  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.	0.0
		13.18 13.17 Signal (real) selected by 13.12	

No	Nom	e/Value	Description			Dof/EbEg16	
No.			Description	me the source for the AO is cha	nand the section	Def/FbEq16	
				nie the source for the AO is cha ninimum and maximum values o			
		13.12 AO1 so	urce.	13.17 AO1 source min,	13.18 AO1 source	ce max.	
		13.22 AO2 so		13.27 AO2 source min	13.28 AO2 source		
	0	Zero		N/A (Output is constant zero.)	)		
	1	Motor speed u	ısed	0	46.01 Speed scaling		
	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	aling	
	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		
	20	Temp sensor	1 excitation	N/A (Analog output is not scaled; it is determined by			
	21	Temp sensor		sensor's triggering voltage.)		,	
	26	Abs motor spe		0	46.01 Speed sca	aling	
	27	Abs motor spe		0	46.01 Speed sca	_	
	28	Abs output fre		0		Frequency scaling	
	30	Abs motor tor	que	0	46.03 Torque sc		
	31	Abs output po	wer	0	46.04 Power sca	aling	
	32	Abs motor sha	aft power	0	46.04 Power sca	caling	
	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	
	-327	68.032767.0	Real signal v value.	alue corresponding to minimum	AO1 output	1 = 1	
13.18	par ma 13.		parameter 13 maximum red	nes the real maximum value of the signal (selected by imeter 13.12 AO1 source) that corresponds to the imum required AO1 output value (defined by paramete 10 AO1 out at AO1 src max). See parameter 13.17 AO rec min.		50.0	
	-327	68.032767.0	Real signal v value.	Real signal value corresponding to maximum AO1 output value.			
13.19	AO1 min	out at AO1 src		ninimum output value for analog wing at parameter 13.17 AO1 s	•	0.000 mA	
	0.00	0 22.000 mA	Minimum AO	1 output value.		1000 = 1 mA	
13.20	AO1 max	out at AO1 src		naximum output value for analowing at parameter 13.17 AO1 s	• .	20.000 mA	
	0 00	0 22.000 mA		O1 output value.	-	1000 = 1 mA	
	0.00	· LL.000 III/ (		z. output valuo.			

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.	0.0
		13.29 13.27 Signal (real) selected by 13.22	
	-32768.032767.0	Peal signal value corresponding to minimum AO2 outset	1 = 1
	-52100.032101.0	Real signal value corresponding to minimum AO2 output value.	' - '

No.	Name/Value	Description	Def/FbEq16
13.28	AO2 source max	Defines the real maximum value of the signal (selected by parameter 13.22 AO2 source) that corresponds to the maximum required AO2 output value (defined by parameter 13.30 AO2 out at AO2 src max). See parameter 13.27 AO2 source min. See parameter 13.17 AO1 source min about the AO automatic scaling.	
	-32768.032767.0	Real signal value corresponding to maximum AO2 output value.	1 = 1
13.29	AO2 out at AO2 src min	Defines the minimum output value for analog output AO2. See also drawing at parameter 13.27 AO2 source min.	0.000 mA
	0.000 22.000 mA	Minimum AO2 output value.	1000 = 1 mA
13.30	AO2 out at AO2 src max	Defines the maximum output value for analog output AO2. See also drawing at parameter 13.27 AO2 source min.	20.000 mA
	0.000 22.000 mA	Maximum AO2 output value.	1000 = 1 mA
	-32768.000 32767.000	Real signal value corresponding to minimum AO8 output value.	1000 = 1
13.91	AO1 data storage	Storage parameter for controlling analog output AO1 eg. through the embedded fieldbus interface. In parameter 13.12 AO1 source, select AO1 data storage. Then set this parameter as the target of the incoming value data. With the embedded fieldbus interface, simply set the target selection parameter of that particular data (58.10158.114) to AO1 data storage.	0.00
	-327.68327.67	Storage parameter for AO1.	100 = 1
13.92	AO2 data storage	Storage parameter for controlling analog output AO2 eg. through the embedded fieldbus interface. In parameter 13.22 AO2 source, select AO2 data storage. Then set this parameter as the target of the incoming value data. With the embedded fieldbus interface, simply set the target selection parameter of that particular data (58.10158.114) to AO2 data storage.	0.00
	-327.68327.67	Storage parameter for AO2.	100 = 1
15 I/O modul	extension e	Configuration of the I/O extension module installed in slot 2. See also section <i>Programmable I/O extensions</i> (page 94).  Note: The contents of the parameter group vary according to the selected I/O extension module type.	
15.01	Extension module type	Activates (and specifies the type of) I/O extension module. If the value is <i>None</i> , when an extension module has been installed and the dive is powered, the drive automatically sets the value to the type it has detected (= value of parameter 15.02 Detected extension module); otherwise warning A7AB Extension I/O configuration failure is generated and you have to set the value of this parameter manually.	None
	None	Inactive.	0
	CMOD-01	CMOD-01.	1
	CMOD-02	CMOD-02.	2
	CHDI-01	CHDI-01.	3
15.02	Detected extension module	I/O extension module detected on the drive.	None
	None	Inactive.	0

No.	Name/Value	Description	Def/FbEq16
	CMOD-01	CMOD-01.	1
	CMOD-02	CMOD-02.	2
	CHDI-01	CHDI-01.	3
15.03	DI status	Displays the status of the digital inputs DI7DI12 on the extension module Bit 0 indicates the status of DI7.  Example: 001001b = DI7 and DI10 are on, remainder are off. This parameter is read-only.	-
	0000hFFFFh	Status of digital input/outputs.	1 = 1
15.04	RO/DO status	Displays the status of the relay outputs RO4 and RO5 and digital output DO1 on the extension module.  Bits 01 indicates the status of RO4RO5; bit 5 indicates the status of DO1.  Example: 100101b = RO4 is on, RO5 is off. and DO1 is on. This parameter is read-only.	-
	0000hFFFFh	Status of relay/digital outputs.	1 = 1
15.05	RO/DO force selection	The electrical statuses of the relay/digital outputs can be overridden for eg. testing purposes. A bit in parameter 15.06 RO/DO forced data is provided for each 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 15.05 and 15.06).	0000h

Bit	Value
0	1 = Force RO4 to value of bit 0 of parameter 15.06 RO/DO forced data.
1	1 = Force RO5 to value of bit 1 of parameter 15.06 RO/DO forced data.
24	Reserved
5	1 = Force DO1 to value of bit 5 of parameter 15.06 RO/DO forced data.
615	Reserved

	0000hFFFFh	Override selection for relay/digital outputs.	1 = 1
15.06	RO/DO forced data	Allows the data value of a forced relay or digital output to be changed from 0 to 1. It is only possible to force an output that has been selected in parameter 15.05 RO/DO force selection. Bits 01 are the forced values for RO4RO5; bit 5 is the forced value for DO1.	0000h
	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	Output is not energized.	0
	Energized	Output is energized.	1
	Ready run	Bit 1 of 06.11 Main status word (see page 145).	2
	Enabled	Bit 0 of 06.16 Drive status word 1 (see page 146).	4
	Started	Bit 5 of 06.16 Drive status word 1 (see page 146).	5
	Magnetized	Bit 1 of 06.17 Drive status word 2 (see page 147).	6
	Running	Bit 6 of 06.16 Drive status word 1 (see page 146).	7
	Ready ref	Bit 2 of 06.11 Main status word (see page 145).	8

No.	Name/Value	Description	Def/FbEq16
	At setpoint	Bit 8 of 06.11 Main status word (see page 145).	9
	Reverse	Bit 2 of 06.19 Speed control status word (see page 148).	10
	Zero speed	Bit 0 of 06.19 Speed control status word (see page 148).	11
	Above limit	Bit 10 of 06.17 Drive status word 2 (see page 147).	12
	Warning	Bit 7 of 06.11 Main status word (see page 145).	13
	Fault	Bit 3 of 06.11 Main status word (see page 145).	14
	Fault (-1)	Inverted bit 3 of 06.11 Main status word (see page 145).	15
	Fault/Warning	Bit 3 of 06.11 Main status word OR bit 7 of 06.11 Main status word (see page 145).	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 275).	22
	Ext2 active	Bit 11 of 06.16 Drive status word 1 (see page 146).	23
	Remote control	Bit 9 of 06.11 Main status word (see page 145).	24
	МСВ	Reserved	25
	Timed function 1	Bit 0 of 34.01 Combined timer status (see page 240).	27
	Timed function 2	Bit 1 of 34.01 Combined timer status (see page 240).	28
	Timed function 3	Bit 2 of 34.01 Combined timer status (see page 240).	29
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 234).	33
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 234).	34
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 234).	35
	Start delay	Bit 13 of 06.17 Drive status word 2 (see page 147).	39
	RO/DIO control word bit0	Bit 0 of 10.99 RO/DIO control word (see page 154).	40
	RO/DIO control word bit1	Bit 1 of 10.99 RO/DIO control word (see page 154).	41
	RO/DIO control word bit2	Bit 2 of 10.99 RO/DIO control word (see page 154).	42
	PFC1	Bit 0 of 76.01 PFC status (see page 299).	43
	PFC2	Bit 1 of 76.01 PFC status (see page 299).	44
	PFC3	Bit 2 of 76.01 PFC status (see page 299).	45
	PFC4	Bit 3 of 76.01 PFC status (see page 299).	46
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 136).	-

No.	Name/Value	Description	Def/FbEq16
15.08	RO4 ON delay	Defines the activation delay for relay output RO4.	0.0 s
	Status of selected source  RO status  ton = 15.08 RO4 ON de	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1 0 1
	$t_{\rm Off} = 15.09  RO4  OFF  d$	elay	
	0.0 3000.0 s	Activation delay for RO4.	10 = 1 s
15.09	RO4 OFF delay	Defines the deactivation delay for relay output RO4. See parameter 15.08 RO4 ON delay.	0.0 s
	0.0 3000.0 s	Deactivation delay for RO4.	10 = 1 s
15.10	RO5 source	Selects a drive signal to be connected to relay output RO4. For the available selections, see parameter 15.07 RO4 source.	Not energized
15.11	RO5 ON delay	Defines the activation delay for relay output RO5.	0.0 s
	Status of selected source _		1 0 1
	RO status — —	$\langle \cdot \rangle$ $\langle \cdot $	──── 0 ────────────────────────────────
	t <sub>On</sub> = 15.11 RO5 ON de t <sub>Off</sub> = 15.12 RO5 OFF d	lay elay	
	0.0 3000.0 s	Activation delay for RO5.	10 = 1 s
15.12	RO5 OFF delay	Defines the deactivation delay for relay output RO5. See parameter 15.11 RO5 ON delay.	0.0 s
	0.0 3000.0 s	Deactivation delay for RO5.	10 = 1 s
15.22	DO1 configuration	Selects how DO1 is used.	Digital output
	Digital output	DO1 is used as a digital output.	0
	Frequency output	DO1 is used as a frequency output.	1
15.23	DO1 source	Selects a drive signal to be connected to digital output DO1 when 15.22 DO1 configuration is set to Digital output.	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 145).	2
	Enabled	Bit 0 of 06.16 Drive status word 1 (see page 146).	4
	Started	Bit 5 of 06.16 Drive status word 1 (see page 146).	5
	Magnetized	Bit 1 of 06.17 Drive status word 2 (see page 147).	6

No.	Name/Value	Description	Def/FbEq16
	Running	Bit 6 of 06.16 Drive status word 1 (see page 146).	7
	Ready ref	Bit 2 of 06.11 Main status word (see page 145).	8
	At setpoint	Bit 8 of 06.11 Main status word (see page 145).	9
	Reverse	Bit 2 of 06.19 Speed control status word (see page 148).	10
	Zero speed	Bit 0 of 06.19 Speed control status word (see page 148).	11
	Above limit	Bit 10 of 06.17 Drive status word 2 (see page 147).	12
	Warning	Bit 7 of 06.11 Main status word (see page 145).	13
	Fault	Bit 3 of 06.11 Main status word (see page 145).	14
	Fault (-1)	Inverted bit 3 of 06.11 Main status word (see page 145).	15
	Fault/Warning	Bit 3 of 06.11 Main status word OR bit 7 of 06.11 Main status word (see page 145).	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 275).	22
	Ext2 active	Bit 11 of 06.16 Drive status word 1 (see page 146).	23
	Remote control	Bit 9 of 06.11 Main status word (see page 145).	24
	MCB	Reserved	25
	Timed function 1	Bit 0 of 34.01 Combined timer status (see page 240).	27
	Timed function 2	Bit 1 of 34.01 Combined timer status (see page 240).	28
	Timed function 3	Bit 2 of 34.01 Combined timer status (see page 240).	29
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 234).	33
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 234).	34
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 234).	35
	Start delay	Bit 13 of 06.17 Drive status word 2 (see page 147).	39
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 136).	-

No.	Name/Value	Description	Def/FbEq16			
15.24	DO1 ON delay	Defines the activation delay for relay output DO1 when 15.22 DO1 configuration is set to Digital output.				
	Status of selected source		1 0			
	RO status —		$ \begin{array}{c} 1\\ \hline \\ \end{array} $ $ \begin{array}{c} 0\\ \end{array} $ Time			
	4 = 45 24 DO4 ON do	t <sub>On</sub> t <sub>Off</sub> t <sub>On</sub> t <sub>Off</sub>				
	$t_{\text{On}} = 15.24 \text{ DO1 ON de} $ $t_{\text{Off}} = 15.25 \text{ DO1 OFF de}$	elay				
	0.0 3000.0 s	Activation delay for DO1.	10 = 1 s			
15.25	DO1 OFF delay	Defines the deactivation delay for relay output DO1 when 15.22 DO1 configuration is set to Digital output. See parameter 15.24 DO1 ON delay.	0.0 s			
	0.0 3000.0 s	Deactivation delay for DO1.	10 = 1 s			
15.32	Freq out 1 actual value	Displays the value of frequency output 1 at digital output DO1 when 15.22 DO1 configuration is set to Frequency output. This parameter is read-only.	-			
	0 16000 Hz	Value of frequency output 1.	1 = 1 Hz			
15.33	Freq out 1 source	Selects a signal to be connected to digital output DO1 when 15.22 DO1 configuration is set to Frequency output.  Alternatively, sets the output to excitation mode to feed a constant current to a temperature sensor.	Not selected			
	Not selected	None.	0			
	Motor speed used	01.01 Motor speed used (page 139).	1			
	Output frequency	01.06 Output frequency (page 139).	3			
	Motor current	01.07 Motor current (page 139).	4			
	Motor torque	01.10 Motor torque (page 139).	6			
	DC voltage	01.11 DC voltage (page 139).	7			
	Output power	01.14 Output power (page 140).	8			
	Speed ref ramp in	23.01 Speed ref ramp input (page 200).	10			
	Speed ref ramp out	23.02 Speed ref ramp output (page 200).	11			
	Speed ref used	24.01 Used speed reference (page 204).	12			
	Torque ref used	26.02 Torque reference used (page 209).	13			
	Freq ref used	28.02 Frequency ref ramp output (page 213).	14			
	Process PID out	40.01 Process PID output actual (page 261).	16			
	Other	Source selection (see <i>Terms and abbreviations</i> on page <i>136</i> ).	-			

No.	Name/Value	Description	Def/FbEq16
15.34	Freq out 1 src min	Defines the real value of the signal (selected by parameter 15.33 Freq out 1 source) that corresponds to the minimum value of frequency output 1 (defined by parameter 15.36 Freq out 1 at src min). This applies when 15.22 DO1 configuration is set to Frequency output.  IAO1 (mA)  15.37  15.36  15.37  Signal (real) selected by par. 15.33  15.36  Signal (real) selected by par. 15.33	0.000
	-32768.000 32767.000	Real signal value corresponding to minimum value of frequency output 1.	1 = 1
15.35	Freq out 1 src max	Defines the real value of the signal (selected by parameter 15.33 Freq out 1 source) that corresponds to the maximum value of frequency output 1 (defined by parameter 15.37 Freq out 1 at src max). This applies when 15.22 DO1 configuration is set to Frequency output.  See parameter 15.34 Freq out 1 src min.	1500.000
	-32768.000 32767.000	Real signal value corresponding to maximum value of frequency output 1.	1 = 1
15.36	Freq out 1 at src min	Defines the minimum output value of frequency output 1 when 15.22 DO1 configuration is set to Frequency output. See also drawing at parameter 15.34 Freq out 1 src min.	0 Hz
	0 16000 Hz	Minimum frequency output 1 value.	1 = 1 Hz
15.37	Freq out 1 at src max	Defines the maximum value of frequency output 1 when 15.22 DO1 configuration is set to Frequency output. See also drawing at parameter 15.34 Freq out 1 src min.	16000 Hz
	0 16000 Hz	Maximum value of frequency output 1.	1 = 1 Hz

No.	Name/Value	Def/FbEq16	
19 Op	eration mode	Selection of local and external control location sources and operating modes.  See also section <i>Operating modes of the drive</i> (page 89).	
19.01	Actual operation mode	Displays the operating mode currently used. See parameters 19.1119.14. This parameter is read-only.	-
	Zero	None.	1
	Speed	Speed control (in vector motor control mode).	2
	Torque	Torque control (in vector motor control mode).	3
	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
	Scalar (Hz)	Frequency control in scalar motor control mode (in scalar motor control mode).	10
	Forced magn.	Motor is in magnetizing mode.	20
19.11	Ext1/Ext2 selection	Selects the source for external control location EXT1/EXT2 selection.  0 = EXT1 1 = EXT2	EXT1
	EXT1	EXT1 (permanently selected).	0
	EXT2	EXT2 (permanently selected).	1
	FBA A MCW bit 11	Control word bit 11 received through fieldbus interface A.	2
	DI1	Digital input DI1 (10.02 DI delayed status, bit 0).	3
	DI2	Digital input DI2 (10.02 DI delayed status, bit 1).	4
	DI3	Digital input DI3 (10.02 DI delayed status, bit 2).	5
	DI4	Digital input DI4 (10.02 DI delayed status, bit 3).	6
	DI5	Digital input DI5 (10.02 DI delayed status, bit 4).	7
	DI6	Digital input DI6 (10.02 DI delayed status, bit 5).	8
	Timed function 1	Bit 0 of 34.01 Combined timer status (see page 240).	19
	Timed function 2	Bit 1 of 34.01 Combined timer status (see page 240).	20
	Timed function 3	Bit 2 of 34.01 Combined timer status (see page 240).	21
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 234).	25
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 234).	26
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 234).	27
	EFB MCW bit 11	Control word bit 11 received through the embedded fieldbus interface.	32
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page <i>136</i> ).	-

Name/Value

Description

No.

NO.	Name/Value	Description	DeliffDEq10	
19.12	Ext1 control mode	Selects the operating mode for external control location EXT1 in vector motor control mode.	Speed	
	Zero	None.	1	
	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 86).		
20.01	20.01 Ext1 commands  Selects the source of start, stop and direction commands for external control location 1 (EXT1).  See also parameters 20.0220.05. See parameter 20.21 for the determination of the actual direction.			
	Not selected	No start or stop command sources selected.	0	

Def/FbEq16

No.	Name/Value	Description	Def/FbEq16				
	In1 Start	The source of the start and stop commands is selected by parameter 20.03 Ext1 in1 source. The state transitions of the source bits are interpreted as follows:					1
		State of source 1 (20)	.03)	Command			
		0 -> 1 (20.02 = Edge 1 (20.02 = Level)	` Start				
		0		Stop			
	In1 Start; In2 Dir  The source selected by 20.03 Ext1 in1 source is the start signal; the source selected by 20.04 Ext1 in2 source determines the direction. The state transitions of the source bits are interpreted as follows:						2
		State of source 1 (20.03)	S	tate of source 2 (20.04)	2	Command	
		0		Any		Stop	
		0 -> 1 (20.02 = Edge)		0		Start forward	
		1 (20.02 = Level)		1		Start reverse	
		the reverse start signal. bits are interpreted as form					
		(20.03)		tate of source 2 (20.04)		Command	
		0		0		Stop	
		0 -> 1 (20.02 = Edge) 1 (20.02 = Level)		0		Start forward	
		0		> 1 (20.02 = Edg (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 s	ource and 20.04	4 Ext	1 in2 source.	4
		State of source 1 (20.03)	Sta	ate of source 2 (20.04)		Command	
		0 -> 1		1		Start	
		Any		0		Stop	
		Notes: Parameter 20.02 Ext this setting. When source 2 is 0, panel are disabled.					

No.	Name/Value	Description				Def/FbEq16			
	In1P Start; In2 Stop; In3 Dir	parameters 20. The source seledirection. The s	The sources of the start and stop commands are selected by parameters 20.03 Ext1 in1 source and 20.04 Ext1 in2 source. The source selected by 20.05 Ext1 in3 source determines the direction. The state transitions of the source bits are interpreted as follows:						
		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.	0.02 Ext1 start		s no effect with				
		panel are dis		rt and Otop Key	on the control				
	In1P Start fwd; In2P Start rev; In3 Stop	parameters 20. 20.05 Ext1 in3 s source determine	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 direction. The state transitions of the source bits are interpreted as follows:						
		State of	State of	State of					
		source 1 (20.03)	source 2 (20.04)	source 3 (20.05)	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				
	Control panel	The start and si panel (or PC co				11			
	Fieldbus A	The start and st A. <b>Note:</b> Set also	•		ieldbus adapter	12			
	Embedded fieldbus	The start and si fieldbus interfact <b>Note:</b> Set also	ce.			14			
20.02	Ext1 start trigger type	Note: This para signal is selected	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.						
	Edge	The start signal	The start signal is edge-triggered.						
	Level	The start signal	The start signal is level-triggered.						
20.03	Ext1 in1 source	Selects source	1 for parameter	r 20.01 Ext1 co	mmands.	DI1			
	Not selected	0 (always off).				0			
	Selected	1 (always on).				1			
	DI1	Digital input DI	1 (10.02 DI dela	ayed status, bit	0).	2			
	DI2	Digital input DI2	2 (10.02 DI dela	ayed status, bit	1).	3			

No.	Name/Value	Description			Def/FbEq16	
	DI3	Digital input DI3 (10.02 I	DI delayed status,	bit 2).	4	
	DI4	Digital input DI4 (10.02 I	DI delayed status,	bit 3).	5	
	DI5	Digital input DI5 (10.02 I	DI delayed status,	bit 4).	6	
	DI6	Digital input DI6 (10.02 I	Digital input DI6 (10.02 DI delayed status, bit 5).			
	Timed function 1	Bit 0 of 34.01 Combined	Bit 0 of 34.01 Combined timer status (see page 240).			
	Timed function 2	Bit 1 of 34.01 Combined	timer status (see	page 240).	19	
	Timed function 3	Bit 2 of 34.01 Combined	timer status (see	page 240).	20	
	Supervision 1	Bit 0 of 32.01 Supervision	on status (see pag	je 234).	24	
	Supervision 2	Bit 1 of 32.01 Supervision	on status (see pag	je 234).	25	
	Supervision 3	Bit 2 of 32.01 Supervision	on status (see pag	je 234).	26	
	Other [bit]	Source selection (see Te	erms and abbrevia	ations on page 136).	-	
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	external control location See also parameters 20	Selects the source of start, stop and direction commands for external control location 2 (EXT2).  See also parameters 20.0720.10. See parameter 20.21 for the determination of the actual direction.			
	Not selected	No start or stop commar	nd sources selecte	ed.	0	
	In1 Start	The source of the start a parameter 20.08 Ext2 in source bits are interpreted or the state of source 1 (20.07 = Edge 1 (20.07 = Level)	1 source. The stated as follows:  08) Command		1	
	In1 Start; In2 Dir	The source selected by 20.08 Ext2 in1 source is the start signal; the source selected by 20.09 Ext2 in2 source determines the direction. The state transitions of the source bits are interpreted as follows:  State of source 1 State of source 2 Command			2	
		<b>(20.08)</b>	<b>(20.09)</b> Any	Stop		
		0 -> 1 (20.07 = Edge)	0	Start forward		
		1 (20.07 = Level)	1	Start reverse		
		<del> </del>		1	1	

No.	Name/Value	Description				Def/FbEq16
	In1 Start fwd; In2 Start rev	The source selected start signal; the souther reverse start subits are interpreted	urce selecte ignal. The st	d by 20.09 Ext2	in2 source is	3
		State of source (20.08)	e 1 Star	te of source 2 (20.09)	Command	
		0		0	Stop	
		0 -> 1 (20.07 = E	• /	0	Start forward	
		0		l (20.07 = Edge <sub>)</sub> 20.07 = Level)	Start reverse	
		1		1	Stop	
	In1P Start; In2 Stop	The sources of the parameters 20.08 The state transition follows:	Ext2 in1 sou	rce and 20.09 E	xt2 in2 source.	4
		State of source (20.08)	1 State	of source 2 (20.09)	Command	
		0 -> 1		1	Start	
		Any		0	Stop	
		Notes:  Parameter 20.0 this setting.  When source 2 panel are disab	is 0, the Sta			
	In1P Start; In2 Stop; In3 Dir	The sources of the parameters 20.08 The source selecte direction. The state interpreted as follows:	Ext2 in1 sou ed by 20.10 i e transitions	rce and 20.09 E Ext2 in3 source	ext2 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	
	<ul> <li>Notes:</li> <li>Parameter 20.07 Ext2 start trigger type has no effect this setting.</li> <li>When source 2 is 0, the Start and Stop keys on the copanel are disabled.</li> </ul>					

No.	Name/Value	Description				Def/FbEq16
	In1P Start fwd; In2P Start rev; In3 Stop	parameters 20. 20.10 Ext2 in3 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 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	
	Control panel	The start and s panel (or PC co				11
	Fieldbus A	The start and st A. <b>Note:</b> Set also	•		fieldbus adapter	12
	Embedded fieldbus	The start and si fieldbus interfact <b>Note:</b> Set also	ce.		the embedded below.	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	l is edge-trigger	ed.		0
	Level	The start signal	l is level-trigger	ed.		1
20.08	Ext2 in1 source	Selects source For the available source.				Not selected
20.09	Ext2 in2 source	Selects source For the available source.	•			Not selected
20.10	Ext2 in3 source	Selects source For the available source.				Not selected
20.11	Run enable stop mode	Selects the way signal switches The source of t 20.12 Run enan	off. he run enable s	• •	ne run enable	Coast
	Coast	The motor coas	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.  Note: This parameter cannot be changed while the drive is running.  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
	Timed function 1	Bit 0 of 34.01 Combined timer status (see page 240).	18
	Timed function 2	Bit 1 of 34.01 Combined timer status (see page 240).	19
	Timed function 3	Bit 2 of 34.01 Combined timer status (see page 240).	20
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 234).	24
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 234).	25
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 234).	26
	FBA A MCW bit 3	Control word bit 3 received through fieldbus interface A.	30
	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 136).	-
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
	Timed function 1	Bit 0 of 34.01 Combined timer status (see page 240).	18
	Timed function 2	Bit 1 of 34.01 Combined timer status (see page 240).	19
	Timed function 3	Bit 2 of 34.01 Combined timer status (see page 240).	20
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 234).	24
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 234).	25

No.	Name/Value	e	Description			Def/FbEq16
	Supervision	3	Bit 2 of 32.01 Supe	ervision status (see page 234	<b>1</b> ).	26
	Other [bit]		Source selection (s	see Terms and abbreviations	on page 136).	-
20.21	20.21 Direction		rather than the sign In the table the act parameter 20.21 D	n lock. Defines the direction of the reference, except in the reference, except in the direction is shown as a direction and Direction comments at 1 commands or 20.06 Ext2	some cases. s a function of and (from	Request
		Direction Forward	n command =	Direction command = Reverse	Direction comi defined	mand not
	Par. 20.21 Direction = Forward	Forward	l	Forward	Forward	
	Par. 20.21 Direction = Reverse	Reverse	•	Reverse	Reverse	
	Par. 20.21 Direction = Request	Cons poter Last, refere used	erence from tant, Motor titiometer, PID, Fail, Jogging or Panel ence, reference as is. erence from the ork, reference used	Reverse, but  If reference from Constant, Motor potentiometer, PID, Fail, Last, Jogging or Panel reference, reference used as is.  If reference from the network, reference multiplied by -1.	Forward	
	Request		command (parame commands).  If the reference collapseds/frequencies asfe, Last speed reference, the refelf the reference collabs.  if the direction collapsed is significant.	the direction is selected by a ster 20.01 Ext1 commands on mes from Constant (constant s), Motor potentiometer, PID eference, Jogging speed or Frence is used as is. mes from a fieldbus: ommand is forward, the referencement	r 20.06 Ext2	0
	Forward		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 we reference values are repla values are multiplied by -1.)		2
20.22	Enable to ro	otate	affect any other co back to 1 starts mo This parameter cal some external equ the equipment is re When this parame	n be used for example with a ipment to prevent the motor r	the parameter signal from totating before is disabled),	Selected
	Not selected	d	0 (always off).			0

No.	Name/Value	Description	Def/FbEq16
	Selected	1 (always on).	1
	DI1	Digital input DI1 (10.02 DI delayed status, bit 0).	2
	DI2	Digital input DI2 (10.02 DI delayed status, bit 1).	3
	DI3	Digital input DI3 (10.02 DI delayed status, bit 2).	4
	DI4	Digital input DI4 (10.02 DI delayed status, bit 3).	5
	DI5	Digital input DI5 (10.02 DI delayed status, bit 4).	6
	DI6	Digital input DI6 (10.02 DI delayed status, bit 5).	7
	Timed function 1	Bit 0 of 34.01 Combined timer status (see page 240).	18
	Timed function 2	Bit 1 of 34.01 Combined timer status (see page 240).	19
	Timed function 3	Bit 2 of 34.01 Combined timer status (see page 240).	20
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 234).	24
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 234).	25
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 234).	26
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 136).	-
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).  See section Rush control (page 98).	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
	Timed function 1	Bit 0 of 34.01 Combined timer status (see page 240).	18
	Timed function 2	Bit 1 of 34.01 Combined timer status (see page 240).	19
	Timed function 3	Bit 2 of 34.01 Combined timer status (see page 240).	20
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 234).	24
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 234).	25
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 234).	26
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 136).	-

No.	Name/Value	Description	Def/FbEq16
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
	Timed function 1	Bit 0 of 34.01 Combined timer status (see page 240).	18
	Timed function 2	Bit 1 of 34.01 Combined timer status (see page 240).	19
	Timed function 3	Bit 2 of 34.01 Combined timer status (see page 240).	20
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 234).	24
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 234).	25
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 234).	26
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 136).	-
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

No.	Name/Value	Description	Def/FbEq16
21 Sta	art/stop mode	Start and stop modes; emergency stop mode and signal source selection; DC magnetization settings.	
21.01	Vector start mode	Selects the motor start function for the vector motor control mode, ie. when 99.04 Motor control mode is set to Vector.  Notes:  • The start function for the scalar motor control mode is selected by parameter 21.19 Scalar start mode.  • Starting into a rotating motor is not possible when DC magnetizing is selected (Fast or Const time).  • With permanent magnet motors, Automatic start mode must be used.  • This parameter cannot be changed while the drive is running.  See also section DC magnetization (page 106).	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 (a stopped motor can be restarted immediately without waiting the motor flux to die away). 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	<ul> <li>Defines the pre-magnetization time when</li> <li>parameter 21.01 Vector start mode is set to Const time (in vector motor control mode), or</li> <li>parameter 21.19 Scalar start mode is set to Const time (in scalar motor control mode).</li> <li>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:</li> </ul>		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 changed while the drive is running.		
	010000 ms	Constant DC magnetizing time	l.	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 mechat safe to stop the drive be	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 2 <i>00</i> or 28	1
	Torque limit	Stop according to torque limits of 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 sparameter 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 Reference ramping [page 96]). 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

No.	Name/Value	Description	Def/FbEq16
	Coast stop (Off2)	With the drive running:  • 1 = Normal operation.  • 0 = Stop by coasting. The drive can be restarted by restoring the start interlock signal and switching the start signal from 0 to 1.  With the drive stopped:  • 1 = Starting allowed.  • 0 = Starting not allowed.	1
	Eme ramp stop (Off3)	With the drive running:  1 = Normal operation  0 = Stop by ramping along emergency stop ramp defined by parameter 23.23 Emergency stop time. After the drive has stopped, it can be restarted by removing the emergency stop signal and switching the start signal from 0 to 1.  With the drive stopped:  1 = Starting allowed  0 = Starting not allowed	2
	Stop torque	With the drive running:  1 = Normal operation  0 = Stop against the maximum torque limit (parameter 30.20 Maximum torque 1 or 30.24 Maximum torque 2). The drive can be restarted by switching the start signal from 0 to 1.  With the drive stopped:  1 = Starting allowed  0 = Starting not allowed	3
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
	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 <i>136</i> ).	-
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

Defines the delay for the zero speed delay function. The function is useful in applications where a smooth and quick restarting is essential. During the delay, the drive knows the rotor position accurately.  Without zero speed delay: The drive receives a stop command and decelerates along a ramp. When actual motor speed falls below the value of parameter 21.06 Zero speed limit, inverter modulation is stopped and the motor coasts to a standstill.  Speed  Speed controller switched off: Motor coasts to a stop.	ns
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:	
Speed controller switched off:	
21.06 Zero speed limit	
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 controller remains active. Motor is decelerated to true zero speed.  21.06 Zero speed limit Delay Time	
030000 ms	: 1 ms

No.	Name/V	alue	Description	Def/FbEq16
21.08	DC curre	Activates/deactivates the DC hold and post-magnetization functions. See section DC magnetization (page 106).  Note: DC magnetization causes the motor to heat up. In applications where long DC magnetization times are required, externally ventilated motors should be used. If the DC magnetization period is long, DC magnetization cannot prevent the motor shaft from rotating if a constant load is applied to the motor.		0000Ь
	Bit	Value		
	0		d. See section <i>DC hold</i> (page 107).	
			DC hold function has no effect if the start signal is switched off.	
	1	Note: Post	agnetization. See section Settings (page 107).  -magnetization is only available when ramping is the selected sto 21.03 Stop mode).	op mode (see
	215	Reserved		
	0000b	0011b	DC magnetization selection.	1 = 1
21.09	DC hold	speed	Defines the DC hold speed in speed control mode. See parameter 21.08 DC current control, and section DC hold (page 107).	5.00 rpm
	0.0010	000.00 rpm	DC hold speed.	See par. 46.01
21.10	DC curre reference		Defines the DC hold current in percent of the motor nominal current. See parameter 21.08 DC current control, and section DC magnetization (page 106).	30.0%
	0.0100	0.0%	DC hold current.	1 = 1%
21.11	Post ma time	gnetization	Defines the length of time for which post-magnetization is active after stopping the motor. The magnetization current is defined by parameter 21.10 DC current reference.  See parameter 21.08 DC current control.	0 s
	03000	s	Post-magnetization time.	1 = 1 s
21.14	Pre-heating input source		Selects the source for triggering pre-heating for the motor. The status of the pre-heating is shown as bit 2 of 06.20 Drive status word 3.  Notes:  The heating function requires that STO is not triggered.  The heating function requires that the drive is not faulted.  Pre-heating uses DC hold to produce current.	Off
	Off		Pre-heating is always deactivated.	0
	On		Pre-heating is always activated when the drive is stopped.	1
	DI1		Digital input DI1 (10.02 DI delayed status, bit 0).	2
	DI2		Digital input DI2 (10.02 DI delayed status, bit 1).	3
	DI3		Digital input DI3 (10.02 DI delayed status, bit 2).	4
	DI4		Digital input DI4 (10.02 DI delayed status, bit 3).	5
	DI5		Digital input DI5 (10.02 DI delayed status, bit 4).	6
	DI6		Digital input DI6 (10.02 DI delayed status, bit 5).	7
	Supervis		Bit 0 of 32.01 Supervision status (see page 234).	8
	Supervis	sion 2	Bit 1 of 32.01 Supervision status (see page 234).	9

No.	Name/Value	Description	Def/FbEq16
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 234).	10
	Timed function 1	Bit 0 of 34.01 Combined timer status (see page 240).	11
	Timed function 2	Bit 1 of 34.01 Combined timer status (see page 240).	12
	Timed function 3	Bit 2 of 34.01 Combined timer status (see page 240).	13
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page <i>136</i> ).	-
21.16	Pre-heating current	Defines the DC current used to heat motor findings.	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 120).  When this parameter is set to 0.0 seconds, automatic restarting is disabled. Otherwise, the parameter defines the maximum duration of the power failure after which restarting is attempted. Note that this time also includes the DC precharging delay.  WARNING! Before you activate the function, make sure that no dangerous situations can occur. The function restarts the drive automatically and continues operation after a supply break.	10.0 s
	0.0 s	Automatic restarting disabled.	0
	0.110.0 s	Maximum power failure duration.	1 = 1 s
21.19	Scalar start mode	Selects the motor start function for the scalar motor control mode, ie. when 99.04 Motor control mode is set to Scalar.  Notes:  The start function for the vector motor control mode is selected by parameter 21.01 Vector start mode.  With permanent magnet motors, Automatic start mode must be used.  This parameter cannot be changed while the drive is running.  See also section DC magnetization (page 106).	Normal
	Normal	Immediate start from zero speed.	0
	Const time	The drive pre-magnetizes the motor before start. The pre-magnetizing time is defined by parameter 21.02  Magnetization time. This mode should be selected if constant pre-magnetizing time is required (e.g. if the motor start must be synchronized with the release of a mechanical brake). This setting also guarantees the highest possible break-away torque when the pre-magnetizing time is set long enough.  Note: This mode cannot be used to start into a rotating motor.  WARNING! The drive will start after the set pre-magnetizing time has passed even if motor magnetization is not completed. In applications where a full break-away torque is essential, ensure that the constant magnetizing time is long enough to allow generation of full magnetization and torque.	1
	Automatic	The drive automatically selects the correct output frequency to start a rotating motor. This is useful for flying starts: if the motor is already rotating, the drive will start smoothly at the current frequency.  Note: Cannot be used in multimotor systems.	2

No.	No. Name/Value Description		
	Torque boost	The drive pre-magnetizes the motor before the start. The pre-magnetizing time is defined by parameter 21.02  Magnetization time.  Torque boost is applied at start. Torque boost is stopped when output frequency exceeds 20 Hz or when it is equal to the reference value. See parameter 21.26 Torque boost current.  This mode should selected if a high break-away torque is required.  Note: This mode cannot be used to start into a rotating motor.  WARNING! The drive will start after the set premagnetizing time has passed even if motor magnetization is not completed. In applications where a full break-away torque is essential, ensure that the constant magnetizing time is long enough to allow generation of full magnetization and torque.	
	Automatic + boost	Automatic start with torque boost.  Automatic start is performed first and the motor is magnetized. If the speed is found to be zero, torque boost is applied.	4
21.21	DC hold frequency	Defines the DC hold frequency, which is used instead of parameter 21.09 DC hold speed when the motor is in scalar frequency mode. See parameter 21.08 DC current control, and section DC hold (page 107).	5.00 Hz
	0.001000.00 Hz	DC hold frequency.	1 = 1 Hz
21.22	Start delay	Defines the start delay. After the conditions for start have been fulfilled, the drive waits until the delay has elapsed and then starts the motor. During the delay, warning <i>AFE9 Start delay</i> is shown.  Start delay can be used with all start modes.	0.00 s
	0.0060.00 s	Start delay	1 = 1 s
21.23	Smooth start	Selects the forced current vector rotation mode at low speeds. When the smooth start mode is selected, the rate of acceleration is limited by the acceleration and deceleration ramp times. If the process driven by the permanent magnet synchronous motor has high inertia, slow ramp times are recommended.  Can be used for permanent magnet synchronous motors only.	Disabled
	Disabled	Disabled.	0
	Enabled always	Enabled always.	1
	Start only	Enabled when starting the motor.	2
21.24	Smooth start current	Current used in the current vector rotation at low speeds. Increase the smooth start current if the application requires motor shaft swinging needs to be minimized. Note that accurate torque control is not possible in the current vector rotation mode.  Can be used for permanent magnet synchronous motors only.	50.0%
	10.0100.0%	Value in percent of the nominal motor current.	1 = 1%

No.	Name/Value	Description	Def/FbEq16
21.25	Smooth start speed	Output frequency up to which the current vector rotation is used. See parameter 21.19 Scalar start mode. Can be used for permanent magnet synchronous motors only.	10.0%
	2.0100.0%	Value as a percentage of the nominal motor frequency.	1 = 1%
21.26	Torque boost current	Maximum current supplied during torque boost. Can be used for permanent magnet synchronous motors only.	100.0%
	15.0300.0%	Value in percent of the nominal motor current.	1 = 1%
21.30	Speed compensated stop mode	Selects the method used to stop the drive. See also section.  Speed compensated stop (page 109).  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 compensated 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%

No.	Name/Value	Description	Def/FbEq16
22 Speed reference selection		Speed reference selection; motor potentiometer settings. See the control chain diagrams on pages 420424.	
22.01	Speed ref unlimited	Displays the output of the speed reference selection block. See the control chain diagram on page 423. 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 —  Other —	22.11  22.13  Ref1  ADD  SUB  MUL  MIN  Ext1  19.11  0  32.12	86
	0 — Al — FB —  Other —	22.18  22.20  Ref1  ADD  SUB  MUL  MUL  B  22.29  B  Ext2  B	
	0 — Al — FB —  Other —	T MAX TO S	
	Zero	None.	0
	Al1 scaled	12.12 Al1 scaled value (see page 157).	1
	Al2 scaled	12.22 Al2 scaled value (see page 158).	2
	FB A ref1	03.05 FB A reference 1 (see page 142).	4

No.	Name/Value	e Description		
	FB A ref2	03.06 FB A reference 2 (see page 142).	5	
	EFB ref1	03.09 EFB reference 1 (see page 142).	8	
	EFB ref2	03.10 EFB reference 2 (see page 142).	9	
	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 DI6 is used as a frequency input).	17	
	Control panel (ref saved)	Panel reference (03.01 Panel reference, see page 141) 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  Inactive reference	18	
	Control panel (ref copied)	Panel reference (03.01 Panel reference, see page 141) for the previous control location is used as the reference when the control location changes if the references for the two locations are of the same type (eg frequency/speed/torque/PID); otherwise, the actual signal is used as the new reference.  Reference  Ext1 reference  Ext1 reference  Active reference  Inactive reference	19	
	Other	Source selection (see <i>Terms and abbreviations</i> on page 136).	-	
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	
	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	

No.	Name/Value	Description	Def/FbEq16
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 157).	1
	Al2 scaled	12.22 Al2 scaled value (see page 158).	2
	FB A ref1	03.05 FB A reference 1 (see page 142).	4
	FB A ref2	03.06 FB A reference 2 (see page 142).	5
	EFB ref1	03.09 EFB reference 1 (see page 142).	8
	EFB ref2	03.10 EFB reference 2 (see page 142).	9
	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	$\emph{11.38 Freq in 1 actual value}$ (when DI6 is used as a frequency input).	17
	Control panel (ref saved)	Panel reference (03.01 Panel reference, see page 141) saved by the control system for the location where the control returns is used as the reference.  Reference  Ext1 reference  Ext2 reference  Active reference  I control returns is used as the reference.	18
	Control panel (ref copied)	Panel reference (03.01 Panel reference, see page 141) for the previous control location is used as the reference when the control location changes if the references for the two locations are of the same type (eg frequency/speed/torque/PID); otherwise, the actual signal is used as the new reference.  Reference  Ext1 reference  Ext2 reference  Active reference  Inactive reference	19
	Other	Source selection (see <i>Terms and abbreviations</i> on page <i>136</i> ).	-
22.19	Ext2 speed ref2	Selects Ext2 speed reference source 2. For the selections, and a diagram of reference source selection, see parameter 22.18 Ext2 speed ref1.	Zero
22.20	Ext2 speed function	Selects a mathematical function between the reference sources selected by parameters 22.18 Ext2 speed ref1 and 22.19 Ext2 speed ref2. See diagram at 22.18 Ext2 speed ref1.	Ref1
	Ref1	Signal selected by <i>Ext2 speed ref1</i> is used as speed reference 1 as such (no function applied).	0

No.	No. Name/Value Description  Add (ref1 + ref2) The sum of the reference sources is used as speed reference 1.		Def/FbEq16
			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
	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
22.21	Constant speed function	Determines how constant speeds are selected, and whether the rotation direction signal is considered or not when applying a constant speed.	0001b

Bit	Name	Information
0	Constant speed 1 = Packed: 7 constant speeds are selectable using the mode defined by parameters 22.22, 22.23 and 22.24.	
		0 = Separate: Constant speeds 1, 2 and 3 are separately activated by the sources defined by parameters 22.22, 22.23 and 22.24 respectively. In case of conflict, the constant speed with the smaller number takes priority.
115	Reserved	

0000b0001b	Constant speed configuration word.	1 = 1
22.22 Constant speed sel1	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 defined by par. 22.22	Source defined by par. 22.23	Source defined by par. 22.24	Constant speed active
0	0	0	None
1	0	0	Constant speed 1
0	1	0	Constant speed 2
1	1	0	Constant speed 3
0	0	1	Constant speed 4
1	0	1	Constant speed 5
0	1	1	Constant speed 6
1	1	1	Constant speed 7

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

No.	. Name/Value Description		Def/FbEq16
	DI6	Digital input DI6 (10.02 DI delayed status, bit 5).	7
	Timed function 1	Bit 0 of 34.01 Combined timer status (see page 240).	18
	Timed function 2	Bit 1 of 34.01 Combined timer status (see page 240).	19
	Timed function 3	Bit 2 of 34.01 Combined timer status (see page 240).	20
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 234).	24
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 234).	25
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 234).	26
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page <i>136</i> ).	-
22.23	Constant speed sel2	When bit 0 of parameter 22.21 Constant speed function is 0 (Separate), selects a source that activates constant speed 2. When bit 0 of parameter 22.21 Constant speed function is 1 (Packed), this parameter and parameters 22.22 Constant speed sel1 and 22.24 Constant speed sel3 select three sources that are used to activate constant speeds. See table at parameter 22.22 Constant speed sel1. For the selections, see parameter 22.22 Constant speed sel1.	D14
22.24	Constant speed sel3	When bit 0 of parameter 22.21 Constant speed function is 0 (Separate), selects a source that activates constant speed 3. When bit 0 of parameter 22.21 Constant speed function is 1 (Packed), this parameter and parameters 22.22 Constant speed sel1 and 22.23 Constant speed sel2 select three sources that are used to activate constant speeds. See table at parameter 22.22 Constant speed sel1. For the selections, see parameter 22.22 Constant speed sel1.	Not selected
22.26	Constant speed 1	Defines constant speed 1 (the speed the motor will turn when constant speed 1 is selected).	300.00 rpm
	-30000.00 30000.00 rpm	Constant speed 1.	See par. 46.01
22.27	Constant speed 2	Defines constant speed 2.	600.00 rpm
	-30000.00 30000.00 rpm	Constant speed 2.	See par. 46.01
22.28	Constant speed 3	Defines constant speed 3.	900.00 rpm
	-30000.00 30000.00 rpm	Constant speed 3.	See par. 46.01
22.29	Constant speed 4	Defines constant speed 4.	1200.00 rpm
	-30000.00 30000.00 rpm	Constant speed 4.	See par. 46.01
22.30	Constant speed 5	Defines constant speed 5.	1500.00 rpm
	-30000.00 30000.00 rpm	Constant speed 5.	See par. 46.01
22.31	Constant speed 6	Defines constant speed 6.	2400.00 rpm
	-30000.00 30000.00 rpm	Constant speed 6.	See par. 46.01
22.32	Constant speed 7	Defines constant speed 7.	3000.00 rpm
	-30000.00 30000.00 rpm	Constant speed 7.	See par. 46.01

No.	Name/Value	Description	Def/FbEq16
22.41	Speed ref safe	Defines a safe speed 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 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 98.	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 98.	0.00 rpm
	-30000.00 30000.00 rpm	Speed reference for jogging function 2.	See par. 46.01
22.51	Critical speed 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 97).	0000b

Bit	Name	Information
0	Enable	1 = Enable: Critical speeds enabled.
		0 = Disable: Critical speeds disabled.
1	Sign mode	1 = Signed: The signs of parameters 22.5222.57 are taken into account.
		0 = Absolute: Parameters 22.5222.57 are handled as absolute values. Each range is effective in both directions of rotation.
215	Reserved	

	0000b0011b	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
	-30000.00 30000.00 rpm	Low limit for critical speed 1.	See par. 46.01
22.53	Critical speed 1 high	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
	-30000.00 30000.00 rpm	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
	-30000.00 30000.00 rpm	Low limit for critical speed 2.	See par. 46.01
22.55	Critical speed 2 high	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
	-30000.00 30000.00 rpm	High limit for critical speed 2.	See par. 46.01

No.	Name/Value	Description	Def/FbEq16
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
	-30000.00 30000.00 rpm	Low limit for critical speed 3.	See par. 46.01
22.57	Critical speed 3 high	Defines the high limit for critical speed range 3.  Note: This value must be greater than or equal to the value of 22.56 Critical speed 3 low.	0.00 rpm
	-30000.00 30000.00 rpm	High limit for critical speed 3.	See par. 46.01
22.71	Motor potentiometer function	Activates and selects the mode of the motor potentiometer. See section <i>Speed control performance figures</i> (page 102).	Disabled
	Disabled	Motor potentiometer is disabled and its value set to 0.	0
	Enabled (init at 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 power cycle will reset the motor potentiometer to the predefined initial value (22.72).	1
	Enabled (resume at power-up)	As Enabled (init at power-up), but the motor potentiometer value is retained over a power cycle.	2
	Enabled (init to actual)	Whenever another reference source is selected, the value of the motor potentiometer follows that reference. After the source of reference returns to the motor potentiometer, its value can again be changed by the up and down sources (defined by 22.73 and 22.74).	3
22.72	Motor potentiometer initial value	Defines an initial value (starting point) for the motor potentiometer. See the selections of parameter 22.71 Motor potentiometer function.	0.00
	-32768.00 32767.00	Initial value for motor potentiometer.	1 = 1
22.73	Motor potentiometer up source	Selects the source of motor potentiometer up signal.  0 = No change  1 = Increase motor potentiometer value. (If both the up and down sources are on, the potentiometer value will not change.)	Not selected
	Not selected	0.	0
	Selected	1.	1
	DI1	Digital input DI1 (10.02 DI delayed status, bit 0).	2
	DI2	Digital input DI2 (10.02 DI delayed status, bit 1).	3
	DI3	Digital input DI3 (10.02 DI delayed status, bit 2).	4
	DI4	Digital input DI4 (10.02 DI delayed status, bit 3).	5
	DI5	Digital input DI5 (10.02 DI delayed status, bit 4).	6
	DI6	Digital input DI6 (10.02 DI delayed status, bit 5).	7
	Timed function 1	Bit 0 of 34.01 Combined timer status (see page 240).	18
	Timed function 2	Bit 1 of 34.01 Combined timer status (see page 240).	19
	Timed function 3	Bit 2 of 34.01 Combined timer status (see page 240).	20

No.	Name/Value	Description	Def/FbEq16
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 234).	24
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 234).	25
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 234).	26
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page <i>136</i> ).	-
22.74	Motor potentiometer down source	Selects the source of motor potentiometer down signal.  0 = No change 1 = Decrease motor potentiometer value. (If both the up and down sources are on, the potentiometer value will not change.)  For the selections, see parameter 22.73 Motor potentiometer up source.	Not selected
22.75	Motor potentiometer ramp time	Defines the change rate of the motor potentiometer. This parameter specifies the time required for the motor potentiometer to change from minimum (22.76) to maximum (22.77). The same change rate applies in both directions.	40.0 s
	0.03600.0 s	Motor potentiometer change time.	10 = 1 s
22.76	Motor potentiometer min value	Defines the minimum value of the motor potentiometer.  Note: If vector control mode is used, value of this parameter must be changed.	0.00
	-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 420.  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 423. 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	ed reference	Speed reference ramp settings (programming of the acceleration and deceleration rates for the drive). See the control chain diagram on page 424.	
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 424.  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 424. 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 1	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
	FBA A	Reserved.	18
	EFB	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 136).	-
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. 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 Rush control (page 98).	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 Rush control (page 98).	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  Speed reference  Time  t = update interval of signal from external control system  A = speed reference change during t	Off
		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:	0.100 s
		Speed  Linear ramp: 23.32 = 0 s  S-curve ramp: 23.32 > 0 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	
		23.32 = 0 s	
	0.1001800.000 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.	0.100 s
	0.1001800.000 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 diagrams on pages 425 and 426.	
24.01	Used speed reference	Displays the ramped and corrected speed reference (before speed error calculation). See the control chain diagram on page 425.  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 425. 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 425.  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 425.  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 425.	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 Spe	eed control	Speed controller settings. See the control chain diagrams on pages 425 and 426.	
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 425. This parameter is read-only.	-
	-1600.01600.0%	Limited speed controller output torque.	See par. 46.03

No.	Name/Value	Description	Def/FbEq16
25.02	Speed proportional gain	Defines the proportional gain $(K_p)$ of the speed controller. Too high a gain may cause speed oscillation. The figure below shows the speed controller output after an error step when the error remains constant.	10.00
	•	Gain = $K_p = 1$ $T_l = Integration time = 0$ $T_D = Derivation time = 0$	
	Controller output = $K_p \times e$	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.	2.50 s
	$K_p \times e \left\{ \begin{array}{c} & & \\ & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & $	Controller output  Gain = $K_p = 1$ $T_1 = Integration time > T_D = Derivation time = 0$ $e = Error value$	0
		Τ <sub>1</sub>	
	0.001000.00 s	Integration time for speed controller.	10 = 1 s

No.	Name/Value	Description	Def/FbEq16
25.04	Speed derivation time $ K_p \times T_D \times \frac{\Delta e}{T_s} \left\{ \begin{array}{l} \\ K_r \end{array} \right. $ $ K_r $ $ K_r $ $ K_r $ $ K_r $	Defines the derivation time of the speed controller. Derivative action boosts the controller output if the error value changes. The longer the derivation time, the more the speed controller output is boosted during the change. If the derivation time is set to zero, the controller works as a PI controller, otherwise as a PID controller. The derivation makes the control more responsive for disturbances. For simple applications (especially those without a pulse encoder), 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
		,	
	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  - Speed reference  - Actual speed	0.00 s
		Time	
	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

Def/FbEq16

25.53	Torque prop reference	Displays the output of the proportional (P) part of the speed controller. See the control chain diagram on page 425.  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 425. 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 425.  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 425. This parameter is read-only.	-
	-30000.0 30000.0%	Output of acceleration compensation function.	See par. 46.03
26 Tor chain	que reference	Settings for the torque reference chain. See the control chain diagrams on pages 427 and 428.	
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 428 and 429.  This parameter is read-only.	-
	-1600.01600.0%	Torque reference for torque control.	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 429.  This parameter is read-only.	-
	-1600.01600.0%	Torque reference for torque control.	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.	See par. 46.03
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.	See par. 46.03

No.

Name/Value

Description

No.	Name/Value	Description	Def/FbEq16
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 AI FB 26.1  Other Other	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 157).	1
	Al2 scaled	12.22 Al2 scaled value (see page 158).	2
	FB A ref1	03.05 FB A reference 1 (see page 142).	4
	FB A ref2	03.06 FB A reference 2 (see page 142).	5
	EFB ref1	03.09 EFB reference 1 (see page 142).	8
	EFB ref2	03.10 EFB reference 2 (see page 142).	9
	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 DI6 is used as a frequency input).	17
	Control panel (ref saved)	Panel reference (03.01 Panel reference, see page 141) 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

No.	Name/Value	Description	Def/FbEq16
	Control panel (ref copied)	Panel reference (03.01 Panel reference, see page 141) for the previous control location is used as the reference when the control location changes if the references for the two locations are of the same type (eg frequency/speed/torque/PID); otherwise, the actual signal is used as the new reference.  Reference  Ext1 reference  Ext2 reference  Active reference  Inactive reference	19
	Other	Source selection (see <i>Terms and abbreviations</i> on page 136).	-
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
	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

No.	Name/Value	Description	Def/FbEq16
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page <i>136</i> ).	-
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
26.21	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 <i>136</i> ).	-
26.22	Torque sel speed in	Selects the source for 25.01 Torque reference speed control.	Torque ref speed ctrl
	Not selected	None.	0
	Torque ref speed ctrl	Torque reference from the speed chain.	1
	Other	Source selection (see <i>Terms and abbreviations</i> on page 136).	-
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 427.  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 427.  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 427.  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 427. This parameter is read-only.	-
	-1600.01600.0%	Torque reference after application of reference additive 1.	See par. 46.03

No.	Name/Value	Description	Def/FbEq16
26.74	Torque ref ramp out	Displays the torque reference after limiting and ramping. See the control chain diagram on page 427. 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 429. This parameter is read-only.	-
	-1600.01600.0%	Torque reference after control mode selection.	See par. 46.03
00 5		Catting for the formula of the in	
chain	quency reference	Settings for the frequency reference chain. See the control chain diagrams on pages 430 and 421.	
28.01	Frequency ref ramp input	Displays the used frequency reference before ramping. See the control chain diagram on page 430.  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 430. 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 —  Other —  Other —  Other —  Other —  Other —  Other —  Other —  Other —  Other —  Other —  Other —  Other —  Other —  Other —	28.11  28.13  Ref1  ADD  MUL  SUB  MIN  MAX  Part  19.11  0  28.15  28.17  Ref1  Ext2  B  B	92
	Zero	None.	0
	Al1 scaled	12.12 Al1 scaled value (see page 157).	1
	Al2 scaled	12.22 AI2 scaled value (see page 157).	2
	FB A ref1	03.05 FB A reference 1 (see page 142).	4
	FB A ref2	03.06 FB A reference 2 (see page 142).	5
	EFB ref1	03.09 EFB reference 1 (see page 142).	8
	EFB ref2	03.10 EFB reference 2 (see page 142).	9
	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

No.	No. Name/Value Description		Def/FbEq16
	Frequency input	11.38 Freq in 1 actual value (when DI6 is used as a frequency input).	17
	Control panel (ref saved)	Panel reference (03.01 Panel reference, see page 141) 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 141) for the previous control location is used as the reference when the control location changes if the references for the two locations are of the same type (eg frequency/speed/torque/PID); otherwise, the actual signal is used as the new reference.  Reference  Ext1 reference  Ext2 reference  Active reference  Inactive reference	19
	Other	Source selection (see <i>Terms and abbreviations</i> on page 136).	-
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
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 157).	1

No.	Name/Value	Description	Def/FbEq16
	Al2 scaled	12.22 Al2 scaled value (see page 158).	2
	FB A ref1	03.05 FB A reference 1 (see page 142).	4
	FB A ref2	03.06 FB A reference 2 (see page 142).	5
	EFB ref1	03.09 EFB reference 1 (see page 142).	8
	EFB ref2	03.10 EFB reference 2 (see page 142).	9
	Motor	22.80 Motor potentiometer ref act (output of the motor	15
	potentiometer	potentiometer).	
	PID	40.01 Process PID output actual (output of the process PID controller).	16
	Frequency input	11.38 Freq in 1 actual value (when DI6 is used as a frequency input).	17
	Control panel (ref saved)	Panel reference (03.01 Panel reference, see page 141) saved by the control system for the location where the control returns is used as the reference.  Reference  Ext1 reference	18
		X Ext2 reference  Active reference Inactive reference	
	Control panel (ref copied)	Panel reference (03.01 Panel reference, see page 141) for the previous control location is used as the reference when the control location changes if the references for the two locations are of the same type (eg frequency/speed/torque/PID); otherwise, the actual signal is used as the new reference.  Reference  Ext1 reference  Ext1 reference  Active reference  Inactive reference	19
	Other	Source selection (see <i>Terms and abbreviations</i> on page 136).	-
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
28.17	Ext2 frequency function	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 (ref1 + ref2)	The sum of the reference sources is used as frequency reference 1.	1
	Sub (ref1 - 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 (ref1 × ref2)	The multiplication of the reference sources is used as frequency reference 1.	3

No.	Name/Value	Description	Def/FbEq16	
	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	
28.21	Constant frequency function	Determines how constant frequencies are selected, and whether the rotation direction signal is considered or not when applying a constant frequency.	0001b	

Bit	Name	Information
0	Const freq mode	1 = Packed: 7 constant frequencies are selectable using the three sources defined by parameters 28.22, 28.23 and 28.24.
		0 = Separate: Constant frequencies 1, 2 and 3 are separately activated by the sources defined by parameters 28.22, 28.23 and 28.24 respectively. In case of conflict, the constant frequency with the smaller number takes priority.

0000b0001b Constant frequency configuration word.		1 = 1
28.22 Constant frequency sel1	When bit 0 of parameter 28.21 Constant frequency function is 0 (Separate), selects a source that activates constant frequency 1.  When bit 0 of parameter 28.21 Constant frequency function is 1 (Packed), this parameter and parameters 28.23 Constant frequency sel2 and 28.24 Constant frequency sel3 select three sources whose states activate constant frequencies as follows:	DI3

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

Not selected	0.	0
Selected	1.	1
DI1	Digital input DI1 (10.02 DI delayed status, bit 0).	2
DI2	Digital input DI2 (10.02 DI delayed status, bit 1).	3
DI3	Digital input DI3 (10.02 DI delayed status, bit 2).	4
DI4	Digital input DI4 (10.02 DI delayed status, bit 3).	5
DI5	Digital input DI5 (10.02 DI delayed status, bit 4).	6
DI6	Digital input DI6 (10.02 DI delayed status, bit 5).	7
Timed function 1	Bit 0 of 34.01 Combined timer status (see page 240).	18
Timed function 2	Bit 1 of 34.01 Combined timer status (see page 240).	19
Timed function 3	Bit 2 of 34.01 Combined timer status (see page 240).	20

No.	Name/Value	Description	Def/FbEq16
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 234).	24
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 234).	25
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 234).	26
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page <i>136</i> ).	-
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.	DI4
28.24	Constant frequency sel3	When bit 0 of parameter 28.21 Constant frequency function is 0 (Separate), selects a source that activates constant frequency 3.  When bit 0 of parameter 28.21 Constant frequency function is 1 (Packed), this parameter and parameters 28.22 Constant frequency sel1 and 28.23 Constant frequency sel2 select three sources that are used to activate constant frequencies. See table at parameter 28.22 Constant frequency sel1.  For the selections, see parameter 28.22 Constant frequency sel1.	Not selected
28.26	Constant frequency 1	Defines constant frequency 1 (the frequency the motor will turn when constant frequency 1 is selected).	5.00 Hz
	-500.00500.00 Hz	Constant frequency 1.	See par. 46.02
28.27	Constant frequency 2	Defines constant frequency 2.	10.00 Hz
	-500.00500.00 Hz	Constant frequency 2.	See par. 46.02
28.28	Constant frequency 3	Defines constant frequency 3.	15.00 Hz
	-500.00500.00 Hz	Constant frequency 3.	See par. 46.02
28.29	Constant frequency 4	Defines constant frequency 4.	20.00 Hz
	-500.00500.00 Hz	Constant frequency 4.	See par. 46.02
28.30	Constant frequency 5	Defines constant frequency 5.	25.00 Hz
	-500.00500.00 Hz	Constant frequency 5.	See par. 46.02
28.31	Constant frequency 6	Defines constant frequency 6.	40.00 Hz
	-500.00500.00 Hz	Constant frequency 6.	See par. 46.02

No.	Name/\	/alue	Description	Def/FbEq16
28.32	Constai 7	nt frequency	Defines constant frequency 7.	50.00 Hz
	-500.00 Hz	500.00	Constant frequency 7.	See par. 46.02
28.41	Freque	ncy ref safe	Defines a safe frequency reference value that is used with supervision functions such as  12.03 Al supervision function  49.05 Communication loss action	0.00 Hz
			• 50.02 FBA A comm loss func.	
	-500.00 Hz	500.00	Safe frequency reference.	See par. 46.02
28.51	Critical function	frequency	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 97).	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 28.5228.3 into account.	
			0 = Absolute: Parameters 28.5228.57 are handled as abs Each range is effective in both directions of rotation.	solute values.
				1
	0000b		Critical frequencies configuration word.	1 = 1
28.52	Critical low	frequency 1	Defines the low limit for critical frequency 1. <b>Note:</b> 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 high	frequency 1	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	low		Defines the low limit for critical frequency 2. <b>Note:</b> 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	8.55 Critical frequency 2 high		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

No.	Name/Value	Description	Def/FbEq16
28.57	Critical frequency 3 high	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
	-500.00500.00 Hz	High limit for critical frequency 3.	See par. 46.02
28.71	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 for 1 = Acceleration time 2 and deceleration time 2 are in for 1 = Acceleration time 2 and deceleration time 2 are in for 1 = Acceleration time 2 and deceleration time 2 are in for 1 = Acceleration time 2 and deceleration time 2 are in for 1 = Acceleration time 2 and deceleration time 2 are in for 1 = Acceleration time 2 and deceleration time 2 are in for 1 = Acceleration time 2 and deceleration time 2 are in for 1 = Acceleration time 2 and deceleration time 3 are in for 1 = Acceleration time 2 and deceleration time 3 are in for 1 = Acceleration time 3 are in for 1		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
	FBA A	Reserved.	18
	EFB	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 <i>136</i> ).	-
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

No.	Name/Value	Description	Def/FbEq16
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
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 <i>136</i> ).	-

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	0.100 s
		Speed  Linear ramp: 28.82 = 0 s  S-curve ramp: 28.82 > 0 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.	0.100 s
	0.0001800.000 s	Ramp shape at start and end of acceleration and deceleration.	10 = 1 s

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 430.  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 430.  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 421.  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	1 = Torque reference is being limited by 26.09 Maximum torque ref or 30.20 Maximum torque 1
4	Torq ref min	1 = Torque reference is being limited by 26.08 Minimum torque ref or 30.19 Minimum torque 1
5	Tlim max speed	1 = Torque reference is being limited by the rush control because of maximum speed limit (30.12 Maximum speed)
6	Tlim min speed	1 = Torque reference is being limited by the rush control because of minimum speed limit (30.11 Minimum speed)
7	Max speed ref lim	1 = Speed reference is being limited by 30.12 Maximum speed
8	Min speed ref lim	1 = Speed reference is being limited by 30.11 Minimum speed
9	Max freq ref lim	1 = Frequency reference is being limited by 30.14 Maximum frequency
10	Min freq ref lim	1 = Frequency reference is being limited by 30.13 Minimum frequency
1115	Reserved	

0000h...FFFFh Limit word 1. 1 = 1

No.	Name/V	alue	Desc	ription	Def/FbEq16	
30.02	Torque I	imit status		ays the torque controller limitation status word. parameter is read-only.	-	
	Bit	Name		Description		
	0	Undervolta	ge	*1 = Intermediate DC circuit undervoltage		
	1	Overvoltage	е	*1 = Intermediate DC circuit overvoltage		
	2	Minimum to	•	*1 = Torque is being limited by 30.19 Minimum torque 1, motoring limit or 30.27 Power generating limit		
	3	Maximum to	•	*1 = Torque is being limited by 30.20 Maximum torque 1, motoring limit or 30.27 Power generating limit		
	4	Internal current		1 = An inverter current limit (identified by bits 811) is a		
	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 pullo	ut	(With asynchronous motors only) Motor pull-out limit is active, ie. the motor cannot produc torque	e any more	
	7	Reserved				
	8	Thermal		1 = Input current is being limited by the main circuit therr	nal limit	
	9	Max curren	t	*1 = Maximum output current (I <sub>MAX</sub> ) is being limited		
	10	User currer	nt	*1 = Output current is being limited by 30.17 Maximum of	urrent	
	11	Thermal IGBT		*1 = Output current is being limited by a calculated thermal current value		
	1215					
	*Only or indicates	ne out of bits is the limit tha	03, at is ex	and one out of bits 911 can be on simultaneously. The ceeded first.	bit typically	
	0000h	FFFFh	Torqu	ue limitation status word.	1 = 1	
30.11	Minimum speed Defin		Defin	warning! This value must not be higher than 30.12 Maximum speed.  WARNING! In speed control mode only. In frequency control mode, use frequency limits (30.13 and 30.14).	-1500.00 rpr	
	-30000.00 Minir 30000.00 rpm		Minin	num allowed speed.	See par. 46.01	
30.12	Maximum speed Defii		Defin	es the maximum allowed speed.  WARNING! This value must not be lower than 30.11  Minimum speed.  WARNING! In speed control mode only. In frequency control mode, use frequency limits (30.13 and 30.14).	1500.00 rpm	
	-30000.0 30000.0		Maxir	mum speed.	See par. 46.01	
30.13	Minimun	n frequency	Defin	es the minimum allowed frequency.  WARNING! This value must not be higher than 30.14  Maximum frequency.  WARNING! in frequency control mode only.	-50.00 Hz	
	-500.00. Hz	500.00	Minin	num frequency.	See par. 46.02	

No.	Name/Value	Description	Def/FbEq16
30.14	Maximum frequency	Defines the maximum allowed frequency.  WARNING! This value must not be lower than 30.13  Minimum frequency.  WARNING! in frequency control mode only.	50.00 Hz
	-500.00500.00 Hz	Maximum frequency.	See par. 46.02
30.17	Maximum current	Defines the maximum allowed motor current.	0.00 A
	0.0030000.00 A	Maximum motor current.	1 = 1 A
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).  30.19  Note: In addition to the user-defined limits, torque may be limited for other reasons (such as power limitation). Refer to the block diagram on page 429.  WARNING! In torque control mode (vector motor control) only.	Torque limit set 1
	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

No.	Name/Value	Description	Def/FbEq16
	DI4	Digital input DI4 (10.02 DI delayed status, bit 3).	5
	DI5	Digital input DI5 (10.02 DI delayed status, bit 4).	6
	DI6	Digital input DI6 (10.02 DI delayed status, bit 5).	7
	FBA A	Reserved.	10
	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 <i>136</i> ).	-
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.  WARNING! In torque control mode (vector motor control) only.	-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.  WARNING! In torque control mode (vector motor control) only.	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.  WARNING! In torque control mode (vector motor control) only.	Minimum torque 2
	Zero	None.	0
	Al1 scaled	12.12 Al1 scaled value (see page 157).	1
	Al2 scaled	12.22 Al2 scaled value (see page 158).	2
	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 <i>136</i> ).	-

No.	Name/Value	Description	Def/FbEq16
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.  WARNING! In torque control mode (vector motor control) only.	Maximum torque 2
	Zero	None.	0
	Al1 scaled	12.12 Al1 scaled value (see page 157).	1
	Al2 scaled	12.22 Al2 scaled value (see page 158).	2
	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 136).	-
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.  WARNING! In torque control mode (vector motor control) only.	-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.  WARNING! In torque control mode (vector motor control) only.	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.	-300.00%
	-600.000.00%	Maximum generating power.	1 = 1%

No.	Name/Value	Description	Def/FbEq16
30.30	Overvoltage control	Enables the overvoltage control of the intermediate DC link. Fast braking of a high inertia load causes the voltage to rise to the overvoltage control limit. To prevent the DC voltage from exceeding the limit, the overvoltage controller automatically decreases the braking torque.  Note: If the drive is equipped with a brake chopper and resistor, or a regenerative supply unit, the controller must be disabled.	Enable
	Disable	Overvoltage control disabled.	0
	Enable	Overvoltage control enabled.	1
30.31	Undervoltage control	Enables the undervoltage control of the intermediate DC link. If the DC voltage drops due to input power cut off, the undervoltage controller will automatically decrease the motor torque in order to keep the voltage above the lower limit. By decreasing the motor torque, the inertia of the load will cause regeneration back to the drive, keeping the DC link charged and preventing an undervoltage trip until the motor coasts to a stop. This will act as a power-loss ride-through functionality in systems with high inertia, such as a centrifuge or a fan.	Enable
	Disable	Undervoltage control disabled.	0
	Enable	Undervoltage control enabled.	1

31 Fault functions		Configuration of external events; selection of behavior of the drive upon fault situations.	
31.01	External event 1 source	Defines the source of external event 1.  See also parameter 31.02 External event 1 type.  0 = Trigger event 1 = Normal operation	Inactive (true)
	Active (false)	0.	0
	Inactive (true)	1.	1
	DI1	Digital input DI1 (10.02 DI delayed status, bit 0).	3
	DI2	Digital input DI2 (10.02 DI delayed status, bit 1).	4
	DI3	Digital input DI3 (10.02 DI delayed status, bit 2).	5
	DI4	Digital input DI4 (10.02 DI delayed status, bit 3).	6
	DI5	Digital input DI5 (10.02 DI delayed status, bit 4).	7
	DI6	Digital input DI6 (10.02 DI delayed status, bit 5).	8
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page <i>136</i> ).	-
31.02	External event 1 type	Selects the type of external event 1.	Fault
	Fault	The external event generates a fault.	0
	Warning	The external event generates a warning.	1
31.03	External event 2 source	Defines the source of external event 2. See also parameter 31.04 External event 2 type.  For the selections, see parameter 31.01 External event 1 source.	Inactive (true)
31.04	External event 2 type	Selects the type of external event 2.	Fault
	Fault	The external event generates a fault.	0
	Warning	The external event generates a warning.	1

No.	Name/Value	Description	Def/FbEq16
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 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
	Timed function 1	Bit 0 of 34.01 Combined timer status (see page 240).	18
	Timed function 2	Bit 1 of 34.01 Combined timer status (see page 240).	19
	Timed function 3	Bit 2 of 34.01 Combined timer status (see page 240).	20
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 234).	24
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 234).	25
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 234).	26
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 136).	-

No.	Name/\	/alue	Description	Def/FbEq16				
31.12	Autores	set selection	Selects faults that are automatically reset. The parameter is a 16-bit word with each bit corresponding to a fault type. Whenever a bit is set to 1, the corresponding fault is automatically reset.  WARNING! Before you activate the function, make sure that no dangerous situations can occur. The function restarts the drive automatically and continues operation after a fault.  The bits of this binary number correspond to the following faults:	0000h				
	Bit	Fault						
	0	Overcurren	t					
	1	Overvoltage						
	2	Undervoltaç	ge					
	3	Al supervis	ion fault					
	49	Reserved						
	10		fault (see parameter 31.13 Selectable fault)					
	11 12		ult 1 (from source selected by parameter 31.01 External event 1					
	13		ult 2 (from source selected by parameter 31.03 External event 2					
	14	External fault 3 (from source selected by parameter 31.05 External event 3  External fault 4 (from source selected by parameter 31.07 External event 4						
	15 External fault 5 (from source selected by parameter 31.09 External event 5 so							
	Profital ladit o (from source solicated by parameter \$1.03 External event o source)							
	0000h.	FFFFh	Automatic reset configuration word.	1 = 1				
31.13	Selecta	ble fault	Defines the fault that can be automatically reset using parameter 31.12 Autoreset selection, bit 10.	0000h				
			Faults are listed in chapter <i>Fault tracing</i> (page 368). <b>Note:</b> The fault codes are in hexadecimal. The selected code must be converted to decimal for this parameter.					
	0000h.	FFFFh	Fault code.	10 = 1				
31.14	Numbe	r of trials	Defines the number of automatic fault resets the drive performs within the time defined by parameter 31.15 Total trials time.	0				
	05		Number of automatic resets.	10 = 1				
31.15	Total tri	als time	Defines the time the automatic reset function will attempt to reset the drive. During this time, it will perform the number of automatic resets defined by 31.14 Number of trials.	30.0 s				
	1.060	00.0 s	Time for automatic resets.	10 = 1 s				
31.16	Delay time		Defines the time that the drive will wait after a fault before attempting an automatic reset. See parameter 31.12 Autoreset selection.	0.0 s				
	0.012	20.0 s	Autoreset delay.	10 = 1 s				
31.19	Motor p	hase loss	Selects how the drive reacts when a motor phase loss is detected.	Fault				
	No action	on	No action taken.	0				
	Fault		The drive trips on fault 3381 Output phase loss.	1				

No.	Name/Value	Descri	iption			Def/FbEq16		
31.20	Earth fault			the drive reacts when an ance is detected in the m		Fault		
	No action	No act	ion tak	en.		0		
	Warning	The dr	ive ger	nerates an A2B3 Earth le	eakage warning.	1		
	Fault	The dr	ive trip	s on fault 2330 Earth lea	kage.	2		
31.21	Supply phase loss	Selecte		the drive reacts when a s	supply phase loss is	Fault		
	No action	No act	No action taken.					
	Fault	The dr	ive trip	s on fault 3130 Input pha	ase loss.	1		
31.22	STO indication run/stop	torque indicat stoppe The ta genera Notes: This function the rem both The as it	Selects which indications are given when one or both Safe torque off (STO) signals are switched off or lost. The indications also depend on whether the drive is running or stopped when this occurs.  The tables at each selection below show the indications generated with that particular setting.  Notes:  This parameter does not affect the operation of the STO function itself. The STO function will operate regardless of the setting of this parameter: a running drive will stop upon removal of one or both STO signals, and will not start until both STO signals are restored and all faults reset.  The loss of only one STO signal always generates a fault as it is interpreted as a malfunction.  For more information on the STO, see chapter <i>The Safe</i>					
				ormation on the STO, see section in the <i>Hardware m</i> a				
	Fault/Fault					0		
	Fault/Fault	torque		nction in the Hardware m	anual of the drive.	0		
	Fault/Fault	torque	off fur	nction in the Hardware m		0		
	Fault/Fault	Inp IN1 0	off fundamental off	Indication (runn Fault 5091 S	ing or stopped) afe torque off	0		
	Fault/Fault	Inp IN1 0 0	off fundamental off fundamenta	Indication (runn Fault 5091 S Fault FA81 Sa	ning or stopped) afe torque off fe torque off 1	0		
	Fault/Fault	Inp   IN1   0   0   1	off fundamental of the second	Indication (runn Fault 5091 S Fault FA81 Sa Fault FA82 Sa	ing or stopped) afe torque off fe torque off 1 fe torque off 2	0		
	Fault/Fault	Inp IN1 0 0	off fundamental off fundamenta	Indication (runn Fault 5091 S Fault FA81 Sa Fault FA82 Sa	ning or stopped) afe torque off fe torque off 1	0		
		Inp   IN1   0   0   1	off fundamental of the second	Indication (runn Fault 5091 S Fault FA81 Sa Fault FA82 Sa	ing or stopped) afe torque off fe torque off 1 fe torque off 2			
	Fault/Fault Fault/Warning	Inp   IN1   0   0   1   1	off fundamental state of the st	Indication (runn Fault 5091 S Fault FA81 Sa Fault FA82 Sa (Normal o	anual of the drive.  sing or stopped)  afe torque off fe torque off 1 fe torque off 2 operation)	1		
		Inp IN1 0 0 1 1 1 Inp	off fundamental outs  IN2  0  1  0  1	Indication (runn Fault 5091 S Fault FA81 Sa Fault FA82 Sa (Normal o	anual of the drive.  sing or stopped)  afe torque off fie torque off 1 fie torque off 2 operation)			
		Inp   IN1   0   0   1   1	off fundamental fu	Indication (runn Fault 5091 S Fault FA81 Sa Fault FA82 Sa (Normal o	anual of the drive.  sing or stopped)  afe torque off fie torque off 1 fie torque off 2 operation)  ation Stopped			
		Inp IN1 0 0 1 1 1 Inp	off fundamental outs  IN2  0  1  0  1	Indication (runn Fault 5091 S Fault FA81 Sa Fault FA82 Sa (Normal o	anual of the drive.  sing or stopped)  afe torque off fie torque off 1 fie torque off 2 operation)			
		Inp IN1 0 1 1 1 Inp IN1 Inp IN1	off fundamental fu	Indication (runn Fault 5091 S Fault FA81 Sa Fault FA82 Sa (Normal of  Indication (runn Fault 5091 S Fault 5091 Safe torque off Fault 5091 Safe torque off 1	anual of the drive.  sing or stopped)  afe torque off off torque off 1  off torque off 2  operation)  ation  Stopped  Warning A5A0 Safe torque off  Fault FA81 Safe torque off 1			
		Inp   IN1   0   0   1   1   Inp   IN1   0	off fundaments IN2 0 11 0 11 0 IN2 IN2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Indication (runn Fault 5091 S Fault FA82 Sa (Normal of Safe torque off 1 Fault FA82 Safe torque off 2	anual of the drive.  sing or stopped)  afe torque off off torque off 1  off torque off 2  operation)  ation  Stopped  Warning A5A0 Safe torque off  Fault FA81 Safe torque off 1			

No.	No. Name/Value Description					Def/FbEq16	
	Fault/Event					2	
		Inp	uts		ation		
		IN1	IN2	Running	Stopped		
		0	0	Fault 5091 Safe torque off	torque off		
		0	1	Fault FA81 Safe torque off 1	Fault FA81 Safe torque off 1		
		1	0	Fault FA82 Safe torque off 2	Fault FA82 Safe torque off 2		
		1	1	(Normal o	operation)		
	Warning/Warning					3	
	0 0	Inp	uts		_		
		IN1	IN2	Indication (runn	ning or stopped)		
		0	0	Warning A5A0	Safe torque off		
		0	1		nfe torque off 1		
		1	0		afe torque off 2		
		1	1	(Normal o	operation)		
		0 1 1				- "	
31.23	Wiring or earth fault	motor	cable c	he drive reacts to incorre connection (ie. input powe connection).		Fault	
	No action	No acti	on tak	en.		0	
	Fault	The dri	ve trips	s on fault 3181 Wiring or	r earth fault.	1	
31.24	Stall function	A stall The limit the 31.2 leve	Selects how the drive reacts to a motor stall condition.  A stall condition is defined as follows:  The drive exceeds the stall current limit (31.25 Stall current limit), and  the output frequency is below the level set by parameter 31.27 Stall frequency limit or the motor speed is below the level set by parameter 31.26 Stall speed limit, and  the conditions above have been true longer than the time set by parameter 31.28 Stall time.				
	No action	None (	stall su	pervision disabled).		0	
	Warning	The dri	ve ger	erates an A780 Motor s	tall warning.	1	
	Fault	The dri	ve trips	s on fault 7121 Motor sta	all.	2	
31.25	Stall current limit			mit in percent of the non arameter 31.24 Stall fund		200.0%	
	0.01600.0%	Stall cu	ırrent li	mit.		-	
31.26	Stall speed limit	Stall sp	eed lin	nit in rpm. See paramete	er 31.24 Stall function.	150.00 rpm	
	0.0010000.00 rpm	Stall sp	See par. 46.01				
31.27	Stall frequency limit			y limit. See parameter 3 the limit below 10 Hz is		15.00 Hz	
	0.001000.00 Hz	Stall fre	equenc	y limit.		See par. 46.02	
31.28	Stall time	Stall tin	ne. Se	e parameter 31.24 Stall	function.	20 s	
	03600 s	Stall tin	ne.			-	

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  Time  30.11	500.00 rpm
	0.0010000.00 rpm	Overspeed trip margin.	See par. 46.01
31.32	Emergency ramp supervision	Parameters 31.32 Emergency ramp supervision and 31.33 Emergency ramp supervision delay, together with the derivative of 24.02 Used speed feedback, provide a supervision function for emergency stop modes Off1 and Off3.  The supervision is based on either  • observing the time within which the motor stops, or  • comparing the actual and expected deceleration rates. If this parameter is set to 0%, the maximum stop time is directly set in parameter 31.33. Otherwise, 31.32 defines the maximum allowed deviation from the expected deceleration rate, which is calculated from parameters 23.1123.15 (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 73B0 Emergency ramp failed, sets bit 8 of 06.17 Drive status word 2, and coasts to a stop.  If 31.32 is set to 0% and 31.33 is set to 0 s, the emergency stop ramp supervision is disabled.  See also parameter 21.04 Emergency stop mode.	0%
		I SEE also parameter 21.04 Efferdency stop mode.	

No.	Name/V	alue	Description		Def/FbEq16
31.33	supervis	ncy ramp ion delay	this parameter (mode Off1 or stopped when Emergency ra 2, and coasts to defines a delar command and recommended change rate to	to a value other than 0%, this parameter y between the receipt of the emergency stop the activation of the supervision. It is to specify a short delay to allow the speed stabilize.	0 s
	0100 s	3	Maximum ram	p-down time, or supervision activation delay.	1 = 1 s
32 Sup	pervision	1	Six values can is generated w	of signal supervision functions 16.  be chosen to be monitored; a warning or fault whenever predefined limits are exceeded.  on Signal supervision (page 129).	
32.01	Supervis	sion status	Signal supervision status word. Indicates whether the values monitored by the signal supervision functions are within or outside their respective limits.  Note: This word is independent of the drive actions defined by parameters 32.06, 32.16, 32.26, 32.36, 32.46 and 32.56.		0000Ь
	Bit	Name	Description		
	0	Supervision	1 active 1 = Signal selected by 32.07 is outside its limits.		
	1	Supervision	2 active	1 = Signal selected by 32.17 is outside its limits	
	2	Supervision	3 active		
	3	Supervision	4 active		
	4	Supervision	5 active 1 = Signal selected by 32.47 is outside its limits		
	5	Supervision	6 active 1 = Signal selected by 32.27 is outside its limits		
	615	Reserved			
	00000	111b	Signal supervi	sion status word.	1 = 1
32.05	Supervis function	sion 1	how the monito to its lower and	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
	Disabled	1	Signal supervi	sion 1 not in use.	0
	Low		Action is taken whenever the signal falls below its lower limit.		1
	High		Action is taken limit.	2	
	Abs low		Action is taken whenever the absolute value of the signal falls below its (absolute) lower limit.  Action is taken whenever the absolute value of the signal rises above its (absolute) upper limit.		3
	Abs high	1			4
	Both		Action is taken rises above its	whenever the signal falls below its low limit or high limit.	5
	Abs both	1		whenever the absolute value of the signal falls blute) low limit or rises above its (absolute) high	6

No.	Name/Value	Description	Def/FbEq16
32.06	Supervision 1 action	Selects whether the drive generates a fault, warning or neither when the value monitored by signal supervision 1 exceeds its limits.	No action
		<b>Note:</b> This parameter does not affect the status indicated by 32.01 Supervision status.	
	No action	No warning or fault generated.	0
	Warning	Warning A8B0 Signal supervision is generated.	1
	Fault	Drive trips on fault 80B0 Signal supervision.	2
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 139).	1
	Frequency	01.06 Output frequency (page 139).	3
	Current	01.07 Motor current (page 139).	4
	Torque	01.10 Motor torque (page 139).	6
	DC voltage	01.11 DC voltage (page 139).	7
	Output power	01.14 Output power (page 140).	8
	AI1	12.11 Al1 actual value (page 157).	9
	AI2	12.21 Al2 actual value (page 158).	10
	Speed ref ramp in 23.01 Speed ref ramp input (page 200).		18
	Speed ref ramp out 23.02 Speed ref ramp output (page 200).		19
	Speed ref used	24.01 Used speed reference (page 204).	20
	Torque ref used	26.02 Torque reference used (page 209).	21
	Freq ref used	28.02 Frequency ref ramp output (page 213).	22
	Inverter temperature	05.11 Inverter temperature (page 143).	23
	Process PID output	40.01 Process PID output actual (page 261).	24
	Process PID feedback	40.02 Process PID feedback actual (page 262).	25
	Process PID setpoint	40.03 Process PID setpoint actual (page 262).	26
	Process PID deviation	40.04 Process PID deviation actual (page 262).	27
	Other	Source selection (see <i>Terms and abbreviations</i> on page 136).	-
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.	-

No.	Name/Value	Description	Def/FbEq16	
32.11	Supervision 1 hysteresis	Defines the hysteresis for the signal monitored by signal supervision 1.	0.00	
	0.00100000.00	Hysteresis.	-	
32.15	Supervision 2 function	Selects the mode of signal supervision function 2. Determines how the monitored signal (see parameter 32.17) is compared to its lower and upper limits (32.19 and 32.20 respectively). The action to be taken when the condition is fulfilled is selected by 32.16.	Disabled	
	Disabled	Signal supervision 2 not in use.	0	
	Low	Action is taken whenever the signal falls below its lower limit.	1	
	High	Action is taken whenever the signal rises above its upper limit.	2	
	Abs low	Action is taken whenever the absolute value of the signal falls below its (absolute) lower limit.	3	
	Abs high	Action is taken whenever the absolute value of the signal rises above its (absolute) upper limit.	4	
	Both	Action is taken whenever the signal falls below its low limit or rises above its high limit.	5	
	Abs both	Action is taken whenever the absolute value of the signal falls below its (absolute) low limit or rises above its (absolute) high limit.	6	
32.16	Supervision 2 action			
	No action	No warning or fault generated.	0	
	Warning	Warning A8B1 Signal supervision is generated.	1	
	Fault	Drive trips on fault 80B1 Signal supervision.	2	
32.17	Supervision 2 signal	Selects the signal to be monitored by signal supervision function 2.  For the available selections, see parameter 32.07  Supervision 1 signal.	Current	
32.18	Supervision 2 filter time	Defines a filter time constant for the signal monitored by signal supervision 2.	0.000 s	
	0.000 30.000 s	Signal filter time.	1000 = 1 s	
32.19	Supervision 2 low	Defines the lower limit for signal supervision 2.	0.00	
	-21474836.00 21474836.00	Low limit.	-	
32.20	Supervision 2 high	Defines the upper limit for signal supervision 2.	0.00	
	-21474836.00 21474836.00	Upper limit.	-	
32.21	Supervision 2 hysteresis	Defines the hysteresis for the signal monitored by signal supervision 2.	0.00	
	0.00100000.00	Hysteresis.	-	

No.	Name/Value	Description	Def/FbEq16
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
	Both	Action is taken whenever the signal falls below its low limit or rises above its high limit.	5
	Abs both	Action is taken whenever the absolute value of the signal falls below its (absolute) low limit or rises above its (absolute) high limit.	6
32.26	Supervision 3 action	Selects whether the drive generates a fault, warning or neither when the value monitored by signal supervision 3 exceeds its limits.  Note: This parameter does not affect the status indicated by 32.01 Supervision status.	No action
	No action	No warning or fault generated.	0
	Warning	Warning A8B2 Signal supervision is generated.	1
	Fault	Drive trips on fault 80B2 Signal supervision.	2
32.27	Supervision 3 signal	Selects the signal to be monitored by signal supervision function 3.  For the available selections, see parameter 32.07  Supervision 1 signal.	Torque
32.28	Supervision 3 filter time	Defines a filter time constant for the signal monitored by signal supervision 3.	0.000 s
	0.000 30.000 s	Signal filter time.	1000 = 1 s
32.29	Supervision 3 low	Defines the lower limit for signal supervision 3.	0.00
	-21474836.00 21474836.00	Low limit.	-
32.30	Supervision 3 high	Defines the upper limit for signal supervision 3.	0.00
	-21474836.00 21474836.00	Upper limit.	-
32.31	Supervision 3 hysteresis	Defines the hysteresis for the signal monitored by signal supervision 3.	0.00
	0.00100000.00	Hysteresis.	-
32.35	Supervision 4 function	Selects the mode of signal supervision function 4. Determines how the monitored signal (see parameter 32.37) is compared to its lower and upper limits (32.39 and 32.30 respectively). The action to be taken when the condition is fulfilled is selected by 32.36.	Disabled
	Disabled	Signal supervision 4 not in use.	0
	Low	Action is taken whenever the signal falls below its lower limit.	1

No.	Name/Value	Description	Def/FbEq16
	High	Action is taken whenever the signal rises above its upper limit.	2
	Abs low	Action is taken whenever the absolute value of the signal falls below its (absolute) lower limit.	3
	Abs high	Action is taken whenever the absolute value of the signal rises above its (absolute) upper limit.	4
	Both	Action is taken whenever the signal falls below its low limit or rises above its high limit.	5
	Abs both	Action is taken whenever the absolute value of the signal falls below its (absolute) low limit or rises above its (absolute) high limit.	6
32.36	Supervision 4 action	Selects whether the drive generates a fault, warning or neither when the value monitored by signal supervision 4 exceeds its limits.  Note: This parameter does not affect the status indicated by 32.01 Supervision status.	No action
	No action	No warning or fault generated.	0
	Warning	Warning A8B3 Signal supervision is generated.	1
	Fault	Drive trips on fault 80B3 Signal supervision.	2
32.37	Supervision 4	Selects the signal to be monitored by signal supervision	Zero
32.37	signal	function 4.  For the available selections, see parameter 32.07  Supervision 1 signal.	2670
32.38	Supervision 4 filter time	Defines a filter time constant for the signal monitored by signal supervision 4.	0.000 s
	0.000 30.000 s	Signal filter time.	1000 = 1 s
32.39	Supervision 4 low	Defines the lower limit for signal supervision 4.	0.00
	-21474836.00 21474836.00	Low limit.	-
32.40	Supervision 4 high	Defines the upper limit for signal supervision 4.	0.00
	-21474836.00 21474836.00	Upper limit.	-
32.41	Supervision 4 hysteresis	Defines the hysteresis for the signal monitored by signal supervision 4.	0.00
	0.00100000.00	Hysteresis.	-
32.45	Supervision 5 function	Selects the mode of signal supervision function 5. Determines how the monitored signal (see parameter 32.47) is compared to its lower and upper limits (32.49 and 32.40 respectively). The action to be taken when the condition is fulfilled is selected by 32.46.	Disabled
	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

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	
32.46	Supervision 5 action			
	No action	No warning or fault generated.	0	
	Warning	Warning A8B4 Signal supervision is generated.	1	
	Fault	Drive trips on fault 80B4 Signal supervision.	2	
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.		
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.	-	
32.51	Supervision 5 hysteresis	Defines the hysteresis for the signal monitored by signal supervision 5.	0.00	
	0.00100000.00	Hysteresis.	-	
32.55	Supervision 6 function	Selects the mode of signal supervision function 6. Determines how the monitored signal (see parameter 32.57) is compared to its lower and upper limits (32.59 and 32.50 respectively). The action to be taken when the condition is fulfilled is selected by 32.56.	Disabled	
	Disabled	Signal supervision 6 not in use.	0	
	Low	Action is taken whenever the signal falls below its lower limit.	1	
	High	Action is taken whenever the signal rises above its upper limit.	2	
	Abs low	Action is taken whenever the absolute value of the signal falls below its (absolute) lower limit.	3	
	Abs high	Action is taken whenever the absolute value of the signal rises above its (absolute) upper limit.	4	
	Both	Action is taken whenever the signal falls below its low limit or rises above its high limit.	5	
	Abs both	Action is taken whenever the absolute value of the signal falls below its (absolute) low limit or rises above its (absolute) high limit.	6	

No.	Name/V	alue	Description		Def/FbEq16	
32.56 Supervision 6 action			neither when t exceeds its lim <b>Note:</b> This par	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 actio	n		fault generated.	0	
	Warning	1		Signal supervision is generated.	1	
	Fault	,		ault 80B5 Signal supervision.	2	
32.57	Supervis signal	sion 6	Selects the signature function 6.	inal to be monitored by signal supervision ble selections, see parameter 32.07	Zero	
32.58	Supervi: time	sion 6 filter	Defines a filter signal supervis	time constant for the signal monitored by sion 6.	0.000 s	
	0.000	. 30.000 s	Signal filter tim	ne.	1000 = 1 s	
32.59	Supervi	sion 6 low	Defines the lov	wer limit for signal supervision 6.	0.00	
	-214748 214748	36.00 36.00	Low limit.		-	
32.60	Supervi	sion 6 high	Defines the up	0.00		
	-214748 214748	36.00 36.00	Upper limit.		-	
32.61	Supervis hysteres		Defines the hy supervision 6.	steresis for the signal monitored by signal	0.00	
	0.001	00.0000	Hysteresis.	-		
34 Tin	ned func	tions	- C	of the timed functions. on <i>Timed functions</i> (page 118).		
34.01	Combine status	ed timer		ombined timers. The status of a combined pical OR of all timers connected to it. r is read-only.	-	
	Bit	Name		Description		
	0	Combined	timer 1	1 = Active.		
	1	Combined	timer 2	1 = Active.		
	2	Combined	timer 3	1 = Active.		
	315	Reserved				
	0000h	.0FFFFh	Status of comb	pined timers 13.	1 = 1	
34.02	Timer st	tatus	Status of timer This paramete		-	

No.	Name/Value		Description		Def/FbEq16	
	Bit	Name		Description		
	0 Timer 1			1 = Active.		
1 Timer 2 2 Timer 3 3 Timer 4			1 = Active.			
			1 = Active.			
			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	Reserved				
	0000h		Timer status		1 = 1	
			Timer status.		1 = 1	
34.04	Season/ day statu	exception us	holiday. Only be a workday	sons 13, exception weekday and exception one season can be active at a time. A day can and a holiday at the same time.  er is read-only.	-	
			! '	,	1	
	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 v	weekday	1 = Active.		
	11	Exception h	noliday	oliday 1 = Active.		
	1215	Reserved				
	0000h		0		1 = 1	
			1	seasons and exception weekday and holiday.		
34.10	Timed fu enable	ınctions	Selects the so 0 = Disabled. 1 = Enabled.	ource for the timed functions enable signal.	Not selected	
	Not sele	cted	0.		0	
	Selected				1	
DI1		Digital input DI1 (10.02 DI delayed status, bit 0).				
	DI2		Digital input D	Digital input DI2 (10.02 DI delayed status, bit 1).		
	DI3		Digital input D	DI3 (10.02 DI delayed status, bit 2).	4	
	DI4			014 (10.02 DI delayed status, bit 3).	5	
	DI5			DIS (10.02 DI delayed status, bit 4).	6	
	DI6			DI6 (10.02 DI delayed status, bit 5).	7	
	Other [bi	it]	Source select	ion (see <i>Terms and abbreviations</i> on page 136).	-	

No.	Name/	Value	Description			
34.11	Timer 1 configuration		Defines when timer 1 is active.		0111 1000 0000b	
	Bit	Name	Description			
	0	Monday	1 = Mo	onday is an active start day.		
	1	Tuesday	1 = Tu	esday is an active start day.		
	2	Wednesday	1 = W	ednesday is an active start day.		
	3	Thursday		ursday is an active start day.		
	4	Friday		day is an active start day.		
	5	Saturday	1 = Sa	turday is an active start day.		
	6	Sunday	1 = Su	inday is an active start day.		
	7	Season 1	1 = Tir	ner is active in season 1.		
	8	Season 2	1 = Tir	ner is active in season 2.		
	9	Season 3	1 = Tir	ner is active in season 3.		
	10	Season 4	1 = Tir	ner is active in season 4.		
	11	Exceptions	0 = Ex	ceptions days are disabled.		
				ception days are enabled. Bits 12 and 13 count.	3 are taken	
	12	Holidays	"Holida	ner is inactive on exception days configuay". ner is active on exception days configure		
			"Holida			
	13	Workdays	"Work	ner is inactive on exception days configuday".  day".  ner is active on exception days configure		
			"Work		u as	
	1415	Reserved				
	0000h.	FFFFh	Configuration of time	· 1.	1 = 1	
34.12	changed in s The timer ca E.g. if the tim session start		changed in second st The timer can be star E.g. if the timer's dura session starts during	t time of timer 1. The time can be eps. ted at an other time than the start time. tion is more than one day and the active the time, the timer is started at 00:00 ere is no duration left.	00:00:00	
	00:00:0023:59:59		Daily start time of the timer.		1 = 1	
34.13	Timer 1 duration Defin in mi The c excel midn days		Defines the duration of timer 1. The duration can be changed in minute steps.  The duration can extend over the change of the day but if an exception day becomes active, the period is interrupted at midnight. In the same way the period started on an exception day stays active only until the end of the day, even if the duration is longer. The timer will continue after a break if there is duration left.		00 00:00	
	00 00:0	007 00:00	Timer duration.		1 = 1	
34.14	Timer 2 See 34.11 configuration		See 34.11 Timer 1 co	nfiguration.	0111 1000 0000b	
34.15	Timer 2	2 start time	See 34.12 Timer 1 st	art time.	00:00:00	
34.16	Timer 2	2 duration	See 34.13 Timer 1 du	ıration.	00 00:00	
34.17	Timer 3		See 34.11 Timer 1 co	nfiguration.	0111 1000 0000b	

No.	Name/Value	Description	Def/FbEq16
34.18	Timer 3 start time	See 34.12 Timer 1 start time.	00:00:00
34.19	Timer 3 duration	See 34.13 Timer 1 duration.	00 00:00
34.20	Timer 4 configuration	See 34.11 Timer 1 configuration.	0111 1000 0000b
34.21	Timer 4 start time	See 34.12 Timer 1 start time.	00:00:00
34.22	Timer 4 duration	See 34.13 Timer 1 duration.	00 00:00
34.23	Timer 5 configuration	See 34.11 Timer 1 configuration.	0111 1000 0000b
34.24	Timer 5 start time	See 34.12 Timer 1 start time.	00:00:00
34.25	Timer 5 duration	See 34.13 Timer 1 duration.	00 00:00
34.26	Timer 6 configuration	See 34.11 Timer 1 configuration.	0111 1000 0000b
34.27	Timer 6 start time	See 34.12 Timer 1 start time.	00:00:00
34.28	Timer 6 duration	See 34.13 Timer 1 duration.	00 00:00
34.29	Timer 7 configuration	See 34.11 Timer 1 configuration.	0111 1000 0000b
34.30	Timer 7 start time	See 34.12 Timer 1 start time.	00:00:00
34.31	Timer 7 duration	See 34.13 Timer 1 duration.	00 00:00
34.32	Timer 8 configuration	See 34.11 Timer 1 configuration.	0111 1000 0000b
34.33	Timer 8 start time	See 34.12 Timer 1 start time.	00:00:00
34.34	Timer 8 duration	See 34.13 Timer 1 duration.	00 00:00
34.35	Timer 9 configuration	See 34.11 Timer 1 configuration.	0111 1000 0000b
34.36	Timer 9 start time	See 34.12 Timer 1 start time.	00:00:00
34.37	Timer 9 duration	See 34.13 Timer 1 duration.	00 00:00
34.38	Timer 10 configuration	See 34.11 Timer 1 configuration.	0111 1000 0000b
34.39	Timer 10 start time	See 34.12 Timer 1 start time.	00:00:00
34.40	Timer 10 duration	See 34.13 Timer 1 duration.	00 00:00
34.41	Timer 11 configuration	See 34.11 Timer 1 configuration.	0111 1000 0000b
34.42	Timer 11 start time	See 34.12 Timer 1 start time.	00:00:00
34.43	Timer 11 duration	See 34.13 Timer 1 duration.	00 00:00
34.44	Timer 12 configuration	See 34.11 Timer 1 configuration.	0111 1000 0000b
34.45	Timer 12 start time	See 34.12 Timer 1 start time.	00:00:00
34.46	Timer 12 duration	See 34.13 Timer 1 duration.	00 00:00

No.	Name/V	alue	Description		Def/FbEq16	
34.60			Defines the start date of season 1 in format dd.mm, where dd is the number of the day and mm is the number of the month. The season changes at midnight. One season can be active at a time. Timers are started on exception days even if they are not inside the active season.  The season start dates (14) must be given in increasing order to use all seasons. The default value is interpreted that the season is not configured. If the season start dates are not in increasing order and the value is something else than the default value, a season configuration warning is given.		01.01.	
	01.01:	31.12	Season start d	ate.		
34.61	Season	2 start date		art date of season 2. ason 1 start date.	01.01.	
34.62	Season	3 start date		art date of season 3. ason 1 start date.	01.01.	
34.63	Season	4 start date		art date of season 4. ason 1 start date.	01.01.	
34.70	Number of active exceptions		Defines how many of the exceptions are active by specifying the last active one. All preceding exceptions are active. Exceptions 13 are periods (duration can be defined) and exceptions 416 are days (duration is always 24 hours). Example: If the value is 4, exceptions 14 are active, and exceptions 516 are not active.		3	
	016		Number of acti	ive exception periods or days.	-	
34.71	Exception types		Defines the types of exceptions 116 as workday or holiday. Exceptions 13 are periods (duration can be defined) and exceptions 416 are days (duration is always 24 hours).		0000ь	
	Bit	Name		Description		
	0	Exception 1		0 = Workday. 1 = Holiday		
	1	Exception 2		0 = Workday. 1 = Holiday		
	2	Exception 3		0 = Workday. 1 = Holiday		
	3	Exception 4		0 = Workday. 1 = Holiday		
	4	Exception 5		0 = Workday. 1 = Holiday		
	5	Exception 6		0 = Workday. 1 = Holiday		
	6	Exception 7		0 = Workday. 1 = Holiday		
	7	Exception 8		0 = Workday. 1 = Holiday		
	8	Exception 9	0 = Workday. 1 = Holiday			
	9	Exception 1	0 = Workday. 1 = Holiday			
	10	Exception 1		0 = Workday. 1 = Holiday		
	11 Exception 1			0 = Workday. 1 = Holiday		
	12	Exception 1		0 = Workday. 1 = Holiday		
	13	Exception 1		0 = Workday. 1 = Holiday		
	14 Exception 1		, ,			
	15	Exception 1	б	0 = Workday. 1 = Holiday		
	0000hFFFFh		Types of excep	otion period or days.	1 = 1	

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.	01.01.
		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.	
	01.0131.12.	Start date of exception period 1.	
34.73	Exception 1 length	Defines the length of the exception period in days.  Exception period is handled the same as a number of consecutive exception days.	0 d
	060 d	Length of exception period 1.	1 = 1
34.74	Exception 2 start	See 34.72 Exception 1 start.	01.01.
34.75	Exception 2 length	See 34.73 Exception 1 length.	0 d
34.76	Exception 3 start	See 34.72 Exception 1 start.	01.01.
34.77	Exception 3 length	See 34.73 Exception 1 length.	0 d
34.78	Exception day 4	Defines the date of exception day 4.	01.01.
	01.0131.12.	Start date of exception day 4. The timer started on an exception day is always stopped at 23:59:59 even if it has duration left.	
34.79	Exception day 5	See 34.79 Exception day 4.	01.01
34.80	Exception day 6	See 34.79 Exception day 4.	01.01
34.81	Exception day 7	See 34.79 Exception day 4	01.01
34.82	Exception day 8	See 34.79 Exception day 4.	01.01
34.83	Exception day 9	See 34.79 Exception day 4.	01.01
34.84	Exception day 10	See 34.79 Exception day 4.	01.01
34.85	Exception day 11	See 34.79 Exception day 4.	01.01
34.86	Exception day 12	See 34.79 Exception day 4.	01.01
34.87	Exception day 13	See 34.79 Exception day 4.	01.01
34.88	Exception day 14	See 34.79 Exception day 4.	01.01
34.89	Exception day 15	See 34.79 Exception day 4.	01.01
34.90	Exception day 16	See 34.79 Exception day 4.	01.01

No.	Name/V	'alue	Description		Def/FbEq16	
34.100			Defines which timers are connected to combined timer 1.  0000b  0 = Not connected.  1 = Connected.  See 34.01 Combined timer status.		-	
	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.		
	1415	Reserved				
	0000h	.FFFFh	Timers connec	cted to combined timer 1.	1 = 1	
34.101	Timed fu	Timed function 2 Defines which timers are connected to combined timer 2 See 34.01 Combined timer status.			0000b	
34.102	Timed fu	ınction 3	Defines which timers are connected to combined timer 3.     See 34.01 Combined timer status.			
34.110	0 Extra time function		Defines which combined timers (that is, timers that are connected to the combined timers) are activated with the extra time function.		0000b	
	Bit	Name		Description		
	0	Combined	0 = Inactive. 1 = Active.			
	1	Combined	2	0 = Inactive. 1 = Active.		
	2	Combined	0 = Inactive. 1 = Active.			
	315	Reserved				
	0000hFFFFh		Combined time	ers including the extra timer.	1 = 1	
34.111	Extra time activation source			urce of extra time activation signal.	Off	
	Off		0.		0	
	On		1. 1 Digital input DI1 (10.02 DI delayed status, bit 0). 2 Digital input DI2 (10.02 DI delayed status, bit 1). 3		1	
	DI1				2	
	DI2				3	
	DI3		Digital input D	Digital input DI3 (10.02 DI delayed status, bit 2).		
	DI4		Digital input D	14 (10.02 DI delayed status, bit 3).	5	
	DI5			l5 (10.02 DI delayed status, bit 4).	6	
	DI6		Digital input D	l6 (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 <i>136</i> ).	-
34.112	Extra time duration	Defines the time inside which the extra time is deactivated after extra time activation signal is switched off. <b>Example:</b> If parameter 34.111 Extra time activation source is set to DI1 and 34.112 Extra time duration is set to 00 01:30, the extra time is active for 1 hour and 30 minutes after digital input DI is deactivated.	00 00:00
	00 00:0000 00:00	Extra time duration.	1 = 1

35 Mo proted	tor thermal ction	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 123).	
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	Measured temperature 1.	1 = 1 unit
35.03	Measured temperature 2	Displays the temperature received through the source defined by parameter 35.21 Temperature 2 source. The unit is selected by parameter 96.16 Unit selection.  This parameter is read-only.	-
	-605000 °C or -769032 °F	Measured temperature 2.	1 = 1 unit
35.11	Temperature 1 source	Selects the source from which measured temperature 1 is read.  Usually this source is from a sensor connected to the motor controlled by the drive, but it could be used to measure and monitor a temperature from other parts of the process as long as a suitable sensor is used as per the selection list.	Estimated temperature
	Disabled	None. Temperature monitoring function 1 is disabled.	0
	Estimated temperature	Estimated motor temperature (see parameter 35.01 Motor estimated temperature).  The temperature is estimated from an internal drive calculation. It is important to set up the ambient temperature of the motor in 35.50 Motor ambient temperature.	1

No.	Name/Value	Description	Def/FbEq16
	KTY84 analog I/O	KTY84 sensor connected to the analog input selected by parameter 35.14 Temperature 1 AI source and an analog output.  The following settings are required: • Set the hardware jumper or switch related to the analog input to U (voltage). Any change must be validated by a control unit reboot. • Set the appropriate analog input unit selection parameter in group 12 Standard AI to V (volt). • In parameter group 13 Standard AO, set the source selection parameter of the analog output to Temp sensor 1 excitation.  The analog output feeds a constant current through the sensor. As the resistance of the sensor increases along with its temperature, the voltage over the sensor increases. The voltage is read by the analog input and converted into	2
	1 × Pt100 analog I/O	legrees.  Pt100 sensor connected to a standard analog input selected by parameter 35.14 Temperature 1 AI source and an analog output.  The following settings are required:  • Set the hardware jumper or switch related to the analog input to U (voltage). Any change must be validated by a control unit reboot.  • Set the appropriate analog input unit selection parameter in group 12 Standard AI to V (volt).  • In parameter group 13 Standard AO, set the source selection parameter of the analog output to Temp sensor 1 excitation.  The analog output feeds a constant current through the sensor. As the resistance of the sensor increases along with its temperature, the voltage over the sensor increases. The voltage is read by the analog input and converted into degrees.	5
	2 × Pt100 analog I/O	As selection 1 × Pt100 analog I/O, but with two sensors connected in series. Using multiple sensors improves measurement accuracy significantly.	6
	3 × Pt100 analog I/O	As selection 1 × Pt100 analog I/O, but with three sensors connected in series. Using multiple sensors improves measurement accuracy significantly.	7
	Direct temperature	The temperature is taken from the source selected by parameter 35.14 Temperature 1 Al source. The value of the source is assumed to be degrees Celsius.	11

No.	Name/Value	Description	Def/FbEq16
	KTY83 analog I/O	KTY83 sensor connected to the analog input selected by parameter 35.14 Temperature 1 AI source and an analog output.  The following settings are required:  Set the hardware jumper or switch related to the analog input to U (voltage). Any change must be validated by a control unit reboot.  Set the appropriate analog input unit selection parameter in group 12 Standard AI to V (volt).  In parameter group 13 Standard AO, set the source selection parameter of the analog output to Temp sensor 1 excitation.  The analog output feeds a constant current through the sensor. As the resistance of the sensor increases along with its temperature, the voltage over the sensor increases. The voltage is read by the analog input and converted into degrees.	12
	1 × Pt1000 analog I/O	Pt1000 sensor connected to a standard analog input selected by parameter 35.14 Temperature 1 AI source and an analog output.  The following settings are required:  • Set the hardware jumper or switch related to the analog input to U (voltage). Any change must be validated by a control unit reboot.  • Set the appropriate analog input unit selection parameter in group 12 Standard AI to V (volt).  • In parameter group 13 Standard AO, set the source selection parameter of the analog output to Temp sensor 1 excitation.  The analog output feeds a constant current through the sensor. As the resistance of the sensor increases along with its temperature, the voltage over the sensor increases. The voltage is read by the analog input and converted into degrees.	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 hardware jumper or switch related to the analog input to U (voltage). Any change must be validated by a control unit reboot.  Set the appropriate analog input unit selection parameter in group 12 Standard AI to V (volt).  In parameter group 13 Standard AO, set the source selection parameter of the analog output to Temp sensor 1 excitation.  The analog output feeds a constant current through the sensor. As the resistance of the sensor increases along with its temperature, the voltage over the sensor increases. The voltage is read by the analog input and converted into degrees.	16

No.	Name/Value	Description	Def/FbEq16
	PTC extension module	PTC is connected to the CMOD-02 multifunction extension module, which is installed in drive slot 2. See chapter Optional I/O extension modules, section CMOD-02 multifunction extension module (external 24 V AC/DC and isolated PTC interface) in the Hardware manual of the drive).	19
35.12	Supervision1 fault limit	Defines the fault limit for temperature supervision function 1. The unit is selected by parameter 96.16 Unit selection.  Note: With a PTC sensor, the unit is ohms.	130 °C or 266 °F
	-605000 °C or -769032 °F	Fault limit for temperature monitoring function 1.	1 = 1 unit
35.13	Supervision1 1 warning limit	Defines the warning limit for temperature supervision function 1. The unit is selected by parameter 96.16 Unit selection.  Note: With a PTC sensor, the unit is ohms.	110 °C or 230 °F
	-605000 °C or -769032 °F	Warning limit for temperature monitoring function 1.	1 = 1 unit
35.14	Temperature 1 AI source	Selects the input for parameter 35.11 Temperature 1 source selections KTY84 analog I/O, 1 × Pt100 analog I/O, 2 × Pt100 analog I/O, 3 × Pt100 analog I/O, Direct temperature, KTY83 analog I/O, 1 × Pt1000 analog I/O, 2 × Pt1000 analog I/O, 3 × Pt1000 analog I/O and Ni1000.	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 136).	-
35.21	Temperature 2 source	Selects the source from which measured temperature 2 is read.  Usually this source is from a sensor connected to the motor controlled by the drive, but it could be used to measure and monitor a temperature from other parts of the process as long as a suitable sensor is used as per the selection list.	Disabled
	Disabled	None. Temperature monitoring function 2 is disabled.	0
	Estimated temperature	Estimated motor temperature (see parameter 35.01 Motor estimated temperature).  The temperature is estimated from an internal drive calculation. It is important to set up the ambient temperature of the motor in 35.50 Motor ambient temperature.	1
	KTY84 analog I/O	<ul> <li>KTY84 sensor connected to the analog input selected by parameter 35.24 Temperature 2 AI source and an analog output.</li> <li>The following settings are required:</li> <li>Set the hardware jumper or switch related to the analog input to U (voltage). Any change must be validated by a control unit reboot.</li> <li>Set the appropriate analog input unit selection parameter in group 12 Standard AI to V (volt).</li> <li>In parameter group 13 Standard AO, set the source selection parameter of the analog output to Temp sensor 2 excitation.</li> <li>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.</li> </ul>	2

No.	Name/Value	Description	Def/FbEq16
	1 × Pt100 analog I/O	Pt100 sensor connected to a standard analog input selected by parameter 35.24 Temperature 2 AI source and an analog output.  The following settings are required:  • Set the hardware jumper or switch related to the analog input to U (voltage). Any change must be validated by a control unit reboot.  • Set the appropriate analog input unit selection parameter in group 12 Standard AI to V (volt).  • In parameter group 13 Standard AO, set the source selection parameter of the analog output to Temp sensor 2 excitation.  The analog output feeds a constant current through the	5
		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 × Pt100 analog I/O	As selection 1 × Pt100 analog I/O, but with two sensors connected in series. Using multiple sensors improves measurement accuracy significantly.	6
	3 × Pt100 analog I/O	As selection 1 × Pt100 analog I/O, but with three sensors connected in series. Using multiple sensors improves measurement accuracy significantly.	7
	Direct temperature	The temperature is taken from the source selected by parameter 35.24 Temperature 2 Al source. The value of the source is assumed to be degrees Celsius.	11
	KTY83 analog I/O	KTY83 sensor connected to the analog input selected by parameter 35.14 Temperature 1 AI source and an analog output.  The following settings are required:  • Set the hardware jumper or switch related to the analog input to U (voltage). Any change must be validated by a control unit reboot.  • Set the appropriate analog input unit selection parameter in group 12 Standard AI to V (volt).  • In parameter group 13 Standard AO, set the source selection parameter of the analog output to Temp sensor 2 excitation.  The analog output feeds a constant current through the sensor. As the resistance of the sensor increases along with its temperature, the voltage over the sensor increases. The voltage is read by the analog input and converted into degrees.	12

No.	Name/Value	Description	Def/FbEq16
	1 × Pt1000 analog I/O	Pt1000 sensor connected to a standard analog input selected by parameter 35.14 Temperature 1 AI source and an analog output.  The following settings are required:  Set the hardware jumper or switch related to the analog input to U (voltage). Any change must be validated by a control unit reboot.  Set the appropriate analog input unit selection parameter in group 12 Standard AI to V (volt).  In parameter group 13 Standard AO, set the source selection parameter of the analog output to Temp sensor 2 excitation.  The analog output feeds a constant current through the sensor. As the resistance of the sensor increases along with its temperature, the voltage over the sensor increases. The voltage is read by the analog input and converted into degrees.	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 hardware jumper or switch related to the analog input to U (voltage). Any change must be validated by a control unit reboot.  Set the appropriate analog input unit selection parameter in group 12 Standard AI to V (volt).  In parameter group 13 Standard AO, set the source selection parameter of the analog output to Temp sensor 2 excitation.  The analog output feeds a constant current through the sensor. As the resistance of the sensor increases along with its temperature, the voltage over the sensor increases. The voltage is read by the analog input and converted into degrees.	16
	PTC extension module	PTC is connected to the CMOD-02 multifunction extension module, which is installed in drive slot 2. See chapter Optional I/O extension modules, section CMOD-02 multifunction extension module (external 24 V AC/DC and isolated PTC interface) in the Hardware manual of the drive).	19
35.22	Supervision1 2 fault limit	Defines the fault limit for temperature supervision function 2. The unit is selected by parameter 96.16 Unit selection.  Note: With a PTC sensor, the unit is ohms.	130 °C or 266 °F
	-605000 °C or -769032 °F	Fault limit for temperature monitoring function 2.	1 = 1 unit
35.23	Supervision1 2 warning limit	Defines the warning limit for temperature supervision function 2. The unit is selected by parameter 96.16 Unit selection.  Note: With a PTC sensor, the unit is ohms.	110 °C or 230 °F
	-605000 °C or -769032 °F	Warning limit for temperature monitoring function 2.	1 = 1 unit

No.	Name/Value	Description	Def/FbEq16
35.24	Temperature 2 AI source	Selects the input for parameter 35.21 Temperature 2 source selections KTY84 analog I/O, 1 × Pt100 analog I/O, 2 × Pt100 analog I/O, 3 × Pt100 analog I/O, Direct temperature, KTY83 analog I/O, 1 × Pt1000 analog I/O, 2 × Pt1000 analog I/O, 3 × Pt1000 analog I/O and Ni1000.	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 136).	-
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.	100%
	// <sub>N</sub> (%) 150	<ul><li>I = Motor current</li><li>I<sub>N</sub> = Nominal motor current</li></ul>	
	100 50 35.52	35.51	, t
		35.53 Drive output frequency	ıl
	50150%	Maximum load for the motor load curve.	1 = 1%

No.	Name/Value	Description	Def/FbEq16
35.52	Zero speed load	Defines the motor load curve together with parameters 35.51 Motor load curve and 35.53 Break point. Defines the maximum motor load at zero speed of the load curve. A higher value can be used if the motor has an external motor fan to boost the cooling. See the motor manufacturer's recommendations.  See parameter 35.51 Motor load curve.	100%
	50150%	Zero speed load for the motor load curve.	1 = 1%
35.53	Break point	Defines the motor load curve together with parameters 35.51 Motor load curve and 35.52 Zero speed load. Defines the break point frequency of the load curve ie. the point at which the motor load curve begins to decrease from the value of parameter 35.51 Motor load curve towards the value of parameter 35.52 Zero speed load.  See parameter 35.51 Motor load curve.	45.00 Hz
	1.00500.00 Hz	Break point for the motor load curve.	See par. 46.02
35.54	Motor nominal temperature rise	Defines the temperature rise of the motor above ambient when the motor is loaded with nominal current. See the motor manufacturer's recommendations.  The unit is selected by parameter 96.16 Unit selection.	80 °C or 176 °F
	Motor nom temperature	····· <del>··</del> ·	ne
	0300 °C or 32572 °F	Temperature rise.	1 = 1°

No.	Name/Value	Description	Def/FbEq16
35.55	Motor thermal time const	Defines the thermal time constant for use with the motor thermal protection model, defined as the time to reach 63% of the nominal motor temperature. See the motor manufacturer's recommendations.	256 s
		Motor current	
		Time	
		Temperature rise	
		Motor thermal time Time	
	10010000 s	Motor thermal time constant.	1 = 1 s

36 Load	analyzer	Peak value and amplitude logger settings. See also section <i>Load analyzer</i> (page 129).	
36.01 P	VL 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 date and time of the last reset are stored into parameters 36.16 and 36.17 respectively.	Output power
N	lot selected	None (peak value logger disabled).	0
M	lotor speed used	01.01 Motor speed used (page 139).	1
0	Output frequency	01.06 Output frequency (page 139).	3
M	lotor current	01.07 Motor current (page 139).	4
M	lotor torque	01.10 Motor torque (page 139).	6
D	C voltage	01.11 DC voltage (page 139).	7
0	output power	01.14 Output power (page 140).	8
S	peed ref ramp in	23.01 Speed ref ramp input (page 200).	10
S	peed ref ramped	23.02 Speed ref ramp output (page 200).	11
S	peed ref used	24.01 Used speed reference (page 204).	12
To	orque ref used	26.02 Torque reference used (page 209).	13
F	req ref used	28.02 Frequency ref ramp output (page 213).	14

No.	Name/Value	Description	Def/FbEq16
	Process PID out	40.01 Process PID output actual (page 261).	16
	Other	Source selection (see <i>Terms and abbreviations</i> on page 136).	-
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 date and time of the last reset are stored into parameters 36.50 and 36.51 respectively.  For the selections, see parameter 36.01 PVL signal source.	Motor torque
36.07	AL2 signal scaling	Defines the signal value that corresponds to 100% amplitude.	100.00
	0.0032767.00	Signal value corresponding to 100%.	1 = 1
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.	-

No.	Name/Value	Description	Def/FbEq16
36.20	AL1 0 to 10%	Percentage of samples recorded by amplitude logger 1 that fall between 0 and 10%.	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%
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%

No.	Name/Value	Description	Def/FbEq16
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%
36.50	AL2 reset date	The date on which amplitude logger 2 was last reset.	01.01.1980
	-	Last reset date of amplitude logger 2.	-
36.51	AL2 reset time	The time at which amplitude logger 2 was last reset.	00:00:00
	-	Last reset time of amplitude logger 2.	-
07.11-	or load ourse	Sattings for upor load out to	

37 User I		Settings for user load curve. See also section <i>User load curve</i> (page <i>104</i> ).	
	ILC output status ord	Displays the status of the monitored signal.	0000h

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

	0000hFFFFh	Status of the monitored signal.	1 = 1
37.02	ULC supervision signal	Selects the signal to be supervised.	Motor torque %
	Not selected	No signal selected. ULC disabled.	0
	Motor speed %	01.03 Motor speed % (page 139).	1
	Motor current %	01.08 Motor current % of motor nom (page 139).	2
	Motor torque %	01.10 Motor torque (page 139).	3
	Output power % of motor nominal	01.15 Output power % of motor nom (page 140).	4
	Output power % of drive nominal	01.16 Output power % of drive nom (page 140).	5
	Other	Source selection (see <i>Terms and abbreviations</i> on page <i>136</i> ).	-
37.03	ULC overload actions	Selects an action taken if the signal stays over the overload curve for a defined time.	Disabled
	Disabled	No warnings or fault generated.	0

No.	Name/Value	Description	Def/FbEq16	
	Warning	The drive generates an A8C1 ULC overload warning if the signal has been continuously over the overload curve for a time defined by parameter 37.41 ULC overload timer.	1	
	Fault	The drive generates an 8002 ULC overload fault if the signal has been continuously over the overload curve for a time defined by parameter 37.41 ULC overload timer.	2	
	Warning/Fault	The drive generates an A8C1 ULC overload warning if the signal has been continuously over the overload curve for half of the time defined by parameter 37.41 ULC overload timer. The drive generates an 8002 ULC overload fault if the signal has been continuously over the overload curve for a time defined by parameter 37.41 ULC overload timer.	3	
37.04	ULC underload actions	Selects an action taken if the signal stays under the underload curve for a defined time.	Disabled	
	Disabled	No warnings or fault generated.	0	
	Warning	The drive generates an A8C4 ULC underload warning if the signal has been continuously under the underload curve for a time defined by parameter 37.42 ULC underload timer.	1	
	Fault	The drive generates an 8001 ULC underload fault if the signal has been continuously under the underload curve for a time defined by parameter 37.42 ULC underload timer.	2	
	Waming/Fault	The drive generates an A8C4 ULC underload warning if the signal has been continuously under the underload curve for half of the time defined by parameter 37.42 ULC underload timer.  The drive generates an 8001 ULC underload fault if the signal has been continuously under the underload curve for a time defined by parameter 37.42 ULC underload timer.	3	
37.11	ULC speed table point 1	Defines the first of the five speed points on the X-axis of the user load curve.  The values of the parameters must satisfy: -30000.0 rpm ≤ 37.11 ULC speed table point 1 < 37.12 ULC speed table point 2 < 37.13 ULC speed table point 3 < 37.14 ULC speed table point 4 < 37.15 ULC speed table point 5 ≤ 30000.0 rpm. 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 Scalar and the reference unit is rpm.	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	

No.	Name/Value	Description	Def/FbEq16
37.15	ULC speed table point 5	Defines the fifth speed point. See parameter 37.11 ULC speed table point 1.	1800.0 rpm
	-30000.030000.0 rpm	Speed.	1 = 1 rpm
37.16	ULC frequency table point 1	Defines the first of the five frequency points on the X-axis of the user load curve. The values of the parameters must satisfy: -500.0 Hz $\leq$ 37.16 ULC frequency table point 1 < 37.17 ULC frequency table point 2 < 37.18 ULC frequency table point 3 < 37.19 ULC frequency table point 4 < 37.20 ULC frequency table point 5 $\leq$ 500.0 Hz. Frequency points are used if parameter 99.04 Motor control mode is set to Scalar and the reference unit is Hz.	5.0 Hz
	-500.0500.0 Hz	Frequency.	1 = 1 Hz
37.17	ULC frequency table point 2	Defines the second frequency point. See parameter 37.16 ULC frequency table point 1.	25.0 Hz
	-500.0500.0 Hz	Frequency.	1 = 1 Hz
37.18	ULC frequency table point 3	Defines the third frequency point. See parameter 37.16 ULC frequency table point 1.	43.0 Hz
	-500.0500.0 Hz	Frequency.	1 = 1 Hz
37.19	ULC frequency table point 4	Defines the fourth frequency point. See parameter 37.16 ULC frequency table point 1.	50.0 Hz
	-500.0500.0 Hz	Frequency.	1 = 1 Hz
37.20	ULC frequency table point 5	Defines the fifth frequency point. See parameter 37.16 ULC frequency table point 1.	60.0 Hz
	-500.0500.0 Hz	Frequency.	1 = 1 Hz
37.21	ULC underload point 1	Defines the first of the five points on the Y-axis that together with the corresponding point on the X-axis (37.11 ULC speed table point 137.15 ULC speed table point 5 or 37.15 ULC speed table point 537.20 ULC frequency table point 5) define the underload (lower) curve.  The following conditions must be fulfilled:  37.21 ULC underload point 1 <= 37.31 ULC overload point 1  37.22 ULC underload point 2 <= 37.32 ULC overload point 2  37.23 ULC underload point 3 <= 37.33 ULC overload point 3  37.24 ULC underload point 4 <= 37.34 ULC overload point 4  37.25 ULC underload point 5 <= 37.35 ULC overload point 5	10.0%
	-1600.01600.0%	Underload point.	1 = 1%
37.22	ULC underload point 2	Defines the second underload point. See parameter 37.21 ULC underload point 1.	15.0%
	-1600.01600.0%	Underload point.	1 = 1%
37.23	ULC underload point 3	Defines the third underload point. See parameter 37.21 ULC underload point 1	25.0%
	-1600.01600.0%	Underload point.	1 = 1%
37.24	ULC underload point 4	Defines the fourth underload point. See parameter 37.21 ULC underload point 1	30.0%
	-1600.01600.0%	Underload point.	1 = 1%

No.	Name/Value	Description	Def/FbEq16
37.25	ULC underload point 5	Defines the fifth underload point. See parameter 37.21 ULC underload point 1	30.0%
	-1600.01600.0%	Underload point.	1 = 1%
37.31	ULC overload point 1	Defines the first of the five points on the Y-axis that together with the corresponding point on the X-axis (37.11 ULC speed table point 137.15 ULC speed table point 5 or 37.15 ULC speed table point 537.20 ULC frequency table point 5) define the overload (higher) curve.  At each of the five points the value of the underload curve point must be equal to or smaller than the value of the overload curve point. See parameter 37.21 ULC underload point 1.	300.0%
	-1600.01600.0%	Overload point.	1 = 1%
37.32	ULC overload point 2	Defines the second overload point. See parameter 37.31 ULC overload point 1.	300.0%
	-1600.01600.0%	Overload point.	1 = 1%
37.33	ULC overload point 3	Defines the third overload point. See parameter 37.31 ULC overload point 1.	300.0%
	-1600.01600.0%	Overload point.	1 = 1%
37.34	ULC overload point 4	Defines the fourth overload point. See parameter 37.31 ULC overload point 1.	300.0%
	-1600.01600.0%	Overload point.	1 = 1%
37.35	ULC overload point 5	Defines the fifth overload point. See parameter 37.31 ULC overload point 1.	300.0%
	-1600.01600.0%	Overload point.	1 = 1%
37.41	ULC overload timer	Defines the time period for which time the monitored signal must remain continuously below the overload curve.	20.0 s
	0.010000.0 s	Time.	1 = 1 s
37.42	ULC underload timer	Defines the time period for which time the monitored signal must remain continuously above the underload curve.	20.0 s
	0.010000.0 s	Time.	1 = 1 s
<b>40.01</b>	Process PID output actual	Parameter values for process PID control.  The drive output can be controlled by the process PID. When the process PID control is enabled, the drive controls the process feedback to the reference value.  Two different parameter sets can be defined for the process PID. One parameter set is in use at a time. The first set is made up of parameters 40.0740.50, the second set is defined by the parameters in group 41 Process PID set 2. The binary source that defines which set is used is selected by parameter 40.57 PID set1/set2 selection.  See also the control chain diagrams on pages 430 and 431. To set the PID customer unit, select Menu - Primary settings - PID - Unit on the panel.  Displays the output of the process PID controller. See the control chain diagram on page 431.	-
	-32768.00	This parameter is read-only.  Process PID controller output.	1 = 1%
	32767.00%		

No.	Name/V	alue	Descri	iption	Def/FbEq16	
40.02	Process feedback		selection feedbar diagram	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 430.  This parameter is read-only.		
	-32768.0 32767.0 custome	0 PID	Proces	ss feedback.	1 = 1 PID customer unit	
40.03	Process setpoint		selection function diagram	ys the value of process PID setpoint after source on, mathematical function (40.18 Set 1 setpoint n), limitation and ramping. See the control chain m on page 431.  arameter is read-only.	-	
	-32768.0 32767.0 custome	0 PID	Setpoi	nt for process PID controller.	1 = 1 PID customer unit	
40.04	Process PID deviation actual		equals paramo chain o	ys the process PID deviation. By default, this value setpoint - feedback, but deviation can be inverted by eter 40.31 Set 1 deviation inversion. See the control diagram on page 431.  arameter is read-only.	-	
	-32768.0 32767.0 custome	0 PID	PID de	PID deviation.		
40.06	Process PID status word			ys status information on process PID control. arameter is read-only.	-	
	Bit	Bit Name		Value		
	0	PID active		1 = Process PID control active.		
	1	Setpoint fro	zen	1 = Process PID setpoint frozen.		
	2	Output froz		1 = Process PID controller output frozen.		
	3	PID sleep r		1 = Sleep mode active.		
	4	Sleep boos		1 = Sleep boost active.		
	5	Reserved		Cloop boost douve.		
	6	Tracking m	nde	1 = Tracking function active.		
	7	Output limit		1 = PID output is being limited by par. 40.37.		
	8	Output limit		1 = PID output is being limited by par. 40.36.		
	9	Reserved				
	10	PID set		0 = Parameter set 1 in use. 1 = Parameter set 2 in use	<u> </u>	
	11	Reserved		. S. Simotor Got 1 in Goo. 1 – 1 drameter Set 2 in Go	· .	
	12	Internal set	noint	1 = Internal setpoint active (see par. 40.1640.16)		
		active	, J. I.			
	1315	Reserved		1		
	0000h	FFFFh	Proces	ss PID control status word.	1 = 1	
40.07	operation mode Note		Note: control	res/deactivates process PID control.  Process PID control is only available in external  ; see section <i>Local control vs. external control</i> (page	Off	
	Off		Proces	ss PID control inactive.	0	
	On		Proces	ss PID control active.	1	
	0				1	

No.	Name/Value Description		
	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 <i>430</i> .	Al2 percent
	Not selected	None.	0
	Al1 scaled	12.12 Al1 scaled value (see page 157).	1
	Al2 scaled	12.22 Al2 scaled value (see page 158).	2
	Freq in scaled	11.39 Freq in 1 scaled value (see page 154).	3
	Al1 percent	12.101 Al1 percent value (see page 160)	8
	Al2 percent	12.102 Al2 percent value (see page 160)	9
	Feedback storage	40.91 Feedback data storage (see page 271),	9
	Other	Source selection (see <i>Terms and abbreviations</i> on page 136).	-
40.09	Set 1 feedback 2 source	Selects the second source of process feedback. The second source is used only if the setpoint function requires two inputs.  For the selections, see parameter 40.08 Set 1 feedback 1 source.	Not selected
40.10	Set 1 feedback function	Defines how process feedback is calculated from the two feedback sources selected by parameters 40.08 Set 1 feedback 1 source and 40.09 Set 1 feedback 2 source.	In1
	In1	Source 1.	0
	ln1+ln2	Sum of sources 1 and 2.	1
	ln1-ln2	Source 2 subtracted from source 1.	2
	In1*In2	Source 1 multiplied by source 2.	3
	ln1/ln2	Source 1 divided by source 2.	4
	MIN(In1,In2)	Smaller of the two sources.	5
	MAX(In1,In2)	Greater of the two sources.	6
	AVE(In1,In2)	Average of the two sources.	7
	sqrt(In1)	Square root of source 1.	8
	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
40.16	Set 1 setpoint 1 source	Selects the primary source of process PID setpoint. See the control chain diagram on page 430.	Al1 percent
	Not selected	None.	0
	Internal setpoint	Internal setpoint. See parameter 40.19 Set 1 internal setpoint sel1.	2
	Al1 scaled	12.12 Al1 scaled value (see page 157).	3
	Al2 scaled	12.22 Al2 scaled value (see page 158).	4
	Motor potentiometer	22.80 Motor potentiometer ref act (output of the motor potentiometer).	8
	Freq in scaled	11.39 Freq in 1 scaled value (see page 154).	10

No.	Name/Value	Description	Def/FbEq16
	Al1 percent	12.101 Al1 percent value (see page 160)	11
	Al2 percent	12.102 Al2 percent value (see page 160)	12
	Control panel (ref saved)	Panel reference (03.01 Panel reference, see page 141) saved by the control system for the location where the control returns is used as the reference.  Reference  Ext1 reference  Ext2 reference  Active reference  I hactive reference	13
	Control panel (ref copied)	Panel reference (03.01 Panel reference, see page 141) for the previous control location is used as the reference when the control location changes if the references for the two locations are of the same type (eg frequency/speed/torque/PID); otherwise, the actual signal is used as the new reference.  Reference  Ext1 reference  Ext2 reference  Active reference  Inactive reference	14
	FB A ref1	03.05 FB A reference 1 (see page 142).	15
	FB A ref2	03.06 FB A reference 2 (see page 142).	16
	EFB ref1	03.09 EFB reference 1 (see page 142).	19
	EFB ref2	03.10 EFB reference 2 (see page 142).	20
	Setpoint data storage	40.92 Setpoint data storage (see page 271)	24
	Other	Source selection (see <i>Terms and abbreviations</i> on page <i>136</i> ).	-
40.17	Set 1 setpoint 2 source	Selects the second source of process setpoint. The second source is used only if the setpoint function requires two inputs.  For the selections, see parameter 40.16 Set 1 setpoint 1 source.	Not selected
40.18	Set 1 setpoint function	Selects a function between the setpoint sources selected by parameters 40.16 Set 1 setpoint 1 source and 40.17 Set 1 setpoint 2 source.	In1
	In1	Source 1.	0
	ln1+ln2	Sum of sources 1 and 2.	1
	In1-In2	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(ln1,ln2)	Average of the two sources.	7
	sqrt(In1)	Square root of source 1.	8

No.	Name/Value	Description	Def/FbEq16			
	sqrt(ln1-ln2)	Square root of (so	urce 1 - source 2).		9	
	sqrt(ln1+ln2)	Square root of (so	urce 1 + source 2)		10	
	sqrt(ln1)+sqrt(ln2)	Square root of sou	11			
40.19	Set 1 internal setpoint sel1	Selects together with 40.20 Set 1 internal setpoint sel2 the internal setpoint out of the presets defined by parameters 40.2140.23.  Note: Parameters 40.16 Set 1 setpoint 1 source and 40.17 Set 1 setpoint 2 source must be set to Internal setpoint.			Not selected	
		Source defined by par. 40.19				
		0	0	Setpoint source		
		1	0	1 (par. 40.21)		
		0	1	2 (par. 40.22)		
		1	1	3 (par. 40.23)		
	Not selected	0.			0	
	Selected	1.			1	
	DI1	Digital input DI1 (1	10.02 DI delayed s	tatus, bit 0).	2	
	DI2	Digital input DI2 (1	10.02 DI delayed s	tatus, bit 1).	3	
	DI3	Digital input DI3 (1	10.02 DI delayed s	tatus, bit 2).	4	
	DI4	Digital input DI4 (1	5			
	DI5	Digital input DI5 (1	6			
	DI6	Digital input DI6 (1	7			
	Timed function 1	Bit 0 of 34.01 Con	18			
	Timed function 2	Bit 1 of 34.01 Con	19			
	Timed function 3	Bit 2 of 34.01 Con	nbined timer status	s (see page 240).	20	
	Supervision 1	Bit 0 of 32.01 Sup	ervision status (se	e page 234).	21	
	Supervision 2	Bit 1 of 32.01 Sup	ervision status (se	e page 234).	22	
	Supervision 3	Bit 2 of 32.01 Sup	ervision status (se	e page 234).	23	
	Other [bit]	Source selection (	see Terms and ab	breviations on page 136).	-	
40.20	Set 1 internal setpoint sel2	internal setpoint us	sed out of the thre eters 40.2140.23	ternal setpoint sel1 the e internal setpoints  B. See table at 40.19 Set	Not selected	
	Not selected	0.			0	
	Selected	1.			1	
	DI1	Digital input DI1 (1	10.02 DI delayed s	tatus, bit 0).	2	
	DI2	Digital input DI2 (1	10.02 DI delayed s	tatus, bit 1).	3	
	DI3	Digital input DI3 (1	10.02 DI delayed s	tatus, bit 2).	4	
	DI4	Digital input DI4 (1	5			
	DI5	Digital input DI5 (1	10.02 DI delayed s	tatus, bit 4).	6	
	DI6	Digital input DI6 (1	10.02 DI delayed s	tatus, bit 5).	7	
	Timed function 1	Bit 0 of 34.01 Con	18			
	Timed function 2	Bit 1 of 34.01 Con	Bit 1 of 34.01 Combined timer status (see page 240).			

No.	o. Name/Value Description		
	Timed function 3	Bit 2 of 34.01 Combined timer status (see page 240).	20
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 234).	21
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 234).	22
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 234).	23
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page <i>136</i> ).	-
40.21	Set 1 internal setpoint 1	Internal process setpoint 1. See parameter 40.19 Set 1 internal setpoint sel1.	0.00 PID customer units
	-32768.00 32767.00 PID customer units	Internal process setpoint 1.	1 = 1 PID customer unit
40.22	Set 1 internal setpoint 2	Internal process setpoint 2. See parameter 40.19 Set 1 internal setpoint sel1.	0.00 PID customer units
	-32768.00 32767.00 PID customer units	Internal process setpoint 2.	1 = 1 PID customer unit
40.23	Set 1 internal setpoint 3	Internal process setpoint 3. See parameter 40.19 Set 1 internal setpoint sel1.	0.00 PID customer units
	-32768.00 32767.00 PID customer units	Internal process setpoint 3.	1 = 1 PID customer unit
40.26	Set 1 setpoint min	Defines a minimum limit for the process PID controller setpoint.	0.00
	-32768.00 32767.00	Minimum limit for process PID controller setpoint.	1 = 1
40.27	Set 1 setpoint max	Defines a maximum limit for the process PID controller setpoint.	32767.00
	-32768.00 32767.00	Maximum limit for process PID controller setpoint.	1 = 1
40.28	Set 1 setpoint increase time	Defines the minimum time it takes for the setpoint to increase from 0% to 100%.	0.0 s
	0.01800.0 s	Setpoint increase time.	1 = 1
40.29	Set 1 setpoint decrease time	Defines the minimum time it takes for the setpoint to decrease from 100% to 0%.	0.0 s
	0.01800.0 s	Setpoint decrease time.	1 = 1
40.30	Set 1 setpoint freeze enable	Freezes, or defines a source that can be used to freeze, the setpoint of the process PID controller. This feature is useful when the reference is based on a process feedback connected to an analog input, and the sensor must be serviced without stopping the process.  1 = Process PID controller setpoint frozen See also parameter 40.38 Set 1 output freeze 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

No.	Name/Value Description				
	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 Combined timer status (see page 240).	18		
	Timed function 2	Bit 1 of 34.01 Combined timer status (see page 240).	19		
	Timed function 3	Bit 2 of 34.01 Combined timer status (see page 240).	20		
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 234).	21		
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 234).	22		
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 234).	23		
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page <i>136</i> ).	-		
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 112).	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 <i>136</i> ).	-		
40.32	Set 1 gain	Defines the gain for the process PID controller. See parameter 40.33 Set 1 integration time.	1.00		
	0.10100.00	Gain for PID controller.	100 = 1		
40.33	Set 1 integration time	Defines the integration time for the process PID controller. This time needs to be set to the same order of magnitude as the reaction time of the process being controlled, otherwise instability will result.  Error/Controller output  G × I  Time  I = controller input (error)	60.0 s		
	0.0.0000.0.0	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.			
	0.09999.0 s	Integration time.	1 = 1 s		

No.	Name/Value	Description	Def/FbEq16
40.34	Set 1 derivation time	Defines the derivation time of the process PID controller. The derivative component at the controller output is calculated on basis of two consecutive error values $(E_{K-1} \text{ and } E_K)$ according to the following formula: PID DERIV TIME × $(E_K - E_{K-1})/T_S$ , in which $T_S = 2$ ms sample time $E = Error = Process reference - process feedback.$	0.000 s
	0.00010.000 s	Derivation time.	1000 = 1 s
40.35	Set 1 derivation filter time	Defines the time constant of the 1-pole filter used to smooth the derivative component of the process PID controller.  """  Unfiltered signal  Filtered signal  T  O = I × (1 - e <sup>-t/T</sup> )  I = filter input (step) O = filter output t = time T = filter time constant	0.0 s
	0.010.0 s	Filter time constant.	10 = 1 s
40.36	Set 1 output min	Defines the minimum limit for the process PID controller output. Using the minimum and maximum limits, it is possible to restrict the operation range.	0.0
	-32768.0 32767.0	Minimum limit for process PID controller output.	1 = 1
40.37	Set 1 output max	Defines the maximum limit for the process PID controller output. See parameter 40.36 Set 1 output min.	100.0
	-32768.0 32767.0	Maximum limit for process PID controller output.	1 = 1
40.38	Set 1 output freeze 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

No.	Name/Value	Description	Def/FbEq16
	DI6	Digital input DI6 (10.02 DI delayed status, bit 5).	7
	Timed function 1	Bit 0 of 34.01 Combined timer status (see page 240).	18
	Timed function 2	Bit 1 of 34.01 Combined timer status (see page 240).	19
	Timed function 3	Bit 2 of 34.01 Combined timer status (see page 240).	20
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 234).	21
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 234).	22
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 234).	23
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 136).	-
40.43	Set 1 sleep level	Defines the start limit for the sleep function. If the value is 0.0, set 1 sleep mode is disabled.  The sleep function compares the motor speed to the value of this parameter. If the motor speed remains below this value longer than the sleep delay defined by 40.44 Set 1 sleep delay, the drive enters the sleep mode and stops the motor.	0.0
	0.032767.0	Sleep start level.	1 = 1
40.44	Set 1 sleep delay	Defines a delay before the sleep function actually becomes enabled, to prevent nuisance sleeping.  The delay timer starts when the sleep mode is enabled by parameter 40.43 Set 1 sleep level, and resets when the sleep mode is disabled.	60.0 s
	0.03600.0 s	Sleep start delay.	1 = 1 s
40.45	Set 1 sleep boost time	Defines a boost time for the sleep boost step. See parameter 40.46 Set 1 sleep boost step.	0.0 s
	0.03600.0 s	Sleep boost time.	1 = 1 s
40.46	Set 1 sleep boost step	When the drive is entering sleep mode, the process setpoint is increased by this value for the time defined by parameter 40.45 Set 1 sleep boost time.  If active, sleep boost is aborted when the drive wakes up.	0.0 PID customer units
	0.032767.0 PID customer units	Sleep boost step.	1 = 1 PID customer unit
40.47	Set 1 wake-up deviation	Defines the wake-up level as deviation between process setpoint and feedback.  When the deviation exceeds the value of this parameter, and remains there for the duration of the wake-up delay (40.48 Set 1 wake-up delay), the drive wakes up.  See also parameter 40.31 Set 1 deviation inversion.	0.00 PID customer units
	-32768.00 32767.00 PID customer units	Wake-up level (as deviation between process setpoint and feedback).	1 = 1 PID customer unit
40.48	Set 1 wake-up delay	Defines a wake-up delay for the sleep function to prevent nuisance wake-ups. See parameter 40.47 Set 1 wake-up deviation.  The delay timer starts when the deviation exceeds the wake-up level (40.47 Set 1 wake-up deviation), and resets if the deviation falls below the wake-up level.	0.50 s
	0.0060.00 s	Wake-up delay.	1 = 1 s

No.	Name/Value	Description	Def/FbEq16
40.49	Set 1 tracking mode	Activates (or selects a source that activates) tracking mode. In tracking mode, the value selected by parameter 40.50 Set 1 tracking ref selection is substituted for the PID controller output. See also section Tracking (page 113).  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
	Timed function 1	Bit 0 of 34.01 Combined timer status (see page 240).	18
	Timed function 2	Bit 1 of 34.01 Combined timer status (see page 240).	19
	Timed function 3	Bit 2 of 34.01 Combined timer status (see page 240).	20
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 234).	21
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 234).	22
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 234).	23
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page <i>136</i> ).	-
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 157).	1
	Al2 scaled	12.22 Al2 scaled value (see page 158).	2
	FB A ref1	03.05 FB A reference 1 (see page 142).	3
	FB A ref2	03.06 FB A reference 2 (see page 142).	4
	Other	Source selection (see <i>Terms and abbreviations</i> on page 136).	-
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.  0 = Process PID parameter set 1 in use	Not selected
		1 = Process PID parameter set 2 in use	
	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
	Timed function 1	Bit 0 of 34.01 Combined timer status (see page 240).	18
	Timed function 2	Bit 1 of 34.01 Combined timer status (see page 240).	19
	Timed function 3	Bit 2 of 34.01 Combined timer status (see page 240).	20

No.	Name/Value	Description	Def/FbEq16
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 234).	21
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 234).	22
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 234).	23
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page <i>136</i> ).	-
40.58	Set 1 increase prevention	Prevention of PID integration term increase for PID set 1.	No
	No	Increase prevention not in use.	0
	Limiting	The PID integration term is not increased if the maximum value for the PID output is reached. This parameter is valid for the PID set 1.	1
	Ext PID min lim	The process PID integration term is not increased when the output of the external PID has reached its minimum limit. In this setup, the external PID is used as a source for the process PID. This parameter is valid for the PID set 1.	2
	Ext PID max lim	The process PID integration term is not increased when the output of the external PID has reached its maximum limit. In this setup, the external PID is used as a source for the process PID. This parameter is valid for the PID set 1.	3
40.59	Set 1 decrease prevention	Prevention of PID integration term decrease for PID set 1.	No
	No	Decrease prevention not in use.	0
	Limiting	The PID integration term is not decreased if the minimum value for the PID output is reached. This parameter is valid for the PID set 1.	1
	Ext PID min lim	The process PID integration term is not decreased when the output of the external PID has reached its minimum limit. In this setup, the external PID is used as a source for the process PID. This parameter is valid for the PID set 1.	2
	Ext PID max lim	The process PID integration term is not decreased when the output of the external PID has reached its maximum limit. In this setup, the external PID is used as a source for the process PID. This parameter is valid for the PID set 1.	3
40.62	PID internal setpoint actual	Displays the value of the internal setpoint. See the control chain diagram on page 431.  This parameter is read-only.	-
	-32768.00 32767.00 PID customer units	Process PID internal setpoint.	1 = 1 PID customer unit
40.91	Feedback data storage	Storage parameter for receiving a process feedback value eg. through the embedded fieldbus interface.  The value can be sent to the drive as Modbus I/O data. Set the target selection parameter of that particular data (58.10158.114) to Feedback data storage. In 40.08 Set 1 feedback 1 source (or 40.09 Set 1 feedback 2 source), select Feedback storage.	-
	-327.68327.67	Storage parameter for process feedback.	100 = 1

freeze enable

No.	Name/Value	Description	Def/FbEq16
40.92	Setpoint data storage	Storage parameter for receiving a process setpoint value eg. through the embedded fieldbus interface.  The value can be sent to the drive as Modbus I/O data. Set the target selection parameter of that particular data (58.10158.114)) to Setpoint data storage. In 40.16 Set 1 setpoint 1 source (or 40.17 Set 1 setpoint 2 source), select Setpoint data storage.	-
	-327.68327.67	Storage parameter for process setpoint.	100 = 1
41 Pro	ocess PID set 2	A second set of parameter values for process PID control.  The selection between this set and first set (parameter group 40 Process PID set 1) is made by parameter 40.57 PID set1/set2 selection.  See also parameters 40.0140.06, and the control chain diagrams on pages 430 and 431.	
41.08	Set 2 feedback 1 source	See parameter 40.08 Set 1 feedback 1 source.	Al2 percent
41.09	Set 2 feedback 2 source	See parameter 40.09 Set 1 feedback 2 source.	Not selected
41.10	Set 2 feedback function	See parameter 40.10 Set 1 feedback function.	In1
41.11	Set 2 feedback filter time	See parameter 40.11 Set 1 feedback filter time.	0.000 s
41.16	Set 2 setpoint 1 source	See parameter 40.16 Set 1 setpoint 1 source.	Al1 percent
41.17	Set 2 setpoint 2 source	See parameter 40.17 Set 1 setpoint 2 source.	Not selected
41.18	Set 2 setpoint function	See parameter 40.18 Set 1 setpoint function.	In1
41.19	Set 2 internal setpoint sel1	See parameter 40.19 Set 1 internal setpoint sel1.	Not selected
41.20	Set 2 internal setpoint sel2	See parameter 40.20 Set 1 internal setpoint sel2.	Not selected
41.21	Set 2 internal setpoint 1	See parameter 40.21 Set 1 internal setpoint 1.	0.00 PID customer units
41.22	Set 2 internal setpoint 2	See parameter 40.22 Set 1 internal setpoint 2.	0.00 PID customer units
41.23	Set 2 internal setpoint 3	See parameter 40.23 Set 1 internal setpoint 3.	0.00 PID customer units
41.26	Set 2 setpoint min	See parameter 40.26 Set 1 setpoint min.	0.00
41.27	Set 2 setpoint max	See parameter 40.27 Set 1 setpoint max.	32767.00
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	See parameter 40.30 Set 1 setpoint freeze enable.	Not selected

No.	Name/Value	Description	Def/FbEq16
41.31	Set 2 deviation inversion	See parameter 40.31 Set 1 deviation inversion.	Not inverted (Ref - Fbk)
41.32	Set 2 gain	See parameter 40.32 Set 1 gain.	1.00
41.33	Set 2 integration time	See parameter 40.33 Set 1 integration time.	60.0 s
41.34	Set 2 derivation time	See parameter 40.34 Set 1 derivation time.	0.000 s
41.35	Set 2 derivation filter time	See parameter 40.35 Set 1 derivation filter time.	0.0 s
41.36	Set 2 output min	See parameter 40.36 Set 1 output min.	0.0
41.37	Set 2 output max	See parameter 40.37 Set 1 output max.	100.0
41.38	Set 2 output freeze enable	See parameter 40.38 Set 1 output freeze enable.	Not selected
41.43	Set 2 sleep level	See parameter 40.43 Set 1 sleep level.	0.0
41.44	Set 2 sleep delay	See parameter 40.44 Set 1 sleep delay.	60.0 s
41.45	Set 2 sleep boost time	See parameter 40.45 Set 1 sleep boost time.	0.0 s
41.46	Set 2 sleep boost step	See parameter 40.46 Set 1 sleep boost step.	0.0 PID customer units
41.47	Set 2 wake-up deviation	See parameter 40.47 Set 1 wake-up deviation.	0.00 PID customer units
41.48	Set 2 wake-up delay	See parameter 40.48 Set 1 wake-up delay.	0.50 s
41.49	Set 2 tracking mode	See parameter 40.49 Set 1 tracking mode.	Not selected
41.50	Set 2 tracking ref selection	See parameter 40.50 Set 1 tracking ref selection.	Not selected
41.58	Set 2 increase prevention	See parameter 40.58 Set 1 increase prevention.	No
41.59	Set 2 decrease prevention	See parameter 40.59 Set 1 decrease prevention.	No
43 Br	ake chopper	Settings for the internal brake chopper.	
	onepoi	g	

43 Brake chopper		Settings for the internal brake chopper.	
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 temperature the resistor would reach if the maximum continuous braking power (43.09 Brake resistor Pmax cont) is applied to the resistor for 100% rated time. The thermal time constant (43.08 Brake resistor thermal tc) defines the rated time to achieve 63% temperature. 100% would be reached when 100% time has elapsed.  This parameter is read-only.	-
	0.0120.0%	Estimated brake resistor temperature.	1 = 1%

No.	Name/Value	Description	Def/FbEq16
43.06	Brake chopper enable	Enables brake chopper control.  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.	Disabled
	Disabled	Brake chopper control disabled.	0
	Enabled with thermal model	Brake chopper control enabled with resistor overload protection.	1
	Enabled without thermal model	Brake chopper control enabled without resistor overload protection. This setting can be used, for example, if the resistor is equipped with a thermal circuit breaker that is wired to stop the drive if the resistor overheats.	2
43.07	Brake chopper runtime 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.  This parameter can be used to program the chopper control to function only when the supply is missing from a drive with a regenerative supply unit.	On
	Off	0.	0
	On	1.	1
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 136).	-
43.08	Brake resistor thermal tc	Defines the thermal time constant of the brake resistor for overload protection.	0 s
	010000 s	Brake resistor thermal time constant.	1 = 1 s
43.09	Brake resistor Pmax cont	Defines the maximum continuous braking power of the resistor (in kW) which will raise the resistor temperature to the maximum allowed value. The value is used in the overload protection.	0.00 kW
	0.00 10000.00 kW	Maximum continuous braking power.	1 = 1 kW
43.10	Brake resistance	Defines the resistance value of the brake resistor. The value is used for brake chopper protection.	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 temperature protection 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 43.09 Brake resistor Pmax cont.	105%
	0150%	Brake resistor temperature fault limit.	1 = 1%
43.12	Brake resistor warning limit	Selects the warning limit for the brake resistor temperature protection 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%

No.	Name/Value	Description	Def/FbEq16
44 Med	chanical brake	Configuration of mechanical brake control. See also section <i>Mechanical brake control</i> (page <i>115</i> ).	
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
	Timed function 1	Bit 0 of 34.01 Combined timer status (see page 240).	18
	Timed function 2	Bit 1 of 34.01 Combined timer status (see page 240).	19
	Timed function 3	Bit 2 of 34.01 Combined timer status (see page 240).	20
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 234).	24
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 234).	25
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 234).	26
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 136).	-

No.	Name/Value	Description	Def/FbEq16
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 make-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. See also section <i>Energy saving calculators</i> (page 129).	
45.01	Saved GW hours	Energy saved in GWh compared to direct-on-line motor connection. This parameter is incremented when 45.02 Saved MW hours rolls over.  This parameter is read-only (see parameter 45.21 Energy calculations reset).	-
	065535 GWh	Energy savings in GWh.	1 = 1 GWh
45.02	Saved MW hours	Energy saved in MWh compared to direct-on-line motor connection. This parameter is incremented when 45.03 Saved kW hours rolls over.  When this parameter rolls over, parameter 45.01 Saved GW hours is incremented.  This parameter is read-only (see parameter 45.21 Energy calculations reset).	-
	0999 MWh	Energy savings in MWh.	1 = 1 MWh
45.03	Saved kW hours	Energy saved in kWh compared to direct-on-line motor connection.  If the internal brake chopper of the drive is enabled, all energy fed by the motor to the drive is assumed to be converted into heat, but the calculation still records savings made by controlling the speed. If the chopper is disabled, then regenerated energy from the motor is also recorded here.  When this parameter rolls over, parameter 45.02 Saved MW hours is incremented.  This parameter is read-only (see parameter 45.21 Energy calculations reset).	-
	0.0999.9 kWh	Energy savings in kWh.	10 = 1 kWh

No.	Name/Value	Description	Def/FbEq16
45.04	Saved energy	Energy saved in kWh compared to direct-on-line motor connection.  If the internal brake chopper of the drive is enabled, all energy fed by the motor to the drive is assumed to be converted into heat.  This parameter is read-only (see parameter 45.21 Energy calculations reset).	-
	0.0214748364.7 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.  The currency is defined by parameter 45.17 Tariff currency unit.  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.  The currency is defined by parameter 45.17 Tariff currency unit.  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).  The currency is defined by parameter 45.17 Tariff currency unit.  This parameter is read-only (see parameter 45.21 Energy calculations reset).	-
	0.00 21474830.08 units	Monetary savings.	1 = 1 unit
45.08	CO2 reduction in kilotons	Reduction in CO <sub>2</sub> 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 <sub>2</sub> emissions in metric kilotons.	1 = 1 metric kiloton

No.	Name/Value	Description	Def/FbEq16
45.09	CO2 reduction in tons	Reduction in CO <sub>2</sub> emissions in metric tons compared to direct-on-line motor connection. This value is calculated by multiplying the saved energy in MWh by the value of parameter 45.18 CO2 conversion factor (by default, 0.5 metric tons/MWh).  When this parameter rolls over, parameter 45.08 CO2 reduction in kilotons is incremented.  This parameter is read-only (see parameter 45.21 Energy calculations reset).	-
	0.0999.9 metric tons	Reduction in CO <sub>2</sub> emissions in metric tons.	1 = 1 metric ton
45.10	Total saved CO2	Reduction in CO <sub>2</sub> 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 <sub>2</sub> conversion factor (by default, 0.5 metric tons/MWh).  This parameter is read-only (see parameter 45.21 Energy calculations reset).	-
	0.0214748300.8 metric tons	Reduction in CO <sub>2</sub> 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, energy optimization is always enabled regardless of this parameter.	Disable
	Disable	Energy optimization disabled.	0
	Enable	Energy optimization enabled.	1
45.12	Energy tariff 1	Defines energy tariff 1 (price of energy per kWh). Depending on the setting of parameter 45.14 Tariff selection, either this value or 45.13 Energy tariff 2 is used for reference when monetary savings are calculated.  The currency is defined by parameter 45.17 Tariff currency unit.  Note: Tariffs are read only at the instant of selection, and are not applied retroactively.	0.100 units
	0.000 4294966.296 units	Energy tariff 1.	-
45.13	Energy tariff 2	Defines energy tariff 2 (price of energy per kWh). See parameter 45.12 Energy tariff 1.	0.200 units
	0.000 4294966.296 units	Energy tariff 2.	-
45.14	Tariff selection	Selects (or defines a source that selects) which pre-defined energy tariff is used.  0 = 45.12 Energy tariff 1 1 = 45.13 Energy tariff 2	Energy tariff 1
	Energy tariff 1	0.	0
	Energy tariff 2	1.	1
	DI1	Digital input DI1 (10.02 DI delayed status, bit 0).	2
	DI2	Digital input DI2 (10.02 DI delayed status, bit 1).	3

No.	Name/Value	Description	Def/FbEq16
	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 136).	-
45.17	Tariff currency unit	Specifies the currency used for the savings calculations.	EUR
	Local currency	The currency is determined by the language selection (see parameter 96.01 Language).	100
	EUR	Euro.	101
	USD	US dollar.	102
45.18	CO2 conversion factor	Defines a factor for conversion of saved energy into CO <sub>2</sub> emissions (kg/kWh or tn/MWh).	0.500 tn/MWh
	0.00065.535 tn/MWh	Factor for conversion of saved energy into CO <sub>2</sub> 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
46 Mo	nitoring/scaling	Speed supervision settings; actual signal filtering; general	

46 Monitoring/scaling settings	Speed supervision settings; actual signal filtering; general scaling settings.	
46.01 Speed scaling	Defines the maximum speed value used to define the acceleration ramp rate and the initial speed value used to define the deceleration ramp rate (see parameter group 23 Speed reference ramp). The speed acceleration and deceleration ramp times are therefore related to this value (not to parameter 30.12 Maximum speed).  Also defines the 16-bit scaling of speed-related parameters. The value of this parameter corresponds to 20000 in eg. fieldbus communication.	1500.00 rpm
0.1030000.00 rpm	Acceleration/deceleration terminal/initial speed.	1 = 1 rpm

No.	Name/Value	Description	Def/FbEq16
46.02	Frequency scaling	Defines the maximum frequency value used to define the acceleration ramp rate and the initial frequency value used to define deceleration ramp rate (see parameter group 28 Frequency reference chain). The frequency acceleration and deceleration ramp times are therefore related to this value (not to parameter 30.14 Maximum frequency).  Also defines the 16-bit scaling of frequency-related parameters. The value of this parameter corresponds to 20000 in eg. fieldbus communication.	50.00 Hz
	0.101000.00 Hz	Acceleration/deceleration terminal/initial frequency.	10 = 1 Hz
46.03	Torque scaling	Defines the 16-bit scaling of torque parameters. The value of this parameter (in percent of nominal motor torque) corresponds to 10000 in eg. fieldbus communication.	100.0%
	0.11000.0%	Torque corresponding to 10000 on fieldbus.	10 = 1%
46.04	Power scaling	Defines the output power value that corresponds to 10000 in eg. fieldbus communication. The unit is selected by parameter 96.16 Unit selection.	1000.00 kW or hp
	0.130000.00 kW or 0.140214.48 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.	10000 A
	030000 A		
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

No.	Name/Value	Description	Def/FbEq16
46.21	At speed hysteresis	Defines the "at setpoint" limits for speed control of the drive. When the difference between 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.  24.02 (rpm)	50.00 rpm
		Drive at setpoint (06.11 bit 8 = 1)  22.87 + 46.21 (rpm)  22.87 (rpm)  22.87 - 46.21 (rpm)  0 rpm	
	0.0030000.00 rpm	Limit for "at setpoint" indication in speed control.	See par. 46.01
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
	0.001000.00 Hz	Limit for "at setpoint" indication in frequency control.	See par. 46.02

No.	Name/Value	Description	Def/FbEq16
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.	5.0%
		01.10 (%)  Drive at setpoint (06.11 bit 8 = 1)  26.73 + 46.23 (%)  26.73 - 46.23 (%)	
		0%	
	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
46.41	kWh pulse scaling	Defines the trigger level for the "kWh pulse" on for 50 ms. The output of the pulse is bit 9 of 05.22 Diagnostic word 3.	1.000 kWh
	0.001 1000.000 kWh	"kWh pulse" on trigger level.	1 = 1 kWh
47 Dai	ta storage	Data storage parameters that can be written to and read from using other parameters' source and target settings.  Note that there are different storage parameters for different data types.  See also section <i>Data storage parameters</i> (page 133).	
47.01	Data storage 1 real32	Data storage parameter 1.	0.000
	-2147483.000 2147483.000	32-bit data.	-
47.02	Data storage 2 real32	Data storage parameter 2.	0.000
	-2147483.000 2147483.000	32-bit data.	-

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

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

No.	Name/Value	Description	Def/FbEq16
	115.2 kbps	115.2 kbit/s.	4
	230.4 kbps	230.4 kbit/s.	5
49.04	Communication loss time	Sets a timeout for control panel (or PC tool) communication. If a communication break lasts longer than the timeout, the action specified by parameter 49.05 Communication loss action is taken.	10.0 s
	0.33000.0 s	Panel/PC tool communication timeout.	10 = 1 s
49.05	Communication loss action	Selects how the drive reacts to a control panel (or PC tool) communication break.	Fault
	No action	No action taken.	0
	Fault	Drive trips on 7081 Control panel loss Programmable fault: 49.05 Communication loss action.	1
	Last speed	Drive generates an ATEE Panel loss warning and freezes the speed to the level the drive was operating at. The speed is determined on the basis of actual speed using 850 ms low-pass filtering.  WARNING! Make sure that it is safe to continue operation in case of a communication break.	2
	Speed ref safe	Drive generates an A7EE Panel loss warning and sets the speed to the speed defined by parameter 22.41 Speed ref safe (or 28.41 Frequency ref safe when frequency reference is being used).  WARNING! Make sure that it is safe to continue operation in case of a communication break.	3
49.06	Refresh settings	Applies the settings of parameters 49.0149.05.  Note: Refreshing may cause a communication break, so reconnecting the drive may be required.	Done
	Done	Refresh done or not requested.	0
	Configure	Refresh parameters 49.0149.05. The value reverts automatically to <i>Done</i> .	1

50 Fieldbus adapter (FBA)		Fieldbus communication configuration. See also chapter <i>Fieldbus control through a fieldbus adapter</i> (page <i>405</i> ).	
50.01	FBA A enable	Enables/disables communication between the drive and fieldbus adapter A, and specifies the slot the adapter is installed into.	Disable
	Disable	Communication between drive and fieldbus adapter A disabled.	0
	Enable	Communication between drive and fieldbus adapter A enabled. The adapter is in slot 1.	1
50.02	FBA A comm loss func	Selects how the drive reacts upon a fieldbus communication break. The time delay is defined by parameter 50.03 FBA A comm loss t out.	No
	No	No action taken.	0
	Fault	Communication break detection active. Upon a communication break, the drive trips on a 7510 FBA A communication fault and coasts to a stop.	1

No.	Name/Value	Description		Def/FbEq16
	Last speed	Communication break detection communication break, the drive FBA A communication) and free drive was operating at. The specific factual speed using 850 ms in WARNING! Make sure operation in case of a communication of the specific factor of the specific	e generates a warning (A7C1 ezes the speed to the level the eed is determined on the basis ow-pass filtering. that it is safe to continue	2
	Speed ref safe	Communication break detection communication break, the drive FBA A communication) and set defined by parameter 22.41 Sp. Frequency ref safe when frequency warning! Make sure operation in case of a communication break to the communication break the detection break to the communication break the detection break the communication break the detection break the communication break the detection break the detectio	e generates a warning (A7C1 ts the speed to the value speed ref safe (or 28.41 ency reference is being used). that it is safe to continue	3
	Fault always	Drive trips on 7510 FBA A com though no control is expected f		4
	Warning	Drive generates an A7C1 FBA This occurs even though no co fieldbus.  WARNING! Make sure operation in case of a c	5	
50.03	FBA A comm loss t out	Defines the time delay before the action defined by parameter 50.02 FBA A comm loss func is taken. Time count starts when the communication link fails to update the message.		0.3 s
	0.36553.5 s	Time delay.		1 = 1 s
50.04	FBA A ref1 type	Selects the type and scaling of fieldbus adapter A. The scaling parameters 46.0146.04, dep type is selected by this parame	of the reference is defined by ending on which reference	Speed or frequency
	Speed or frequency	Type and scaling is chosen aut currently active operation mode		0
		Operation mode (see par. 19.01)	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.	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 parame			neter 46.02 Frequency scaling.	5

No.	Name/Value	Description		Def/FbEq16
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 aut currently active operation mode		0
		Operation mode (see par. 19.01)	Reference 2 type	
		Speed control	Torque	
		Torque control	Torque	
		Frequency control	Torque	
	Transparent	No scaling is applied.		1
	General	Generic reference without a sp	ecific unit.	2
	Torque	The scaling is defined by parar	meter 46.03 Torque scaling.	3
	Speed	The scaling is defined by parar	meter 46.01 Speed scaling.	4
	Frequency	The scaling is defined by paran	meter 46.02 Frequency scaling.	5
50.06	06 FBA A SW sel Selects the source of the Status word to be sent to the fieldbus network through fieldbus adapter A.			Auto
	Auto	Source of the Status word is ch	0	
	Transparent mode	The source selected by parametransparent source is transmitte 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 fie of the value is defined by parar depending on which actual value 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	No scaling is applied.		1
	General	Generic reference without a sp	ecific unit.	2
	Torque	The scaling is defined by parar	meter 46.03 Torque scaling.	3
	Speed	The scaling is defined by parar	meter 46.01 Speed scaling.	4
	Frequency	The scaling is defined by paran	neter 46.02 Frequency scaling.	5
		1		1

No.	Name/Value	Description		Def/FbEq16	
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 aut currently active operation mode		0	
		Operation mode (see par. 19.01)	Actual value 2 type		
		Speed control	Torque		
		Torque control	Torque		
		Frequency control	Torque		
	Transparent	No scaling is applied.		1	
	General	Generic reference without a sp	ecific unit.	2	
	Torque	The scaling is defined by parar	neter 46.03 Torque scaling.	3	
	Speed	The scaling is defined by parar	neter 46.01 Speed scaling.	4	
	Frequency	The scaling is defined by paran	neter 46.02 Frequency scaling.	5	
50.09	FBA A SW transparent source	Selects the source of the fieldb parameter 50.06 FBA A SW se		Not selected	
	Not selected	No source selected.	No source selected.		
	Other	Source selection (see Terms at	Source selection (see <i>Terms and abbreviations</i> on page 136).		
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.	No source selected.		
	Other	Source selection (see Terms ar	Source selection (see <i>Terms and abbreviations</i> on page <i>136</i> ).		
50.11	FBA A act2 transparent source	When parameter 50.08 FBA A Transparent, this parameter sel 2 transmitted to the fieldbus net A.	ects the source of actual value	Not selected	
	Not selected	No source selected.		-	
	Other	Source selection (see Terms at	nd abbreviations on page 136).	-	
50.12	FBA A debug mode	This parameter enables debug (unmodified) data received from A in parameters 50.1350.18.		Normal	
	Disable	Debug mode disabled.		0	
	Fast	Debug mode enabled. Cyclical possible which increases CPU		1	
	Normal	Debug mode is enabled but dat to enable normal operations.	a update cycle is slow enough	2	
50.13	FBA A control word	Displays the raw (unmodified) master (PLC) to fieldbus adapte parameter 50.12 FBA A debug This parameter is read-only.	er A if debugging is enabled by	-	
	00000000h FFFFFFFh	Control word sent by master to	fieldbus adapter A.	-	

No.	Name/Value	Description	Def/FbEq16
50.14	FBA A reference 1	Displays raw (unmodified) reference REF1 sent by the master (PLC) to fieldbus adapter A if debugging is enabled by parameter 50.12 FBA A debug mode.  This parameter is read-only.	-
	-2147483648 2147483647	Raw REF1 sent by master to fieldbus adapter A.	-
50.15	FBA A reference 2	Displays raw (unmodified) reference REF2 sent by the master (PLC) to fieldbus adapter A if debugging is enabled by parameter 50.12 FBA A debug mode.  This parameter is read-only.	-
	-2147483648 2147483647	Raw REF2 sent by master to fieldbus adapter A.	-
50.16	FBA A status word	Displays the raw (unmodified) status word sent by fieldbus adapter A to the master (PLC) if debugging is enabled by parameter 50.12 FBA A debug mode.  This parameter is read-only.	-
	00000000h FFFFFFFh	Status word sent by fieldbus adapter A to master.	-
50.17	FBA A actual value 1	Displays raw (unmodified) actual value ACT1 sent by fieldbus adapter A to the master (PLC) if debugging is enabled by parameter 50.12 FBA A debug mode.  This parameter is read-only.	-
	-2147483648 2147483647	Raw ACT1 sent by fieldbus adapter A to master.	-
50.18	FBA A actual value 2	Displays raw (unmodified) actual value ACT2 sent by fieldbus adapter A to the master (PLC) if debugging is enabled by parameter 50.12 FBA A debug mode.  This parameter is read-only.	-
	-2147483648 2147483647	Raw ACT2 sent by fieldbus adapter A to master.	-
51 FB/	A A settings	Fieldbus adapter A configuration.	
51.01	FBA A type	Displays the type of the connected fieldbus adapter module.  0 = Module is not found or is not properly connected, or is disabled by parameter 50.01 FBA A enable; 0 = None; 1 = PROFIBUS-DP; 32 = CANopen; 37 = DeviceNet; 128 = Ethernet; 132 = PROFInet IO; 135 = EtherCAT; 136 = ETH Pwrlink; 485 = RS-485 comm; 101 = ControlNet; 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	Done
		running.	
	Done	Refreshing done.	0
	Configure	Refreshing.	1
51.28	FBA A par table ver	Displays the parameter table revision of the fieldbus adapter module mapping file (stored in the memory of the drive). In format axyz, where ax = major table revision number; yz = minor table revision number.  This parameter is read-only.	-
		Parameter table revision of adapter module.	-
51.29	FBA A drive type code	Displays the drive type code in the fieldbus adapter module mapping file (stored in the memory of the drive).  This parameter is read-only.	-
	065535	Drive type code stored in the mapping file.	1 = 1
51.30	FBA A mapping file ver	Displays the fieldbus adapter module mapping file revision stored in the memory of the drive in decimal format.  This parameter is read-only.	-
	065535	Mapping file revision.	1 = 1
51.31	D2FBA A comm status	Displays the status of the fieldbus adapter module communication.	Not configured
	Not configured	Adapter is not configured.	0
	Initializing	Adapter is initializing.	1
	Time out	A timeout has occurred in the communication between the adapter and the drive.	2
	Configuration error	Adapter configuration error: mapping file not found in the file system of the drive, or mapping file upload has failed more than three times.	3
	Off-line	Fieldbus communication is off-line.	4
	On-line	Fieldbus communication is on-line, or fieldbus adapter has been configured not to detect a communication break. For more information, see the documentation of the fieldbus adapter.	5
	Reset	Adapter is performing a hardware reset.	6
51.32	FBA A comm SW ver	Displays the common program revision of the adapter module in format axyz, where a = major revision number, xy = minor revision number, z = correction number or letter.  Example: 190A = revision 1.90A.	
		Common program revision of adapter module.	-
51.33	FBA A appl SW ver	Displays the application program revision of the adapter module in format axyz, where a = major revision number, xy = minor revision number, z = correction number or letter.  Example: 190A = revision 1.90A.	
		Application program version of adapter module.	-

No.	Name/Value	Description	Def/FbEq16
52 FBA	A data in	Selection of data to be transferred from drive to fieldbus controller through fieldbus adapter A.  Note: 32-bit values require two consecutive parameters.  Whenever a 32-bit value is selected in a data parameter, the next parameter is automatically reserved.	
52.01	FBA A data in1	Parameters 52.0152.12 select data to be transferred from the drive to the fieldbus controller through fieldbus adapter A.	None
	None	None.	0
	CW 16bit	Control Word (16 bits)	1
	Ref1 16bit	Reference REF1 (16 bits)	2
	Ref2 16bit	Reference REF2 (16 bits)	3
	SW 16bit	Status Word (16 bits)	4
	Act1 16bit	Actual value ACT1 (16 bits)	5
	Act2 16bit	Actual value ACT2 (16 bits)	6
	CW 32bit	Control Word (32 bits)	11
	Ref1 32bit	Reference REF1 (32 bits)	12
	Ref2 32bit	Reference REF2 (32 bits)	13
	SW 32bit	Status Word (32 bits)	14
	Act1 32bit	Actual value ACT1 (32 bits)	15
	Act2 32bit	Actual value ACT2 (32 bits)	16
	SW2 16bit	Status Word 2 (16 bits)	24
	Other	Source selection (see <i>Terms and abbreviations</i> on page <i>136</i> ).	-
52.12	FBA A data in12	See parameter 52.01 FBA A data in1.	None
53 FBA	A data out	Selection of data to be transferred from fieldbus controller to drive through fieldbus adapter A.  Note: 32-bit values require two consecutive parameters.  Whenever a 32-bit value is selected in a data parameter, the next parameter is automatically reserved.	
53.01	FBA A data out1	Parameters 53.0153.12 select data to be transferred from the fieldbus controller to the drive through fieldbus adapter A.	None
	None	None.	0
	CW 16bit	Control Word (16 bits)	1
	Ref1 16bit	Reference REF1 (16 bits)	2
	Ref2 16bit	Reference REF2 (16 bits)	3
	CW 32bit	Control Word (32 bits)	11
	Ref1 32bit	Reference REF1 (32 bits)	12
	Ref2 32bit	Reference REF2 (32 bits)	13
	CW2 16bit	Control Word 2 (16 bits)	21
	Other	Source selection (see <i>Terms and abbreviations</i> on page <i>136</i> ).	-
53.12	FBA A data out12	See parameter 53.01 FBA A data out1.	None

No.	Name/Value	Description	Def/FbEq16
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 377).	
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. This parameter is read-only.	-
		Protocol ID and revision.	1 = 1
58.03	Node address	Defines the node address of the drive on the fieldbus link. Values 1247 are allowable. Two devices with the same address are not allowed on-line. Changes to this parameter take effect after the control unit is rebooted or the new settings validated by parameter 58.06 Communication control (Refresh settings).	1
	0255	Node address (values 1247 are allowed).	1 = 1
58.04	Baud rate	Selects the transfer rate of the fieldbus link. Changes to this parameter take effect after the control unit is rebooted or the new settings validated by parameter 58.06 Communication control (Refresh settings).	19.2 kbps
	4.8 kbps	4.8 kbit/s.	1
	9.6 kbps	9.6 kbit/s.	2
	19.2 kbps	19.2 kbit/s.	3
	38.4 kbps	38.4 kbit/s.	4
	57.6 kbps	57.6 kbit/s.	5
	76.8 kbps	76.8 kbit/s.	6
	115.2 kbps	115.2 kbit/s.	7
58.05	Parity	Selects the type of parity bit and number of stop bits. Changes to this parameter take effect after the control unit is rebooted or the new settings validated by parameter 58.06 Communication control (Refresh settings).	8 EVEN 1
	8 NONE 1	Eight data bits, no parity bit, one stop bit.	0
	8 NONE 2	Eight data bits, no parity bit, two stop bits.	1
	8 EVEN 1	Eight data bits, even parity bit, one stop bit.	2
	8 ODD 1	Eight data bits, odd parity bit, one stop bit.	3
58.06	Communication control	Takes changed EFB settings in use, or activates silent mode.	Enabled
	Enabled	Normal operation.	0
	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 Refresh settings selection of this parameter.	2

No.	Name/	Value	Description	on	Def/FbEq16	
58.07	Comm diagno	unication estics	This parar	ne status of the EFB communication. neter is read-only. the name is only visible when the error is present s 1).	-	
	Bit	Name		Description		
	0	Init failed		1 = EFB initialization failed		
	1	Addr config	err	1 = Node address not allowed by protocol		
	2	Silent mode	)	1 = Drive not allowed to transmit 0 = Drive allowed to transmit		
	3	Reserved				
	4	Wiring erro	r	1 = Errors detected (A/B wires possibly swapped)		
	5	Parity error		1 = Error detected: check parameters 58.04 and 58	3.05	
	6	Baud rate e	error	1 = Error detected: check parameters 58.05 and 58	3.04	
	7	No bus acti		1 = 0 bytes received during last 5 seconds		
	8	No packets		1 = 0 packets (addressed to any device) detected of seconds	J	
	9	Noise or ad error		1 = Errors detected (interference, or another device same address on line)		
	10	Comm loss		1 = 0 packets addressed to the drive received withit (58.16)	n timeout	
	11	CW/Ref los	s	1 = No control word or references received within timeout (58.1		
	12	Not active 15 Reserved		Reserved		
58.08		FFFFh	Displays a	nunication status.  count of valid packets addressed to the drive. rmal operation, this number increases constantly.	1 = 1	
				set from the control panel by keeping Reset down		
	0429	94967295	Number of	f received packets addressed to the drive.	1 = 1	
58.09	Transn	nitted packets	During nor	count of valid packets transmitted by the drive.  rmal operation, this number increases constantly.  set from the control panel by keeping Reset down seconds.	-	
	0429	94967295	Number of	f transmitted packets.	1 = 1	
58.10	All pac	kets	the bus. D	set from the control panel by keeping Reset down	-	
	0429	94967295	Number of	f all received packets.	1 = 1	
58.11	UART	errors	increasing bus.	count of character errors received by the drive. An count indicates a configuration problem on the set from the control panel by keeping Reset down seconds.	-	
		94967295	t	f UART errors.	1 = 1	

No.	Name/Value	Description	Def/FbEq16
58.12	CRC errors	Displays a count of packets with a CRC error received by the drive. An increasing count indicates interference on the bus. Can be reset from the control panel by keeping Reset down for over 3 seconds.	-
	04294967295	Number of CRC errors.	1 = 1
58.14	Communication loss action	Selects how the drive reacts to an EFB communication break. Changes to this parameter take effect after the control unit is rebooted or the new settings validated by parameter 58.06 Communication control (Refresh settings). See also parameters 58.15 Communication loss mode and 58.16 Communication loss time.	Fault
	No	No action taken (monitoring disabled).	0
	Fault	The drive monitors communication loss when start/stop is expected from the EFB on the currently active control location. Drive trips on 6681 EFB comm loss only if control in the currently active control location is expected from the EFB. The drive does not trip if only reference is coming from EFB and the communication is lost.	1
	Last speed	Drive generates an A7CE EFB comm loss warning and freezes the speed to the level the drive was operating at. The speed is determined on the basis of actual speed using 850 ms low-pass filtering. This occurs only if control 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 only if control is expected from the EFB.  WARNING! Make sure that it is safe to continue operation in case of a communication break.	3
	Fault always	Drive continuously monitors for communication loss. Drive trips on 6681 EFB comm loss. This happens even thought the drive is in a control location where the EFB start/stop or reference is not used.	4
	Warning	Drive generates an A7CE EFB comm loss warning. This occurs even though no control is expected from the EFB.  WARNING! Make sure that it is safe to continue operation in case of a communication break.	5
58.15	Communication loss mode	Defines which message types reset the timeout counter for detecting an EFB communication loss. Changes to this parameter take effect after the control unit is rebooted or the new settings validated by parameter 58.06 Communication control (Refresh settings). See also parameters 58.14 Communication loss action and 58.16 Communication loss time.	Cw / Ref1 / Ref2
	Any message	Any message addressed to the drive resets the timeout.	1
	Cw / Ref1 / Ref2	A write of the control word or a reference resets the timeout.	2

No.	Name/Value	Description		Def/FbEq16
58.16	Communication loss time	Sets a timeout for EFB commu break lasts longer than the time parameter 58.14 Communication	eout, the action specified by on loss action is taken.	3.0 s
		Changes to this parameter take rebooted or the new settings va Communication control (Refres See also parameter 58.15 Con		
	0.06000.0 s	EFB communication timeout.		1 = 1
58.17	Transmit delay	Defines a minimum response of delay imposed by the protocol. Changes to this parameter take rebooted or the new settings vaccommunication control (Refres	e effect after the control unit is alidated by parameter 58.06	0 ms
	065535 ms	Minimum response delay.		1 = 1
58.18	EFB control word	Displays the raw (unmodified) s the Modbus controller. For deb This parameter is read-only.		-
	0000hFFFFh	Control word sent by Modbus of	controller to the drive.	1 = 1
58.19	EFB status word	Displays the raw (unmodified) spurposes. This parameter is read-only.	status word for debugging	-
	0000hFFFFh	Status word sent by the drive to	the Modbus controller.	1 = 1
58.25	Control profile	Defines the communication pro Changes to this parameter take rebooted or the new settings va Communication control (Refres	e effect after the control unit is alidated by parameter 58.06	ABB Drives
	ABB Drives	ABB Drives control profile (with	a 16-bit control word)	0
	DCU Profile	DCU control profile (with a 16 of	or 32-bit control word)	5
58.26	EFB ref1 type	Selects the type and scaling of the embedded fieldbus interfac The scaled reference is display	e.	Speed or frequency
	Speed or frequency	Type and scaling is chosen aut currently active operation mode		0
		Operation mode (see par. 19.01)	Reference 1 type	
		Speed control	Speed	
		Torque control Frequency control	Speed Frequency	
		r requeries control	rroquonoy	
	Transparent	No scaling is applied.  Generic reference without a specific unit. Scaling: 1 = 100.		1
	General			2
	Torque Torque reference. The scaling is defined by parameter 46.03  Torque scaling.		is defined by parameter 46.03	3
	Speed	Speed reference. The scaling is defined by parameter 46.01 Speed scaling.		4
	Frequency	Frequency reference. The scal 46.02 Frequency scaling.	ing is defined by parameter	5

No.	Name/Value	Description	Def/FbEq16
58.27	EFB ref2 type	Selects the type and scaling of reference 2 received throthe embedded fieldbus interface. The scaled reference is displayed by 03.10 EFB reference.	
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 to currently active operation mode as follows.	ne 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 specific unit. Scaling: 1 = 1	00. 2
	Torque	Scaling is defined by parameter 46.03 Torque scaling.	3
	Speed	Scaling is defined by parameter 46.01 Speed scaling.	4
	Frequency	Scaling is defined by parameter 46.02 Frequency scaling	g. 5
58.29	EFB act2 type	Selects the type of actual value 2. For the selections, see parameter 58.28 EFB act1 type.	Transparent
58.31	EFB act1 transparent source	Selects the source of actual value 1 when parameter 58 EFB act1 type is set to Transparent.	Not selected
	Not selected	None.	0
	Other	Source selection (see <i>Terms and abbreviations</i> on page	136)
58.32	EFB act2 transparent source	Selects the source of actual value 1 when parameter 58 EFB act2 type is set to Transparent.	3.29 Other (par. 01.07 Motor current)
	Not selected	None.	0
	Other	Source selection (see Terms and abbreviations on page	136)
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 urebooted or the new settings validated by parameter 58 Communication control (Refresh settings).	ınit is
	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.		
	Mode 1	16-bit values (groups 1255, indexes 1255): Register address = 400000 + 256 × parameter group + parameter index. For example, parameter 22.80 would l mapped to register 400000 + 5632 + 80 = 405712.	1 pe
	Mode 2	32-bit values (groups 1127, indexes 1255): Register address = 400000 + 512 × parameter group + 2 × parameter index. For example, parameter 22.80 wou mapped to register 400000 + 11264 + 160 = 411424.	2 uld be

No.	Name/Value	Description	Def/FbEq16
58.34	Word order	Selects in which order 16-bit registers of 32-bit parameters are transferred.  For each register, the first byte contains the high order byte 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
	CW 32bit	Control Word (32 bits)	11
	Ref1 32bit	Reference REF1 (32 bits)	12
	Ref2 32bit	Reference REF2 (32 bits)	13
	SW 32bit	Status Word (32 bits)	14
	Act1 32bit	Actual value ACT1 (32 bits)	15
	Act2 32bit	Actual value ACT2 (32 bits)	16
	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
	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
	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 <i>136</i> ).	-

No.	Name/Value	Description	Def/FbEq16
58.102	Data I/O 2	Defines the address in the drive which the Modbus master accesses when it reads from or writes to register address 400002.  For the selections, see parameter 58.101 Data I/O 1.	Ref1 16bit
58.103	Data I/O 3	Defines the address in the drive which the Modbus master accesses when it reads from or writes to register address 400003.  For the selections, see parameter 58.101 Data I/O 1.	Ref2 16bit
58.104	Data I/O 4	Defines the address in the drive which the Modbus master accesses when it reads from or writes to register address 400004. For the selections, see parameter 58.101 Data I/O 1.	SW 16bit
58.105	Data I/O 5	Defines the address in the drive which the Modbus master accesses when it reads from or writes to register address 400005. For the selections, see parameter 58.101 Data I/O 1.	Act1 16bit
58.106	Data I/O 6	Defines the address in the drive which the Modbus master accesses when it reads from or writes to register address 400006.  For the selections, see parameter 58.101 Data I/O 1.	Act2 16bit
58.107	Data I/O 7	Parameter selector for Modbus register address 400007. For the selections, see parameter 58.101 Data I/O 1.	None
58.114	Data I/O 14	Parameter selector for Modbus register address 400014. For the selections, see parameter 58.101 Data I/O 1.	None
71 Ext	ernal PID1	Configuration of external PID.	
71.01	External PID act value	See parameter 40.01 Process PID output actual.	-
71.02	Feedback act value	See parameter 40.02 Process PID feedback actual.	-

See parameter 40.03 Process PID setpoint actual.

See parameter 40.04 Process PID deviation actual.

71.03

71.04

Setpoint act value

Deviation act value

					I
No.	Name/V		Descri	-	Def/FbEq16
71.06	PID stat	us word		s status information on process external PID control. arameter is read-only.	-
	Bit Name			Value	
	0	PID active		1 = Process PID control active.	
	1	Reserved			
	2	Output froz	en	1 = Process PID controller output frozen. Bit is set if para 71.38 Output freeze enable is TRUE, or the deadband active (bit 9 is set).	
	36	Reserved			
	7	Output limit		1 = PID output is being limited by par. 40.37.	
	8	Output limit		1 = PID output is being limited by par. 40.36.	
	9	Deadband	active	1 = Deadband is active.	
	1011	Reserved			
	12	Internal set active	point	1 = Internal setpoint active (see par. 40.1640.16)	
	1315	Reserved			
	0000h	.FFFFh	Proces	s PID control status word.	1 = 1
71.07	PID ope	ration mode	See pa	rameter 40.07 Process PID operation mode.	Off
71.08	Feedbad	ck 1 source	See pa	rameter 40.08 Set 1 feedback 1 source.	Al2 percent
71.11	Feedbad	ack filter time See pa		rameter 40.11 Set 1 feedback filter time.	0.000 s
71.14	scaling a TT se us pa no In de N 7		a gene The sc setpoir used a parame nomina In effect deviation Note: 71.15.	s, together with parameter 71.15 Set 1 output scaling, ral scaling factor for the external PID control chain. alling can be utilized when, for example, the process it is input in Hz, and the output of the PID controller is an rpm value in speed control. In this case, this eter might be set to 50, and parameter 71.15 to the all motor speed at 50 Hz.  It, the output of the PID controller [71.15] when con (setpoint - feedback) = [71.14] and [71.32] = 1.  The scaling is based on the ratio between 71.14 and For example, the values 50 and 1500 would produce the scaling as 1 and 3.	1500.00
	-32768.0 32767.0		Proces	s setpoint base.	1 = 1
71.15	Set 1 ou	tput scaling	See pa	rameter 71.14 Set 1 setpoint scaling.	1500.00
	-32768.0 32767.0		Proces	s PID controller output base.	1 = 1
71.16	Setpoint	1 source	See pa	rameter 40.16 Set 1 setpoint 1 source.	Al1 percent
71.19	Internal sel1	setpoint	See pa	rameter 40.19 Set 1 internal setpoint sel1.	Not selected
71.20	Internal sel2	setpoint	See pa	rameter 40.20 Set 1 internal setpoint sel2.	Not selected
71.21	Internal	setpoint 1	See pa	rameter 40.21 Set 1 internal setpoint 1.	0.00 PID customer units
71.22	Internal	setpoint 2	See pa	rameter 40.22 Set 1 internal setpoint 2.	0.00 PID customer units

No.	Name/Value	Description	Def/FbEq16
71.23	Internal setpoint 3	See parameter 40.23 Set 1 internal setpoint 3.	0.00 PID customer units
71.26	Setpoint min	See parameter 40.26 Set 1 setpoint min.	0.00
71.27	Setpoint max	See parameter 40.27 Set 1 setpoint max.	32767.00
71.31	Deviation inversion	See parameter 40.31 Set 1 deviation inversion.	Not inverted (Ref - Fbk)
71.32	Gain	See parameter 40.32 Set 1 gain.	1.00
71.33	Integration time	See parameter 40.33 Set 1 integration time.	60.0 s
71.34	Derivation time	See parameter 40.34 Set 1 derivation time.	0.000 s
71.35	Derivation filter time	See parameter 40.35 Set 1 derivation filter time.	0.0 s
71.36	Output min	See parameter 40.36 Set 1 output min.	-32768.0
71.37	Output max	See parameter 40.37 Set 1 output max.	32767.0
71.38	Output freeze enable	See parameter 40.38 Set 1 output freeze 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
	0.032767.0	Range	1 = 1
71.40	Deadband delay	Defines the deadband delay for the deadband function. See parameter 71.39 Deadband range.	0.0 s
	0.03600.0 s	Delay	1 = 1 s
71.58	Increase prevention	See parameter 40.58 Set 1 increase prevention.	No
71.59	Decrease prevention	See parameter 40.59 Set 1 decrease prevention.	No
71.62	Internal setpoint actual	See parameter 40.62 PID internal setpoint actual.	-
76 PF	C configuration	PFC (Pump and fan control) and Autochange configuration parameters. See also section <i>Pump and fan control (PFC)</i> on	
		page 114.	
76.01	PFC status	Displays the running/stopped status of the PFC motors. PFC1, PFC2, PFC3 and PFC4 always correspond to the 1st4th motor of the PFC system. If 76.74 Autochange auxiliary PFC auxiliary PFC is set to Aux motors only, PFC1 represents the motor connected to the drive and PFC2 the first auxiliary motor (the 2nd motor of the system). If 76.74 is set to All motors, PFC1 is the first motor, PFC2 the 2nd. The drive can be connected to any of these motors depending on	-

the Autochange functionality.

No.	Name/\	/alue	Description		Def/FbEq16
	Bit	Name	l V	/alue	
	0	PFC 1 runr	ing 0	) = Stop, 1 = Start	
	1	PFC 2 runr		) = Stop, 1 = Start	
	2	PFC 3 runr	ning 0	) = Stop, 1 = Start	
	3	PFC 4 runr	ning 0	) = Stop, 1 = Start	
	415	Reserved	<u> </u>	17	
	0000h	FFFFh	Status of the PFC	relay outputs	1 = 1
76.02	PFC sys	stem status	Displays the status	of the PFC system in text form. Provides a overview, eg. if the parameter is added to	-
76.11	Pump/fa	an status 1	Shows the status of	of pump or fan 1.	-
	Bit	Name	IV.	/alue	
	0	Ready	0	) = False, 1 = True	
	2	Running	C	) = False, 1 = True	
	5	In PFC con	trol 0	) = False, 1 = True	
	1, 3, 410	Reserved	<u> </u>		
	11	Interlocked	lo	) = False, 1 = True	
	1215		Į c	7 - 1 disc, 1 - 11dc	
	0000h	.FFFFh	Status of pump or	fan 1.	1 = 1
76.12		an status 2		11 Pump/fan status 1.	-
76.13		an status 3		11 Pump/fan status 1.	-
76.14		an status 4	-	11 Pump/fan status 1.	-
76.21		nfiguration		ump/fan control (PFC) mode.	Off
	Off		PFC disabled.		0
	PFC		The remaining pun started and stoppe The frequency (group 22 Speed re	e pump at a time is controlled by the drive. nps are direct-on-line pumps that are do by the drive logic bup 28 Frequency reference chain) / speed eference selection) reference must be the PFC functionality to work properly.	2
76.25	Number	r of motors	Total number of motor connected d	otors used in the application, including the lirectly to the drive.	1
	14		Number of motors.		1 = 1
76.26	Min nun		Minimum number o	of motors running simultaneously.	1
	04		Minimum number	of motors.	1 = 1
76.27	Max nui	mber of allowed	Maximum number	of motors running simultaneously.	1
	motors	unowcu			

No.	Name/Value	Description	Def/FbEq16
76.30	Start speed 1	Defines the start speed (Hz/rpm) for the first auxiliary motor. As the motor speed or frequency 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 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 (US: 58 Hz)
	Speed	76.55	I
	76.30	76.57 76.56 76.58	Max. speed
		→ <del>K</del>	e
	Aux. pump 1 Stop/Start Stop/Start ON	Start Increasing flow Decreasing flow	
	032767 rpm/Hz	Speed/frequency.	1 = 1 unit
76.31	Start speed 2	Defines the start speed (Hz/rpm) for the second auxiliary motor. See parameter 76.31 Start speed 1.	Vector: 1300 rpm; Scalar 48 Hz (US: 58 Hz)
76.32	Start speed 3	Defines the start speed (Hz/rpm) for the third auxiliary motor. See parameter 76.31 Start speed 1.	Vector: 1300 rpm; Scalar 48 Hz (US: 58 Hz)
76.41	Stop speed 1	Defines the stop speed (Hz/rpm) for the first auxiliary motor. When the speed 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 speed 1 - Stop speed 1] after the auxiliary motor stops	Vector: 800 rpm; Scalar 25 Hz (US: 30 Hz)
			1 = 1 unit

No.	Name/Value	Description	Def/FbEq16
76.42	Stop speed 2	Defines the stop speed (Hz/rpm) for the second auxiliary motor. See parameter 76.31 Stop speed 1.	Vector: 800 rpm; Scalar 25 Hz (US: 30 Hz)
76.43	Stop speed 3	Defines the stop speed (Hz/rpm) for the third auxiliary motor. See parameter 76.31 Stop speed 1.	Vector: 800 rpm; Scalar 25 Hz (US: 30 Hz)
76.55	Start delay	Defines a start delay for auxiliary motors. See parameter 76.31 Start speed 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 speed 1.	10.00 s
	0.0012600.00 s	Time delay.	1 = 1 s
76.57	Speed hold on	Hold time for auxiliary motor switch-on. See parameter 76.31 Start speed 1.	0.00 s
	0.001000.00 s	Time.	1 = 1 s
76.58	Speed hold off	Hold time for auxiliary motor switch-off. See parameter 76.31 Stop speed 1.	0.00 s
	0.001000.00 s	Time.	1 = 1 s
76.59	PFC contactor delay	Start delay for the motor that is directly controlled by the drive. This does not affect the starting of the auxiliary motors.  WARNING! There must always be a delay set if the 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.  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.  The parameter sets the ramp-up time as seconds from maximum to zero frequency (not from the previous reference to the new reference).	1.00 s
	0.001800.00 s	Time.	1 = 1 s

No.	Name/Value	Description	Def/FbEq16
76.70	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 level.  See also section Autochange on page 114.	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
	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 Combined timer status (see page 240)).	8
	Timed function 2	Autochange triggered by timed function 2 (bit 1 of 34.01 Combined timer status (see page 240)).	9
	Timed function 3	Autochange triggered by timed function 3 (bit 2 of 34.01 Combined timer status (see page 240)).	10
	Fixed interval	Autochange is done when the interval determined in the parameter 76.71 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 <i>136</i> ).	-
76.71	Autochange interval	Specifies the interval that is used in setting <i>Fixed interval</i> of parameter 76.70 <i>Autochange</i> .	1.00 h
	0.0042949672.95 h	Time.	1 = 1 h

No.	Name/Value	Description	Def/FbEq16
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 Autochange.	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 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
	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 Autochangee.  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 interlock 1	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 Combined timer status (see page 240).	8
	Timed function 2	Bit 1 of 34.01 Combined timer status (see page 240).	9
	Timed function 3	Bit 2 of 34.01 Combined timer status (see page 240).	10
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page <i>136</i> ).	-
76.82	PFC interlock 2	See parameter 76.82 PFC interlock 1.	Available. PFC motor is available

No.	Name/Value	Description	Def/FbEq16
76.83	PFC interlock 3	See parameter 76.82 PFC interlock 1.	Available. PFC motor is available
76.84	PFC interlock 4	See parameter 76.82 PFC interlock 1.	Available. PFC motor is available
	C maintenance onitoring	PFC (Pump and fan control) maintenance and monitoring parameters.	
77.10	Runtime change	Enables the reset, or arbitrary setting, of 77.11 Pump/fan 1 running time 77.14 Pump/fan 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/fan 1 running time 77.14 Pump/fan 4 running time to an arbitrary value.	1
	Reset PFC1 run time	Resets parameter 77.11 Pump/fan 1 running time.	2
	Reset PFC2 run time	Resets parameter 77.12 Pump/fan 2 running time.	3
	Reset PFC3 run time	Resets parameter 77.13 Pump/fan 3 running time.	4
	Reset PFC4 run time	Resets parameter 77.14 Pump/fan 4 running time.	5
77.11	Pump/fan 1 running time	Running time counter of pump/fan 1. Can be set or reset by parameter 77.10 Pump/fan 1 running time.	0.00 h
	0.0042949672.95 h	Time	1 = 1 h
77.12	Pump/fan 2 running time	See parameter 77.11 Pump/fan 1 running time.	0.00 h
77.13	Pump/fan 3 running time	See parameter 77.11 Pump/fan 1 running time.	0.00 h
77.14	Pump/fan 4 running time	See parameter 77.11 Pump/fan 1 running time.	0.00 h
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	Automatic / not selected
	A towards to t	drive. If only one voltage range is valid for the drive in question, it is selected by default.	
	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
	208240 V	208240 V	1
	380415 V	380415 V	2

No.	Name/V	alue	Descri	ption	Def/FbEq16
	44048	0 V	4404	80 V	3
	500 V		500 V		4
	52560	0 V	5256	500 V	5
	66069	0 V	6606	90 V	6
95.02	Adaptive voltage limits can be used if, for example, supply unit is used to raise the DC voltage level. If the communication between the inverter and IGBT supplicative, the voltage limits are related to the DC voltage reference from the IGBT supply unit. Otherwise the calculated based on the measured DC voltage at the the pre-charging sequence.  This function is also useful if the AC supply voltage		re voltage limits can be used if, for example, an IGBT unit is used to raise the DC voltage level. If the inication between the inverter and IGBT supply unit is the voltage limits are related to the DC voltage ce from the IGBT supply unit. Otherwise the limits are ted based on the measured DC voltage at the end of charging sequence.	Enable	
	Disable		Adaptiv	ve voltage limits disabled.	0
	Enable		Adaptiv	ve voltage limits enabled.	1
95.03	B Estimated AC supply voltage		done e	ply voltage estimated by calculation. Estimation is very time the drive is powered up and is based on the eed of voltage level of the DC bus while the drive s the DC bus.	-
	06553	5 V	Voltage	).	10 = 1 V
95.04	Control L supply	board	Specifi	es how the control board of the drive is powered.	Internal 24V
	Internal 24V			ve control board is powered from the drive power unit nected to.	0
	External	24V	The dri supply.	ve control board is powered from an external power	1
95.20	HW option	ons word 1	parame	es hardware-related options that require differentiated eter defaults.  Irameter is not affected by a parameter restore.	-
	Bit	Name		Value	
	0 Supply frequence 60 Hz		uency	If you change the value of this bit, you have to do a com the drive after the change. After reset you have to resel to be used. 0 = 50 Hz. 1 = 60 Hz.	
	115	Reserved			
	0000h	FFFFh	Hardwa	are options configuration word.	1 = 1

No.	Name/Value	Description	Def/FbEq16
96 System		Language selection; access levels; macro selection; parameter save and restore; control unit reboot; user parameter sets; unit selection.	
96.01 Language		Selects the language of the parameter interface and other displayed information when viewed on the control panel.  Notes: Not all languages listed below are necessarily supported. This parameter does not affect the languages visible in the Drive composer PC tool. (Those are specified under View – Settings – Drive default language.)	-
	Not selected	None.	0
	English	English.	1033
	Deutsch	German.	1031
	Italiano	Italian.	1040
	Español	Spanish.	3082
	Portugues	Portuguese.	2070
	Nederlands	Dutch.	1043
	Français	French.	1036
	Dansk	Danish.	1030
	Suomi	Finnish.	1035
	Svenska	Swedish.	1053
	Russki	Russian.	1049
	Polski	Polish.	1045
	Türkçe	Turkish.	1055
	Chinese (Simplified, PRC)	Simplified Chinese.	2052
96.02	Pass code	Pass codes can be entered into this parameter to activate further access levels, for example additional parameters, parameter lock, etc. See parameter <i>96.03 Access level status</i> .  Entering "358" toggles the parameter lock, which prevents the changing of all other parameters.	0
	099999999	Pass code.	-

No.	Name/V	/alue	Description	Def/FbEq16
96.03	Access	level status	Shows which access levels have been activated by pass codes entered into parameter 96.02 Pass code.	0001b
	Bit	Name		
	0	End user		
	1	Service		
	2		programmer	
	310	Reserved		
	11	OEM acces		
	12 13	OEM acces		
	14	Parameter		
	15	Reserved	iout	
		. 1000.100		
	0000b	.0111b	Active access levels.	-
96.04			Selects the control macro. See chapter <i>Control macros</i> (page 59) 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 sta	ındard	Factory macro (see page 60). For scalar motor control.	1
	Hand/A	uto	Hand/Auto macro (see page 70).	2
	Hand/P	ID	Hand/PID macro (see page 72).	3
	3-wire		3-wire macro see page 60).	11
	Alternat	e	Alternate macro see page 66).	12
	Motor potentio	meter	Motor potentiometer macro (see page 68).	13
	PID		PID macro (see page 74).	14
	Panel P	ID	Panel PID macro (see page 76).	15
	PFC		PFC macro (see page 78).	16
	ABB sta (vector)	indard	ABB standard (vector) macro (see page 62). For vector motor control.	17
96.05	Macro a	ctive	Shows which control macro is currently selected. See chapter <i>Control macros</i> (page <i>59</i> ) for more information.  To change the macro, use parameter <i>96.04 Macro select</i> .	ABB standard
	ABB sta	ındard	Factory macro (see page 60). For scalar motor control.	1
	Hand/A	uto	Hand/Auto macro (see page 70).	2
	Hand/P	ID	Hand/PID macro (see page 72).	3
	3-wire		3-wire macro see page 60).	11
	Alternate		Alternate macro see page 66).	12
	Motor potentio	meter	Motor potentiometer macro (see page 68).	13
	PID		PID macro (see page 74).	14
	Panel P	ID	Panel PID macro (see page 76).	15
	PFC		PFC macro (see page 78).	16

No.	Name/Value	Description	Def/FbEq16
	ABB standard (vector)	ABB standard (vector) macro (see page 62). For vector motor control.	17
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 implemented by it  • parameter 95.20 HW options word 1 and the differentiated defaults implemented by it.	8
	Clear all	Restores all editable parameter values to default values, except  end user texts, such as customized warnings and faults, and the drive name  control macro selection and the parameter defaults implemented by it  parameter 95.20 HW options word 1 and the differentiated defaults implemented by it.	62
	Reset all fieldbus settings	Restores all fieldbus and communication related settings to default values.  Note: Fieldbus, control panel and PC tool communication are interrupted during the restore.	32
	Reset home view	Restores the home view layout back to show the values of the default parameters defined by the control macro in use	512
	Reset end user texts	Restores all end user texts to default values, including the drive name, contact info, customized fault and warning texts, PID unit and currency unit.	1024
	Reset motor data	Restores all motor nominal values and motor ID run results to default values.	2
	All to factory defaults	Restores all drive parameters and settings back to initial factory values, except  • parameter 95.20 HW options word 1 and the differentiated defaults implemented by it.	34560
96.07	Parameter save manually	Saves the valid parameter values to the permanent memory on the drive control unit to ensure that operation can continue after cycling the power. Save the parameters with this parameter  • to store values sent from the fieldbus  • when using external +24 V DC power supply to the control unit: to save parameter changes before you power down the control unit. The supply has a very short hold-up time when powered off.  Note: A new parameter value is saved automatically when changed from the PC tool or control panel but not when altered through a fieldbus adapter connection.	Done
	Done	Save completed.	0

No.	Name/Value	Description	Def/FbEq16
	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).	0
		The value reverts to 0 automatically.	
<u> </u>	01	1 = Reboot the control unit.	1 = 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 <i>133</i> ).	-
	n/a	No user parameter sets have been saved.	0
	Loading	A user set is being loaded.	1
	Saving	A user set is being saved.	2
	Faulted	Invalid or empty parameter set.	3
	User1 IO active	User set 1 has been selected by parameters 96.12 User set I/O mode in1 and 96.13 User set I/O mode in2.	4
	User2 IO active	User set 2 has been selected by parameters 96.12 User set I/O mode in1 and 96.13 User set I/O mode in2.	5
	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
	User1 backup	User set 1 has been saved or loaded.	20
	User2 backup	User set 2 has been saved or loaded.	21
	User3 backup	User set 3 has been saved or loaded.	22
	User4 backup	User set 4 has been saved or loaded.	23
96.11	User set save/load	Enables the saving and restoring of up to four custom sets of parameter settings.  The set that was in use before powering down the drive is in use after the next power-up.  Notes:  Some hardware configuration settings, such as I/O extension module, fieldbus and encoder 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
	Save to set 1	Save user parameter set 1.	18
1	Save to set 2	Save user parameter set 2.	19

No.	Name/Value	Description	- <del></del>		Def/FbEq16
	Save to set 3	Save user parameter	r set 3.		20
	Save to set 4	Save user parameter	r set 4.		21
96.12	User set I/O mode in1	When parameter 96.11 User set save/load is set to User set I/O mode, selects the user parameter set together with parameter 96.13 User set I/O mode in2 as follows:		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.			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
	Timed function 1	Bit 0 of 34.01 Combi	ned timer status (see	e page <b>240</b> ).	18
	Timed function 2	Bit 1 of 34.01 Combi	ned timer status (see	e page <b>240</b> ).	19
	Timed function 3	Bit 2 of 34.01 Combi	ned timer status (see	e page <b>240</b> ).	20
	Supervision 1	Bit 0 of 32.01 Superv	vision status (see pag	ge <b>234</b> ).	24
	Supervision 2	Bit 1 of 32.01 Superv	vision status (see pag	ge <b>234</b> ).	25
	Supervision 3	Bit 2 of 32.01 Superv	vision status (see pag	ge <b>234</b> ).	26
	Other [bit]	Source selection (se	e Terms and abbrevi	ations on page 136).	-
96.13	User set I/O mode in2	See parameter 96.12	2 User set I/O mode	in1.	Not selected

No.	Name/\	/alue	Description	Def/FbEq16	
96.16	Unit sel	ection	Selects the unit of parameters indicating power, temperature and torque.	perature 0000b	
	Bit	Name	Information		
	0	Power unit	0 = kW		
			1 = hp		
	1	Reserved			
	2	2 Temperature	e 0 = °C		
		unit	1 = °F		
	3	3 Reserved			
	4 Torque unit 0 = Nm		$0 = Nm (N \cdot m)$		
			$1 = lbft (lb \cdot ft)$		
	515 Reserved				
		•		_	
	0000h	.FFFFh	Unit selection word.	1 = 1	
96.51	Clear fa		Clears all events from the drive's fault and event logs.	0	
	01		0 = No effect; 1 = Clears the logger.	1 = 1	

97 Motor control		Switching frequency; slip gain; voltage reserve; flux braking; anti-cogging (signal injection); IR compensation.	
97.01	Switching frequency reference	Defines the switching frequency of the drive that is used as long as the drive does not heat too much. See section Switching frequency on page 108. Higher switching frequency results in lower acoustic noise. In multimotor systems, do not change the switching frequency from the default value.	4 kHz
	4 kHz	4 kHz.	4
	8 kHz	8 kHz.	8
	12 kHz	12 kHz.	12
97.02	Minimum switching frequency	Lowest switching frequency that is allowed. Depends on the frame size.	2 kHz
	1.5 kHz	1.5 kHz.	1.5
	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%

No.	Name/Value	Description	Def/FbEq16
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 $0.95 \times 550  \text{V}$ / 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
	Full	Maximum braking power. Almost all available current is used to convert the mechanical braking energy to thermal energy in the motor.  WARNING! Using full flux braking heats up the motor especially in cyclic operation. Make sure that the motor can withstand this if you have a cyclic application.	2
97.10	Signal injection	Enables the anti-cogging function: a high-frequency alternating signal is injected to the motor in the low speed region to improve the stability of torque control. This removes the "cogging" that can sometimes be seen as the rotor passes the motor magnetic poles. Anti-cogging can be enabled with different amplitude levels.  Notes:  This is an expert level parameter and should not be adjusted without appropriate skill.  Use as low a level as possible that gives satisfactory performance.  Signal injection cannot be applied to asynchronous motors.	Disabled
	Disabled	Anti-cogging disabled.	0
	Enabled (5%)	Anti-cogging enabled with amplitude level of 5%.	1
	Enabled (10%)	Anti-cogging enabled with amplitude level of 10%.	2
	Enabled (15%)	Anti-cogging enabled with amplitude level of 15%.	3
	Enabled (20%)	Anti-cogging enabled with amplitude level of 20%.	4

No.	Name/Value	Description	Def/FbEq16
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%
97.13	IR compensation	Defines the relative output voltage boost at zero speed (IR compensation). The function is useful in applications with a high break-away torque where vector control cannot be applied.  U / U <sub>N</sub> (%)  Relative output voltage. IR compensation set to 15%.  100%  Relative output voltage. IR compensation.  Field weakening point  Field weakening point  See also section IR compensation for scalar motor control on page 103.	3.50%
	0.0050.00%	Voltage boost at zero speed in percent of nominal motor voltage.	1 = 1%
97.15	Motor model temperature adaptation	Enables the motor model temperature adaptation. Estimated motor temperature can be used to adapt temperature dependent parameters (e.g. resistances) of motor model.	Disabled
	Disabled	Temperature adaptation disabled.	0
	Estimated temperature	Temperature adaptation with motor temperature estimate (parameter 35.01 Motor estimated temperature).	1
97.16	Stator temperature factor	Tunes the motor temperature dependence of stator parameters (stator resistance).	50%
	0200%	Tuning factor.	1 = 1%
97.17	Rotor temperature factor	Tunes the motor temperature dependence of rotor parameters (eg. rotor resistance).	100%
	0200%	Tuning factor.	1 = 1%
97.20	U/F ratio	Selects the form for the <i>Ulf</i> (voltage to frequency) ratio below field weakening point. For scalar control only.	Squared
	Linear	Linear ratio for constant torque applications.	0

No.	Name/Value	Description	Def/FbEq16
	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
98 Use param	er motor veters	Motor values supplied by the user that are used in the motor model.  These parameters are useful for non-standard motors, or to just get more accurate motor control of the motor on site. A better motor model always improves the shaft performance.	
98.01	User motor model mode	Activates the motor model parameters 98.0298.12 and 98.14.  Notes: Parameter value is automatically set to zero when ID run is selected by parameter 99.13 ID run requested. The values of parameters 98.0298.12 are then updated according to the motor characteristics identified during the ID run. Measurements made directly from the motor terminals during the ID run are likely to produce slightly different values than those on a data sheet from a motor manufacturer. This parameter cannot be changed while the drive is running.	Not selected
	Not selected	Parameters 98.0298.12 inactive.	0
	Motor parameters	The values of parameters 98.02 98.12 are used as the motor model.	1
98.02	Rs user	Defines the stator resistance $R_{\rm S}$ of the motor model. With a star-connected motor, $R_{\rm S}$ is the resistance of one winding. With a delta-connected motor, $R_{\rm S}$ is one-third of the resistance of one winding.	0.00000 p.u.
	0.000000.50000 p.u.	Stator resistance in per unit.	-
98.03	Rr user	Defines the rotor resistance $R_{\rm R}$ of the motor model. <b>Note:</b> 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. <b>Note:</b> 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 $\sigma L_{S}$ . 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.

No.	Name/Value	Description	Def/FbEq16
	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 <sub>S</sub> of the motor model.	0.00000 ohm
	0.00000100.0000 0 ohm	Stator resistance.	-
98.10	Rr user SI	Defines the rotor resistance $R_{\rm R}$ of the motor model. <b>Note:</b> This parameter is valid only for asynchronous motors.	0.00000 ohm
	0.00000100.0000 0 ohm	Rotor resistance.	-
98.11	Lm user SI	Defines the main inductance $L_{\rm M}$ of the motor model. <b>Note:</b> This parameter is valid only for asynchronous motors.	0.00 mH
	0.00100000.00 mH	Main inductance.	1 = 10000 mH
98.12	SigmaL user SI	Defines the leakage inductance $\sigma L_{\rm S}$ . Note: This parameter is valid only for asynchronous motors.	0.00 mH
	0.00100000.00 mH	Leakage inductance.	1 = 10000 mH
98.13	Ld user SI	Defines the direct axis (synchronous) inductance.  Note: This parameter is valid only for permanent magnet motors.	0.00 mH
	0.00100000.00 mH	Direct axis inductance.	1 = 10000 mH
98.14	Lq user SI	Defines the quadrature axis (synchronous) inductance.  Note: This parameter is valid only for permanent magnet motors.	0.00 mH
	0.00100000.00 mH	Quadrature axis inductance.	1 = 10000 mH

99 Motor 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

No.	Name/Value	Description	Def/FbEq16
99.04	Motor control mode	Selects the motor control mode.	Scalar
	Vector	Vector control. Vector control has better accuracy than scalar control but cannot be used in all situations (see selection <i>Scalar</i> below).  Requires motor identification run (ID run). See parameter 99.13 ID run requested.  Note: In vector control the drive performs a standstill ID run at the first start if ID run has not been previously performed. A new start command is required after standstill ID run.  Note: To achieve a better motor control performance, you can perform a normal ID run without load.  See also section <i>Operating modes of the drive</i> (page 89).	0
	Scalar	Scalar control. Suitable for most applications, if top performance is not required.  Motor identification run is not required.  Note: Scalar control must be used in the following situations:  • with multimotor applications 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 control performance figures (page 102), and section Operating modes of the drive (page 89).	1
99.06	Motor nominal current	Defines the nominal motor current. Must be equal to the value on the motor rating plate. If multiple motors are connected to the drive, enter the total current of the motors.  Notes:  Correct motor operation requires that the magnetizing current of the motor does not exceed 90% of the nominal current of the drive.  This parameter cannot be changed while the drive is running.	0.0 A
	0.06400.0 A	Nominal current of the motor. The allowable range is $1/62 \times I_N$ of the drive $(02 \times I_N)$ with scalar control mode).	1 = 1 A

No.	Name/Value	Description	Def/FbEq16
99.07	Motor nominal voltage	Defines the nominal motor voltage supplied to the motor. This setting must match the value on the rating plate of the motor. Notes:  • With permanent magnet motors, the nominal voltage is the BackEMF voltage at nominal speed of the motor. If the voltage is given as voltage per rpm, e.g. 60 V per 1000 rpm, the voltage for a nominal speed of 3000 rpm is 3 × 60 V = 180 V. Note that the nominal voltage is not equal to the equivalent DC motor voltage (EDCM) specified by some motor manufacturers. The nominal voltage can be calculated by dividing the EDCM voltage by 1.7 (or square root of 3).  • The stress on the motor insulation is always dependent on the drive supply voltage. This also applies to the case where the motor voltage rating is lower than that of the drive and the supply.  • This parameter cannot be changed while the drive is running.	0.0 V
	0.0800.0	Nominal voltage of the motor.	10 = 1 V
99.08	Motor nominal frequency	Defines the nominal motor frequency. This setting must match the value on the rating plate of the motor.  Note: This parameter cannot be changed while the drive is running.	50.0 Hz
	0.0500.0 Hz	Nominal frequency of the motor.	10 = 1 Hz
99.09	Motor nominal speed	Defines the nominal motor speed. The setting must match the value on the rating plate of the motor.  Note: This parameter cannot be changed while the drive is running.	0 rpm
	030000 rpm	Nominal speed of the motor.	1 = 1 rpm
99.10	Motor nominal power	Defines the nominal motor power. The setting must match the value on the rating plate of the motor. If multiple motors are connected to the drive, enter the total power of the motors. The unit is selected by parameter 96.16 Unit selection.  Note: This parameter cannot be changed while the drive is running.	0.00 kW or hp
	-10000.00 10000.00 kW or -13404.83 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. (Not applicable to permanent magnet motors.) Not obligatory; if set, should match the value on the rating plate of the motor.  Note: This parameter cannot be changed while the drive is running.	0.00
	0.001.00	Cosphi of the motor.	100 = 1

No.	Name/Value	Description	Def/FbEq16
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.	0.000 N·m or lb·ft
		<b>Note:</b> This parameter cannot be changed while the drive is running.	
	0.0004000000.000 N·m or 0.0002950248.597	Nominal motor torque.	1 = 100 unit
	lb·ft		
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.	None
		If no ID run has been performed yet (or if default parameter values have been restored using parameter 96.06 Parameter restore), this parameter is automatically set to Standstill, signifying that an ID run must be performed.  After the ID run, the drive stops and this parameter is automatically set to None.  Notes:	
		• To ensure that the ID run can work properly, the drive limits in group 30 (maximum speed and minimum speed, and maximum torque and minimum torque) must to be large enough (the range specified by the limits must be wide enough. If eg. speed limits are less than the motor nominal speed, the ID run cannot be completed.	
		For the Advanced ID run, the machinery must always be de-coupled from the motor.	
		With a permanent magnet or synchronous reluctance motor, a <i>Normal</i> , <i>Reduced</i> or <i>Standstill</i> ID run requires that the motor shaft is NOT locked and the load torque is less than 10%.	
		With scalar control mode (99.04 Motor control mode = Scalar), only the Current measurement calibration ID run mode is possible.	
		<ul> <li>Once the ID run is activated, it can be canceled by stopping the drive.</li> <li>The ID run must be performed every time any of the motor parameters (99.04, 99.0699.12) have been changed.</li> </ul>	
		Ensure that the Safe Torque Off and emergency stop circuits (if any) are closed during the ID run.	
		Mechanical brake (if present) is not opened by the logic for the ID run.	
		This parameter cannot be changed while the drive is running.	
	None	No motor ID run is requested. This mode can be selected only if the ID run (Normal/Reduced/Standstill/Advanced/Advanced standstill) has already been performed once.	0

No.	Name/Value	Description	Def/FbEq16
	Normal	Normal ID run. Guarantees good control accuracy for all cases. The ID run takes about 90 seconds. This mode should be selected whenever it is possible.  Notes:  • If the load torque will be higher than 20% of motor nominal torque, or if the machinery is not able to withstand the nominal torque transient during the ID run, then the driven machinery must be de-coupled from the motor during a Normal ID run.  • Check the direction of rotation of the motor before starting the ID run. During the run, the motor will rotate in the forward direction.  MARNING! 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
	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.  MARNING! The motor will run at up to approximately 50100% of the nominal speed during the ID run. ENSURE THAT IT IS SAFE TO RUN THE MOTOR BEFORE PERFORMING THE ID RUN!	2
	Standstill	Standstill ID run. The motor is injected with DC current. With an AC induction (asynchronous) motor, the motor shaft is not rotated. With a permanent magnet motor, the shaft can rotate up to half a revolution.  Note: This mode should be selected only if the Normal, Reduced or Advanced ID run is not possible due to the restrictions caused by the connected mechanics (e.g. with lift or crane applications).	3
	Current measurement calibration	Current offset and gain measurement calibration is set to calibrate the control loops. The calibration will be performed at next start. Only for frames R5R9.	5

No.	Name/Value	Description	Def/FbEq16
	Advanced	Advanced ID run. Only for frames R5R9.  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
	Advanced standstill	Advanced standstill ID run.  Recommended for AC induction motors larger than 30 kW instead of the <i>Standstill</i> ID run if  • the exact nominal ratings of the motor are not known, or  • the control performance of the motor is not satisfactory after a <i>Standstill</i> ID run.  Note: The time it takes for the <i>Advanced standstill</i> ID run to complete varies according to motor size. With a small motor, it typically completes within 5 minutes; with a large motor, it may take up to an hour.	7
99.14	Last ID run performed	Shows the type of ID run that was performed last. For more information about the different modes, see the selections of parameter 99.13 ID run requested.	None
	None	No ID run has been performed.	0
	Normal	Normal ID run.	1
	Reduced	Reduced ID run.	2
	Standstill	Standstill ID run.	3
	Current measurement calibration	Current measurement calibration.	5
	Advanced	Advanced ID run.	6
	Advanced standstill	Advanced standstill ID run	7
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.  Notes:  Changing this parameter does not affect speed reference polarities, so positive speed reference will rotate the motor forward. The phase order selection just ensures that "forward" is in fact the correct direction.	UVW
	UVW	Normal.	0
	UWV	Reversed rotation direction.	1

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

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

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

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

No	Name	95.20 HW options word 1 bit Supply frequency 60 Hz = 50 Hz	95.20 HW options word 1 bit Supply frequency 60 Hz = 60 Hz
11.45	Freq in 1 at scaled max	1500.000	1800.000
15.35	Freq out 1 src max	1500.000	1800.000
12.20	Al1 scaled at Al1 max	1500.000	1800.000
13.18	AO1 source max	1500.0	1800.0
22.26	Constant speed 1	300.00 rpm	360.00 rpm
22.27	Constant speed 2	600.00 rpm	720.00 rpm
22.28	Constant speed 3	900 .00 rpm	1080.00 rpm
22.29	Constant speed 4	1200.00 rpm	1440.00 rpm
22.30	Constant speed 5	1500.00 rpm	1800.00 rpm
22.30	Constant speed 6	2400.00 rpm	2880.00 rpm
22.31	Constant speed 7	3000.00 rpm	3600.00 rpm
28.26	Constant frequency 1	5.00 Hz	6.00 Hz
28.27	Constant frequency 2	10.00 Hz	12.00 Hz
28.28	Constant frequency 3	15.00 Hz	18.00 Hz
28.29	Constant frequency 4	20.00 Hz	24.00 Hz
28.30	Constant frequency 5	25.00 Hz	30.00 Hz
28.31	Constant frequency 6	40.00 Hz	48.00 Hz
28.32	Constant frequency 7	50.00 Hz	60.00 Hz

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 = <b>60 Hz</b>
30.11	Minimum speed	-1500.00 rpm	-1800.00 rpm
30.12	Maximum speed	1500.00 rpm	1800.00 rpm
30.13	Minimum frequency	-50.00 Hz	-60.00 Hz
30.14	Maximum frequency	50.00 Hz	60.00 Hz
31.26	Stall speed limit	150.00 rpm	180.00 rpm
31.27	Stall frequency limit	15.00 Hz	18.00 Hz
31.30	Overspeed trip margin	500.00 rpm	500.00 rpm
46.01	Speed scaling	1500.00 rpm	1800.00 rpm
46.02	Frequency scaling	50.00 Hz	60.00 Hz



## Additional parameter data

#### What this chapter contains

This chapter lists the parameters with some additional data such as their ranges and 32-bit fieldbus scaling. For parameter descriptions, see chapter *Parameters* (page 135).

#### 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 135).
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	Type	Range	Unit	FbEq32
01 Actu	al values				
01.01	Motor speed used	Real	-30000.0030000.00	rpm	100 = 1 rpm
01.02	Motor speed estimated	Real	-30000.0030000.00	rpm	100 = 1 rpm
01.03	Motor speed %	Real	-1000.001000.00	%	100 = 1%
01.06	Output frequency	Real	-500.00500.00	Hz	100 = 1 Hz
01.07	Motor current	Real	0.0030000.00	Α	100 = 1 A
01.08	Motor current % of motor nom	Real	0.01000.0	%	10 = 1%
01.09	Motor current % of drive nom	Real	0.01000.0	%	10 = 1%
01.10	Motor torque	Real	-1600.01600.0	%	10 = 1%
01.11	DC voltage	Real	0.002000.00	V	100 = 1 V
01.13	Output voltage	Real	02000	V	1 = 1 V
01.14	Output power	Real	-32768.0032767.00	kW or hp	100 = 1 unit
01.15	Output power % of motor nom	Real	-300.00300.00	%	100 = 1%
01.16	Output power % of drive nom	Real	-300.00300.00	%	100 = 1%
01.17	Motor shaft power	Real	-32768.0032767.00	kW or hp	100 = 1 unit
01.18	Inverter GWh counter	Real	065535	GWh	1 = 1 GWh
01.19	Inverter MWh counter	Real	01000	MWh	1 = 1 MWh
01.20	Inverter kWh counter	Real	01000	kWh	1 = 1 kWh
01.24	Flux actual %	Real	0200	%	1 = 1%
01.30	Nominal torque scale	Real	0.0004000000	N·m or lb·ft	1000 = 1 unit
01.50	Current hour kWh	Real	0.001000000.00	kWh	100 = 1 kWh
01.51	Previous hour kWh	Real	0.001000000.00	kWh	100 = 1 kWh
01.52	Current day kWh	Real	0.001000000.00	kWh	100 = 1 kWh
01.53	Previous day kWh	Real	0.001000000.00	kWh	100 = 1 kWh
01.61	Abs motor speed used		0.0030000.00	rpm	100 = 1 rpm
01.62	Abs motor speed %		0.001000.00%	%	100 = 1%
01.63	Abs output frequency		0.00500.00 Hz	Hz	100 = 1 Hz
01.64	Abs motor torque		0.01600.0	%	10 = 1%
01.65	Abs output power		0.0032767.00	kW	100 = 1 kW
01.66	Abs output power % mot nom		0.00300.00	%	100 = 1%
01.67	Abs output power % drive nom		0.00300.00	%	100 = 1%
01.68	Abs motor shaft power		0.0030000.00	kW	100 = 1 kW
03 Input	t references		•		
03.01	Panel reference	Real	-100000.00100000.00	rpm, Hz or %	100 = 1 unit
03.02	Panel reference remote	Real	-100000.00100000.00	rpm, Hz or %	100 = 1 unit
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

No.	Name	Туре	Range	Unit	FbEq32
03.10	EFB reference 2	Real	-30000.0030000.00	-	100 = 1
04 Warr	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
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
05.04	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%
05.22	Diagnostic word 3	PB	0000hFFFFh	-	
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
06.30	MSW bit 11 selection	Binary src	-	1	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	0999	-	1 = 1
07.04	Firmware name	List	=	-	1 = 1
07.05	Firmware version	Data	-	-	1 = 1

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

## Parameter groups 10...99

No.	Name	Type	Range	Unit	FbEq32
10 Stand	dard DI, RO			•	
10.02	DI delayed status	PB	0000hFFFFh	-	1 = 1
10.03	DI force selection	PB	0000hFFFFh	-	1 = 1
10.04	DI forced data	PB	0000hFFFFh	-	1 = 1
10.21	RO status	PB	0000hFFFFh	-	1 = 1
10.22	RO force selection	PB	0000hFFFFh	-	1 = 1
10.23	RO forced data	PB	0000hFFFFh	-	1 = 1
10.24	RO1 source	Binary src	-	-	1 = 1
10.25	RO1 ON delay	Real	0.03000.0	s	10 = 1 s
10.26	RO1 OFF delay	Real	0.03000.0	s	10 = 1 s
10.27	RO2 source	Binary src	-	-	1 = 1
10.28	RO2 ON delay	Real	0.03000.0	s	10 = 1 s
10.29	RO2 OFF delay	Real	0.03000.0	s	10 = 1 s
10.30	RO3 source	Binary src	-	-	1 = 1
10.31	RO3 ON delay	Real	0.03000.0	S	10 = 1 s
10.32	RO3 OFF delay	Real	0.03000.0	s	10 = 1 s
10.99	RO/DIO control word	PB	0000hFFFFh	-	1 = 1
10.101	RO1 toggle counter	Real	04294967000	-	1 = 1
10.102	RO2 toggle counter	Real	04294967000	-	1 = 1
10.103	RO3 toggle counter	Real	04294967000	-	1 = 1
11 Stand	dard DIO, FI, FO				
11.25	DI6 configuration	List	01	-	1 = 1
11.38	Freq in 1 actual value	Real	016000	Hz	1 = 1 Hz
11.39	Freq in 1 scaled value	Real	-32768.00032767.000	-	1000 = 1
11.42	Freq in 1 min	Real	016000	Hz	1 = 1 Hz
11.43	Freq in 1 max	Real	016000	Hz	1 = 1 Hz
11.44	Freq in 1 at scaled min	Real	-32768.00032767.000	-	1000 = 1
11.45	Freq in 1 at scaled max	Real	-32768.00032767.000	-	1000 = 1
12 Stand	dard Al				
12.02	Al force selection	PB	0000hFFFFh	-	1 = 1
12.03	Al supervision function	List	04	-	1 = 1
12.04	Al supervision selection	PB	0000hFFFFh	-	1 = 1
12.11	Al1 actual value	Real	0.00020.000 mA or 0.00010.000 V	mA or V	1000 = 1 unit
12.12	Al1 scaled value	Real	-32768.00032767.000	-	1000 = 1
12.13	Al1 forced value	Real	0.00020.000 mA or 0.00010.000 V	mA or V	1000 = 1 unit
12.15	Al1 unit selection	List	2, 10	-	1 = 1

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

No.	Name	Type	Range	Unit	FbEq32
20.05	Ext1 in3 source	Binary src	-	-	1 = 1
20.06	Ext2 commands	List	06, 1112, 14	-	1 = 1
20.07	Ext2 start trigger type	List	01	-	1 = 1
20.08	Ext2 in1 source	Binary src	-	-	1 = 1
20.09	Ext2 in2 source	Binary src	-	-	1 = 1
20.10	Ext2 in3 source	Binary src	-	-	1 = 1
20.11	Run enable stop mode	List	02	-	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	02	-	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
21 Start	/stop mode				l
21.01	Vector start mode	List	02	-	1 = 1
21.02	Magnetization time	Real	010000	ms	1 = 1 ms
21.03	Stop mode	List	02	-	1 = 1
21.04	Emergency stop mode	List	03	-	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
21.16	Pre-heating current	Real	0.030.0	%	10 = 1%
21.18	Auto restart time	Real	0.0, 0.110.0	s	10 = 1 s
21.19	Scalar start mode	List	04	-	1 = 1
21.21	DC hold frequency	Real	0.001000.00	Hz	100 = 1 Hz
21.22	Start delay	Real	0.0060.00	s	100 = 1 s
21.23	Smooth start	Real	02	-	1 = 1

No.	Name	Туре	Range	Unit	FbEq32
21.24	Smooth start current	Real	10.0100.0	%	100 = 1%
21.25	Smooth start speed	Real	2.0100.0	%	100 = 1%
21.26	Torque boost current	Real	15.0300.0	%	100 = 1%
21.30	Speed compensated stop mode	Real	03	-	1 = 1
21.31	Speed compensated stop delay	Real	0.001000.00	S	100 = 1 s
21.32	Speed comp stop threshold	Real	0100	%	1 = 1%
22 Spee	d reference selection				
22.01	Speed ref unlimited	Real	-30000.0030000.00	rpm	100 = 1 rpm
22.11	Ext1 speed ref1	Analog src	1	-	1 = 1
22.12	Ext1 speed ref2	Analog src	-	-	1 = 1
22.13	Ext1 speed function	List	05	-	1 = 1
22.18	Ext2 speed ref1	Analog src	-	-	1 = 1
22.19	Ext2 speed ref2	Analog src	-	-	1 = 1
22.20	Ext2 speed function	List	05	-	1 = 1
22.21	Constant speed function	PB	00b11b	-	1 = 1
22.22	Constant speed sel1	Binary src	-	-	1 = 1
22.23	Constant speed sel2	Binary src	-	-	1 = 1
22.24	Constant speed sel3	Binary src	-	-	1 = 1
22.26	Constant speed 1	Real	-30000.0030000.00	rpm	100 = 1 rpm
22.27	Constant speed 2	Real	-30000.0030000.00	rpm	100 = 1 rpm
22.28	Constant speed 3	Real	-30000.0030000.00	rpm	100 = 1 rpm
22.29	Constant speed 4	Real	-30000.0030000.00	rpm	100 = 1 rpm
22.30	Constant speed 5	Real	-30000.0030000.00	rpm	100 = 1 rpm
22.31	Constant speed 6	Real	-30000.0030000.00	rpm	100 = 1 rpm
22.32	Constant speed 7	Real	-30000.0030000.00	rpm	100 = 1 rpm
22.41	Speed ref safe	Real	-30000.0030000.00	rpm	100 = 1 rpm
22.42	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

No.	Name	Туре	Range	Unit	FbEq32
22.71	Motor potentiometer function	List	03	-	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
23.11	Ramp set selection	Binary src	-	=	1 = 1
23.12	Acceleration time 1	Real	0.0001800.000	s	1000 = 1 s
23.13	Deceleration time 1	Real	0.0001800.000	S	1000 = 1 s
23.14	Acceleration time 2	Real	0.0001800.000	s	1000 = 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 = 1 s
23.21	Dec time jogging	Real	0.0001800.000	s	1000 = 1 s
23.23	Emergency stop time	Real	0.0001800.000	s	1000 = 1 s
23.28	Variable slope enable	List	01	-	1 = 1
23.29	Variable slope rate	Real	230000	ms	1 = 1 ms
23.32	Shape time 1	Real	0.0001800.000	s	1000 = 1 s
23.33	Shape time 2	Real	0.0001800.000	s	1000 = 1 s
24 Spee	d reference conditioning				
24.01	Used speed reference	Real	-30000.0030000.00	rpm	100 = 1 rpm
24.02	Used speed feedback	Real	-30000.0030000.00	rpm	100 = 1 rpm
24.03	Speed error filtered	Real	-30000.030000.0	rpm	100 = 1 rpm
24.04	Speed error inverted	Real	-30000.030000.0	rpm	100 = 1 rpm
24.11	Speed correction	Real	-10000.0010000.00	rpm	100 = 1 rpm
24.12	Speed error filter time	Real	010000	ms	1 = 1 ms
25 Spee	d control				
25.01	Torque reference speed control	Real	-1600.01600.0	%	10 = 1%
25.02	Speed proportional gain	Real	0.00250.00	-	100 = 1
25.03	Speed integration time	Real	0.001000.00	S	100 = 1 s
25.04	Speed derivation time	Real	0.00010.000	s	1000 = 1 s

No.	Name	Type	Range	Unit	FbEq32
25.05	Derivation filter time	Real	010000	ms	1 = 1 ms
25.06	Acc comp derivation time	Real	0.001000.00	S	100 = 1 s
25.07	Acc comp filter time	Real	0.01000.0	ms	10 = 1 ms
25.15	Proportional gain em stop	Real	1.00250.00	-	100 = 1
25.53	Torque prop reference	Real	-30000.030000.0	%	10 = 1%
25.54	Torque integral reference	Real	-30000.030000.0	%	10 = 1%
25.55	Torque deriv reference	Real	-30000.030000.0	%	10 = 1%
25.56	Torque acc compensation	Real	-30000.030000.0	%	10 = 1%
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
26.21	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%
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	05	-	1 = 1
28.15	Ext2 frequency ref1	Analog src	-	-	1 = 1

No.	Name	Type	Range	Unit	FbEq32
28.16	Ext2 frequency ref2	Analog src	-	-	1 = 1
28.17	Ext2 frequency function	List	05	-	1 = 1
28.21	Constant frequency function	PB	0000b0001b	-	1 = 1
28.22	Constant frequency sel1	Binary src	-	-	1 = 1
28.23	Constant frequency sel2	Binary src	-	-	1 = 1
28.24	Constant frequency sel3	Binary src	-	-	1 = 1
28.26	Constant frequency 1	Real	-500.00500.00	Hz	100 = 1 Hz
28.27	Constant frequency 2	Real	-500.00500.00	Hz	100 = 1 Hz
28.28	Constant frequency 3	Real	-500.00500.00	Hz	100 = 1 Hz
28.29	Constant frequency 4	Real	-500.00500.00	Hz	100 = 1 Hz
28.30	Constant frequency 5	Real	-500.00500.00	Hz	100 = 1 Hz
28.31	Constant frequency 6	Real	-500.00500.00	Hz	100 = 1 Hz
28.32	Constant frequency 7	Real	-500.00500.00	Hz	100 = 1 Hz
28.41	Frequency ref safe	Real	-500.00500.00	Hz	100 = 1 Hz
28.51	Critical frequency function	PB	00b11b	-	1 = 1
28.52	Critical frequency 1 low	Real	-500.00500.00	Hz	100 = 1 Hz
28.53	Critical frequency 1 high	Real	-500.00500.00	Hz	100 = 1 Hz
28.54	Critical frequency 2 low	Real	-500.00500.00	Hz	100 = 1 Hz
28.55	Critical frequency 2 high	Real	-500.00500.00	Hz	100 = 1 Hz
28.56	Critical frequency 3 low	Real	-500.00500.00	Hz	100 = 1 Hz
28.57	Critical frequency 3 high	Real	-500.00500.00	Hz	100 = 1 Hz
28.71	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	ts	<del> </del>		<u> </u>	
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

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

No.	Name	Type	Range	Unit	FbEq32
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	06	-	1 = 1
32.46	Supervision 5 action	List	02	-	1 = 1
32.47	Supervision 5 signal	Analog src	-	-	1 = 1
32.48	Supervision 5 filter time	Real	0.00030.000	s	1000 = 1 s
32.49	Supervision 5 low	Real	-21474836.00 21474836.00	-	100 = 1
32.50	Supervision 5 high	Real	-21474836.00 21474836.00	-	100 = 1
32.51	Supervision 5 hysteresis	Real	0.00100000.00	-	100 = 1
32.55	Supervision 6 function	List	06	-	1 = 1
32.56	Supervision 6 action	List	02	-	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	Combined timer status	PB	0000hFFFFh	-	1 = 1
34.02	Timer status	PB	0000hFFFFh	-	1 = 1
34.04	Season/exception day status	PB	0000hFFFFh	-	1 = 1
34.10	Timed functions enable	Binary src	-	-	1 = 1
34.11	Timer 1 configuration	PB	0000hFFFFh	-	1 = 1
34.12	Timer 1 start time	Time	00:00:0023:59:59	S	1 = 1 s
34.13	Timer 1 duration	Duration	00 00:0007 00:00	min	1 = 1 min
34.14	Timer 2 configuration	PB	0000hFFFFh	-	1 = 1
34.15	Timer 2 start time	Time	00:00:0023:59:59	s	1 = 1 s
34.16	Timer 2 duration	Duration	00 00:0007 00:00	min	1 = 1 min
34.17	Timer 3 configuration	PB	0000hFFFFh	-	1 = 1
34.18	Timer 3 start time	Time	00:00:0023:59:59	s	1 = 1 s
34.19	Timer 3 duration	Duration	00 00:0007 00:00	min	1 = 1 min
34.20	Timer 4 configuration	PB	0000hFFFFh	-	1 = 1

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

No.	Name	Туре	Range	Unit	FbEq32
34.81	Exception day 7	Date	01.0131.12	d	1 = 1 d
34.82	Exception day 8	Date	01.0131.12	d	1 = 1 d
34.83	Exception day 9	Date	01.0131.12	d	1 = 1 d
34.84	Exception day 10	Date	01.0131.12	d	1 = 1 d
34.85	Exception day 11	Date	01.0131.12	d	1 = 1 d
34.86	Exception day 12	Date	01.0131.12	d	1 = 1 d
34.87	Exception day 13	Date	01.0131.12	d	1 = 1 d
34.88	Exception day 14	Date	01.0131.12	d	1 = 1 d
34.89	Exception day 15	Date	01.0131.12	d	1 = 1 d
34.90	Exception day 16	Date	01.0131.12	d	1 = 1 d
34.100	Timed function 1	PB	0000hFFFFh	-	1 = 1
34.101	Timed function 2	PB	0000hFFFFh	-	1 = 1
34.102	Timed function 3	PB	0000hFFFFh	-	1 = 1
34.110	Extra time function	PB	0000hFFFFh	-	1 = 1
34.111	Extra time activation source	Binary src	-	-	1 = 1
34.112	Extra time duration	Duration	00 00:0007 00:00	min	1 = 1 min
35 Moto	r thermal protection				
35.01	Motor estimated temperature	Real	-601000 °C or -761832 °F	°C or °F	1 = 1 °
35.02	Measured temperature 1	Real	-605000 °C or -769032 °F	°C, °F or ohm	1 = 1 unit
35.03	Measured temperature 2	Real	-605000 °C or -769032 °F	°C, °F or ohm	1 = 1 unit
35.11	Temperature 1 source	List	02, 57, 1116, 19	-	1 = 1
35.12	Supervision1 fault limit	Real	-605000 °C or -769032 °F	°C, °F or ohm	1 = 1 unit
35.13	Supervision1 1 warning limit	Real	-605000 °C or -769032 °F	°C, °F or ohm	1 = 1 unit
35.14	Temperature 1 AI source	Analog src	-	-	1 = 1
35.21	Temperature 2 source	List	02, 57, 1116, 19	-	1 = 1
35.22	Supervision1 2 fault limit	Real	-605000 °C or -769032 °F	°C, °F or ohm	1 = 1 unit
35.23	Supervision1 2 warning limit	Real	-605000 °C or -769032 °F	°C, °F or ohm	1 = 1 unit
35.24	Temperature 2 AI source	Analog src	-	-	1 = 1
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	50150	%	1 = 1%
35.53	Break point	Real	1.00 500.00	Hz	100 = 1 Hz
35.54	Motor nominal temperature rise	Real	0300 °C or 32572 °F	°C or °F	1 = 1 °

No.	Name	Туре	Range	Unit	FbEq32
35.55	Motor thermal time const	Real	10010000	S	1 = 1 s
36 Load	analyzer				
36.01	PVL signal source	Analog src	-	-	1 = 1
36.02	PVL filter time	Real	0.00120.00	S	100 = 1 s
36.06	AL2 signal source	Analog src	-	-	1 = 1
36.07	AL2 signal scaling	Real	0.0032767.00	-	100 = 1
36.09	Reset loggers	List	03	-	1 = 1
36.10	PVL peak value	Real	-32768.0032767.00	-	100 = 1
36.11	PVL peak date	Data	-	-	1 = 1
36.12	PVL peak time	Data	-	-	1 = 1
36.13	PVL current at peak	Real	-32768.0032767.00	Α	100 = 1 A
36.14	PVL DC voltage at peak	Real	0.002000.00	V	100 = 1 V
36.15	PVL speed at peak	Real	-30000.00 30000.00	rpm	100 = 1 rpm
36.16	PVL reset date	Data	-	-	1 = 1
36.17	PVL reset time	Data	-	-	1 = 1
36.20	AL1 0 to 10%	Real	0.00100.00	%	100 = 1%
36.21	AL1 10 to 20%	Real	0.00100.00	%	100 = 1%
36.22	AL1 20 to 30%	Real	0.00100.00	%	100 = 1%
36.23	AL1 30 to 40%	Real	0.00100.00	%	100 = 1%
36.24	AL1 40 to 50%	Real	0.00100.00	%	100 = 1%
36.25	AL1 50 to 60%	Real	0.00100.00	%	100 = 1%
36.26	AL1 60 to 70%	Real	0.00100.00	%	100 = 1%
36.27	AL1 70 to 80%	Real	0.00100.00	%	100 = 1%
36.28	AL1 80 to 90%	Real	0.00100.00	%	100 = 1%
36.29	AL1 over 90%	Real	0.00100.00	%	100 = 1%
36.40	AL2 0 to 10%	Real	0.00100.00	%	100 = 1%
36.41	AL2 10 to 20%	Real	0.00100.00	%	100 = 1%
36.42	AL2 20 to 30%	Real	0.00100.00	%	100 = 1%
36.43	AL2 30 to 40%	Real	0.00100.00	%	100 = 1%
36.44	AL2 40 to 50%	Real	0.00100.00	%	100 = 1%
36.45	AL2 50 to 60%	Real	0.00100.00	%	100 = 1%
36.46	AL2 60 to 70%	Real	0.00100.00	%	100 = 1%
36.47	AL2 70 to 80%	Real	0.00100.00	%	100 = 1%
36.48	AL2 80 to 90%	Real	0.00100.00	%	100 = 1%
36.49	AL2 over 90%	Real	0.00100.00	%	100 = 1%
36.50	AL2 reset date	Data	=	-	1 = 1
36.51	AL2 reset time	Data	-	-	1 = 1
37 User	load curve				•
37.01	ULC output status word	PB	0000hFFFFh	-	1 = 1

No.	Name	Type	Range	Unit	FbEq32
37.02	ULC supervision signal	Analog src	-	-	1 = 1
37.03	ULC overload actions	List	03	-	1 = 1
37.04	ULC underload actions	List	03	-	1 = 1
37.11	ULC speed table point 1	Real	-30000.030000.0	rpm	10 = 1 rpm
37.12	ULC speed table point 2	Real	-30000.030000.0	rpm	10 = 1 rpm
37.13	ULC speed table point 3	Real	-30000.030000.0	rpm	10 = 1 rpm
37.14	ULC speed table point 4	Real	-30000.030000.0	rpm	10 = 1 rpm
37.15	ULC speed table point 5	Real	-30000.030000.0	rpm	10 = 1 rpm
37.16	ULC frequency table point 1	Real	-500.0500.0	Hz	10 = 1 Hz
37.17	ULC frequency table point 2	Real	-500.0500.0	Hz	10 = 1 Hz
37.18	ULC frequency table point 3	Real	-500.0500.0	Hz	10 = 1 Hz
37.19	ULC frequency table point 4	Real	-500.0500.0	Hz	10 = 1 Hz
37.20	ULC frequency table point 5	Real	-500.0500.0	Hz	10 = 1 Hz
37.21	ULC underload point 1	Real	-1600.01600.0	%	10 = 1%
37.22	ULC underload point 2	Real	-1600.01600.0	%	10 = 1%
37.23	ULC underload point 3	Real	-1600.01600.0	%	10 = 1%
37.24	ULC underload point 4	Real	-1600.01600.0	%	10 = 1%
37.25	ULC underload point 5	Real	-1600.01600.0	%	10 = 1%
37.31	ULC overload point 1	Real	-1600.01600.0	%	10 = 1%
37.32	ULC overload point 2	Real	-1600.01600.0	%	10 = 1%
37.33	ULC overload point 3	Real	-1600.01600.0	%	10 = 1%
37.34	ULC overload point 4	Real	-1600.01600.0	%	10 = 1%
37.35	ULC overload point 5	Real	-1600.01600.0	%	10 = 1%
37.41	ULC overload timer	Real	0.010000.0	s	10 = 1 s
37.42	ULC underload timer	Real	0.010000.0	s	10 = 1 s
40 Proc	ess PID set 1				
40.01	Process PID output actual	Real	-32768.0032767.00	%	100 = 1%
40.02	Process PID feedback actual	Real	-32768.0032767.00	PID customer units	100 = 1 PID customer unit
40.03	Process PID setpoint actual	Real	-32768.0032767.00	PID customer units	100 = 1 PID customer unit
40.04	Process PID deviation actual	Real	-32768.0032767.00	PID customer units	100 = 1 PID customer unit
40.06	Process PID status word	PB	0000hFFFFh	-	1 = 1
40.07	Process PID operation mode	List	02	-	1 = 1
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	011	-	1 = 1

No.	Name	Туре	Range	Unit	FbEq32
40.11	Set 1 feedback filter time	Real	0.00030.000	S	1000 = 1 s
40.16	Set 1 setpoint 1 source	Analog src	-	-	1 = 1
40.17	Set 1 setpoint 2 source	Analog src	-	-	1 = 1
40.18	Set 1 setpoint function	List	011	-	1 = 1
40.19	Set 1 internal setpoint sel1	Binary src	-	-	1 = 1
40.20	Set 1 internal setpoint sel2	Binary src	-	-	1 = 1
40.21	Set 1 internal setpoint 1	Real	-32768.0032767.00	PID customer units	100 = 1 PID customer unit
40.22	Set 1 internal setpoint 2	Real	-32768.0032767.00	PID customer units	100 = 1 PID customer unit
40.23	Set 1 internal setpoint 3	Real	-32768.0032767.00	PID customer units	100 = 1 PID customer unit
40.26	Set 1 setpoint min	Real	-32768.0032767.00	-	100 = 1
40.27	Set 1 setpoint max	Real	-32768.0032767.00	-	100 = 1
40.28	Set 1 setpoint increase time	Real	0.01800.0	S	10 = 1 s
40.29	Set 1 setpoint decrease time	Real	0.01800.0	S	10 = 1 s
40.30	Set 1 setpoint freeze enable	Binary src	-	-	1 = 1
40.31	Set 1 deviation inversion	Binary src	-	-	1 = 1
40.32	Set 1 gain	Real	0.10100.00	-	100 = 1
40.33	Set 1 integration time	Real	0.09999.0	S	10 = 1 s
40.34	Set 1 derivation time	Real	0.00010.000	S	1000 = 1 s
40.35	Set 1 derivation filter time	Real	0.010.0	S	10 = 1 s
40.36	Set 1 output min	Real	-32768.032767.0	-	10 = 1
40.37	Set 1 output max	Real	-32768.032767.0	-	10 = 1
40.38	Set 1 output freeze enable	Binary src	-	-	1 = 1
40.43	Set 1 sleep level	Real	0.032767.0	-	10 = 1
40.44	Set 1 sleep delay	Real	0.03600.0	S	10 = 1 s
40.45	Set 1 sleep boost time	Real	0.03600.0	S	10 = 1 s
40.46	Set 1 sleep boost step	Real	0.032767.0	PID customer units	10 = 1 PID customer unit
40.47	Set 1 wake-up deviation	Real	-32768.00 32767.00	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

No.	Name	Type	Range	Unit	FbEq32
40.50	Set 1 tracking ref selection	Analog src	-	-	1 = 1
40.57	PID set1/set2 selection	Binary src	-	-	1 = 1
40.58	Set 1 increase prevention	List	03	-	1 = 1
40.59	Set 1 decrease prevention	List	03	-	1 = 1
40.62	PID internal setpoint actual	Real	-32768.0032767.00	PID customer units	100 = 1 PID customer unit
40.91	Feedback data storage	Real	-327.68327.67	-	100 = 1
40.92	Setpoint data storage	Real	-327.68327.67	-	100 = 1
41 Proc	ess PID set 2				
41.08	Set 2 feedback 1 source	Analog src	-	-	1 = 1
41.09	Set 2 feedback 2 source	Analog src	-	-	1 = 1
41.10	Set 2 feedback function	List	011	-	1 = 1
41.11	Set 2 feedback filter time	Real	0.00030.000	S	1000 = 1 s
41.16	Set 2 setpoint 1 source	Analog src	-	-	1 = 1
41.17	Set 2 setpoint 2 source	Analog src	-	-	1 = 1
41.18	Set 2 setpoint function	List	011	-	1 = 1
41.19	Set 2 internal setpoint sel1	Binary src	-	-	1 = 1
41.20	Set 2 internal setpoint sel2	Binary src	-	-	1 = 1
41.21	Set 2 internal setpoint 1	Real	-32768.032767.0	PID customer unit	100 = 1 PID customer unit
41.22	Set 2 internal setpoint 2	Real	-32768.032767.0	PID customer units	100 = 1 PID customer unit
41.23	Set 2 internal setpoint 3	Real	-32768.032767.0	PID customer units	100 = 1 PID customer unit
41.26	Set 2 setpoint min	Real	-32768.032767.0	-	100 = 1
41.27	Set 2 setpoint max	Real	-32768.032767.0	-	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
41.30	Set 2 setpoint freeze enable	Binary src	-	=	1 = 1
41.31	Set 2 deviation inversion	Binary src	-	=	1 = 1
41.32	Set 2 gain	Real	0.10100.00	-	100 = 1
41.33	Set 2 integration time	Real	0.09999.0	S	10 = 1 s
41.34	Set 2 derivation time	Real	0.00010.000	S	1000 = 1 s

No.	Name	Type	Range	Unit	FbEq32
41.35	Set 2 derivation filter time	Real	0.010.0	S	10 = 1 s
41.36	Set 2 output min	Real	-32768.032767.0	-	10 = 1
41.37	Set 2 output max	Real	-32768.032767.0	-	10 = 1
41.38	Set 2 output freeze enable	Binary src	-	-	1 = 1
41.43	Set 2 sleep level	Real	0.032767.0	-	10 = 1
41.44	Set 2 sleep delay	Real	0.03600.0	s	10 = 1 s
41.45	Set 2 sleep boost time	Real	0.03600.0	s	10 = 1 s
41.46	Set 2 sleep boost step	Real	0.032767.0	PID customer units	10 = 1 PID customer unit
41.47	Set 2 wake-up deviation	Real	-2147483648 2147483647	PID customer units	100 = 1 PID customer unit
41.48	Set 2 wake-up delay	Real	0.0060.00	s	100 = 1 s
41.49	Set 2 tracking mode	Binary src	-	-	1 = 1
41.50	Set 2 tracking ref selection	Analog src	-	-	1 = 1
41.58	Set 2 increase prevention	List	03	-	1 = 1
41.59	Set 2 decrease prevention	List	03	-	1 = 1
43 Brak	e chopper				
43.01	Braking resistor temperature	Real	0.0120.0	%	10 = 1%
43.06	Brake chopper enable	List	02	-	1 = 1
43.07	Brake chopper runtime enable	Binary src	-	-	1 = 1
43.08	Brake resistor thermal tc	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	0.0214748364.7	kWh	10 = 1 kWh

No.	Name	Type	Range	Unit	FbEq32
45.05	Saved money x1000	Real	04294967295 thousands	(selecta- ble)	1 = 1 unit
45.06	Saved money	Real	0.00999.99	(selecta- ble)	100 = 1 unit
45.07	Saved amount	Real	0.0021474830.08	(selecta- ble)	100 = 1 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	0.0214748300.8	metric ton	10 = 1 metric ton
45.11	Energy optimizer	List	01	-	1 = 1
45.12	Energy tariff 1	Real	0.0004294966.296	(selecta- ble)	1000 = 1 unit
45.13	Energy tariff 2	Real	0.0004294966.296	(selecta- ble)	1000 = 1 unit
45.14	Tariff selection	Binary src	-	1	1 = 1
45.17	Tariff currency unit	List	100102	-	1 = 1
45.18	CO2 conversion factor	Real	0.00065.535	metric ton/ MWh	1000 = 1 metric ton/MWh
45.19	Comparison power	Real	0.0010000000.00	kW	10 = 1 kW
45.21	Energy calculations reset	List	01	-	1 = 1
46 Moni	toring/scaling settings	•			
46.01	Speed scaling	Real	0.0030000.00	rpm	100 = 1 rpm
46.02	Frequency scaling	Real	0.101000.00	Hz	100 = 1 Hz
46.03	Torque scaling	Real	0.11000.0	%	10 = 1%
46.04	Power scaling	Real	0.1030000.00 kW or 0.1040214.48 hp	kW or hp	10 = 1 unit
46.05	Current scaling	Real	030000	Α	1 = 1 A
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

No.	Name	Туре	Range	Unit	FbEq32
47 Data	storage				
47.01	Data storage 1 real32	Real	-2147483.000 2147483.000	-	1000 = 1
47.02	Data storage 2 real32	Real	-2147483.000 2147483.000	-	1000 = 1
47.03	Data storage 3 real32	Real	-2147483.000 2147483.000	-	1000 = 1
47.04	Data storage 4 real32	Real	-2147483.000 2147483.000	-	1000 = 1
47.11	Data storage 1 int32	Real	-2147483648 2147483647	-	1 = 1
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	port communication				
49.01	Node ID number	Real	132	-	1 = 1
49.03	Baud rate	List	15	-	1 = 1
49.04	Communication loss time	Real	0.33000.0	S	10 = 1 s
49.05	Communication loss action	List	03	-	1 = 1
49.06	Refresh settings	List	01	-	1 = 1
50 Field	bus adapter (FBA)				
50.01	FBA A enable	List	01	-	1 = 1
50.02	FBA A comm loss func	List	05	-	1 = 1
50.03	FBA A comm loss t out	Real	0.36553.5	s	10 = 1 s
50.04	FBA A ref1 type	List	05	-	1 = 1
50.05	FBA A ref2 type	List	05	-	1 = 1
50.06	FBA A SW sel	List	01	-	1 = 1
50.07	FBA A actual 1 type	List	05	-	1 = 1
50.08	FBA A actual 2 type	List	05	-	1 = 1
50.09	FBA A SW transparent source	Analog src	-	-	1 = 1
50.10	FBA A act1 transparent source	Analog src	-	-	1 = 1
50.11	FBA A act2 transparent source	Analog src	-	-	1 = 1
50.12	FBA A debug mode	List	02	-	1 = 1
50.13	FBA A control word	Data	00000000hFFFFFFFh	-	1 = 1

No.	Name	Type	Range	Unit	FbEq32
58.14	Communication loss action	List	05	-	1 = 1
58.15	Communication loss mode	List	12	-	1 = 1
58.16	Communication loss time	Real	0.06000.0	s	10 = 1 s
58.17	Transmit delay	Real	065535	ms	1 = 1 ms
58.18	EFB control word	PB	0000hFFFFh	-	1 = 1
58.19	EFB status word	PB	0000hFFFFh	-	1 = 1
58.25	Control profile	List	0, 5	-	1 = 1
58.26	EFB ref1 type	List	05	-	1 = 1
58.27	EFB ref2 type	List	05	-	1 = 1
58.28	EFB act1 type	List	05	-	1 = 1
58.29	EFB act2 type	List	05	-	1 = 1
58.31	EFB act1 transparent source	Analog src	-	-	1 = 1
58.32	EFB act2 transparent source	Analog src	-	-	1 = 1
58.33	Addressing mode	List	02	-	1 = 1
58.34	Word order	List	01	-	1 = 1
58.101	Data I/O 1	Analog src	-	-	1 = 1
58.102	Data I/O 2	Analog src	-	-	1 = 1
58.103	Data I/O 3	Analog src	-	-	1 = 1
58.104	Data I/O 4	Analog src	-	-	1 = 1
58.105	Data I/O 5	Analog src	-	-	1 = 1
58.106	Data I/O 6	Analog src	-	-	1 = 1
58.107	Data I/O 7	Analog src	-	-	1 = 1
58.114	Data I/O 14	Analog src	-	-	1 = 1
71 Exte	rnal PID1				
71.01	External PID act value	Real	-32768.0032767.00	%	100 = 1 %
71.02	Feedback act value	Real	-32768.0032767.00	PID customer units	100 = 1 PID customer unit
71.03	Setpoint act value	Real	-32768.0032767.00	PID customer units	100 = 1 PID customer unit
71.04	Deviation act value	Real	-32768.0032767.00	PID customer units	100 = 1 PID customer unit
71.06	PID status word	PB	0000hFFFFh	-	1 = 1

No.	Name	Type	Range	Unit	FbEq32	
76.14	Pump/fan status 4	PB	0000hFFFFh	-	1 = 1	
76.21	PFC configuration	List	0, 2	-	1 = 1	
76.25	Number of motors	Real	14	-	1 = 1	
76.26	Min number of motors allowed	Real	04	-	1 = 1	
76.27	Max number of motors allowed	Real	14	-	1 = 1	
76.30	Start speed 1	Real	032767	rpm/Hz	1 = 1 unit	
76.31	Start speed 2	Real	032767	rpm/Hz	1 = 1 unit	
76.32	Start speed 3	Real	032767	rpm/Hz	1 = 1 unit	
76.41	Stop speed 1	Real	032767	rpm/Hz	1 = 1 unit	
76.42	Stop speed 2	Real	032767	rpm/Hz	1 = 1 unit	
76.43	Stop speed 3	Real	032767	rpm/Hz	1 = 1 unit	
76.55	Start delay	Real	0.0012600.00	S	100 = 1 s	
76.56	Stop delay	Real	0.0012600.00	s	100 = 1 s	
76.57	Speed hold on	Real	0.001000.00	s	100 = 1 s	
76.58	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	Autochange	List	013	-	1 = 1	
76.71	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	01	-	1 = 1	
76.81	PFC interlock 1	List	010	-	1 = 1	
76.82	PFC interlock 2	List	010	-	1 = 1	
76.83	PFC interlock 3	List	010	-	1 = 1	
76.84	PFC interlock 4	List	010	-	1 = 1	
77 PFC	maintenance and monitoring					
77.10	Runtime change	List	05	-	1 = 1	
77.11	Pump/fan 1 running time	Real	0.0042949672.95	h	100 = 1 h	
77.12	Pump/fan 2 running time	Real	0.0042949672.95	h	100 = 1 h	
77.13	Pump/fan 3 running time	Real	0.0042949672.95	h	100 = 1 h	
77.14	Pump/fan 4 running time	Real	0.0042949672.95	h	100 = 1 h	
95 HW configuration						
95.01	Supply voltage	List	06	-	1 = 1	
95.02	Adaptive voltage limits	List	01	-	1 = 1	
95.03	Estimated AC supply voltage	Real	065535	V	1 = 1 V	
95.04	Control board supply	List	01	-	1 = 1	
95.20	HW options word 1	PB	0000hFFFFh	<u> </u>	1 = 1	
96 System						
96.01	Language	List	-	-	1 = 1	

No.	Name	Туре	Range	Unit	FbEq32
96.02	Pass code	Data	099999999	-	1 = 1
96.03	Access level status	PB	000b111b	-	1 = 1
96.04	Macro select	List	03, 1117	-	1 = 1
96.05	Macro active	List	13, 1117	-	1 = 1
96.06	Parameter restore	List	0, 2, 8, 32, 62, 512, 1024, 34560	-	1 = 1
96.07	Parameter save manually	List	01	-	1 = 1
96.08	Control board boot	Real	01	-	1 = 1
96.10	User set status	List	07, 2023	-	1 = 1
96.11	User set save/load	List	05, 1821	-	1 = 1
96.12	User set I/O mode in1	Binary src	-	=	-
96.13	User set I/O mode in2	Binary src	-	-	-
96.16	Unit selection	PB	000hFFFFh		1 = 1
96.51	Clear fault and event logger	Real	01	-	1 = 1
97 Moto	r control				
97.01	Switching frequency reference	List	4, 8, 12	kHz	1 = 1 kHz
97.02	Minimum switching frequency	List	1.5, 2, 4, 8, 12	kHz	1 = 1 kHz
97.03	Slip gain	Real	0200	%	1 = 1%
97.04	Voltage reserve	Real	-450	%	1 = 1%
97.05	Flux braking	List	02	-	1 = 1
97.10	Signal injection	List	04	-	1 = 1
97.11	TR tuning	Real	25400	%	1 = 1%
97.13	IR compensation	Real	0.0050.00	%	100 = 1%
97.15	Motor model temperature adaptation	List	01	-	1 = 1
97.16	Stator temperature factor	Real	0200	%	1 = 1%
97.17	Rotor temperature factor	Real	0200	%	1 = 1%
97.20	U/F ratio	List	01	1	1 = 1
98 User	motor parameters				
98.01	User motor model mode	List	01	-	1 = 1
98.02	Rs user	Real	0.00000.50000	p.u.	100000 = 1 p.u.
98.03	Rr user	Real	0.00000.50000	p.u.	100000 = 1 p.u.
98.04	Lm user	Real	0.0000010.00000	p.u.	100000 = 1 p.u.
98.05	SigmaL user	Real	0.000001.00000	p.u.	100000 = 1 p.u.
98.06	Ld user	Real	0.0000010.00000	p.u.	100000 = 1 p.u.
98.07	Lq user	Real	0.0000010.00000	p.u.	100000 = 1 p.u.

No.	Name	Type	Range	Unit	FbEq32
98.08	PM flux user	Real	0.000002.00000	p.u.	100000 = 1 p.u.
98.09	Rs user SI	Real	0.00000100.00000	ohm	100000 = 1 p.u.
98.10	Rr user SI	Real	0.00000100.00000	ohm	100000 = 1 p.u.
98.11	Lm user SI	Real	0.00100000.00	mH	100 = 1 mH
98.12	SigmaL user SI	Real	0.00100000.00	mH	100 = 1 mH
98.13	Ld user SI	Real	0.00100000.00	mΗ	100 = 1 mH
98.14	Lq user SI	Real	0.00100000.00	mΗ	100 = 1 mH
99 Moto	r data				
99.03	Motor type	List	01	-	1 = 1
99.04	Motor control mode	List	01	-	1 = 1
99.06	Motor nominal current	Real	0.06400.0	Α	10 = 1 A
99.07	Motor nominal voltage	Real	0.0800.0	V	10 = 1 V
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	-10000.0010000.00 kW or -13404.83 13404.83 hp	kW or hp	100 = 1 unit
99.11	Motor nominal cos Φ	Real	0.00 1.00	-	100 = 1
99.12	Motor nominal torque	Real	0.0004000000.000 N·m or 0.0002950248.597 lb·ft	N·m or lb·ft	1000 = 1 unit
99.13	ID run requested	List	03, 57	-	1 = 1
99.14	Last ID run performed	List	03, 57	-	1 = 1
99.15	Motor polepairs calculated	Real	01000	-	1 = 1
99.16	Motor phase order	List	01	-	1 = 1

# Fault tracing

# What this chapter contains

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

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

# Safety

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

## Indications

# Warnings and faults

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

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

Faults latch inside the drive and cause the drive to trip, and the motor stops. After the cause of a fault has been removed, the fault can be reset from a selectable source (Menu - Primary settings - Advanced functions - Reset faults manually (Reset faults manually from:); 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 (*360*).

### 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 358.

## **Auxiliary codes**

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

# Viewing warning/fault information

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

For active faults and warnings, see

- Menu Diagnostics Active faults
- Menu Diagnostics Active warnings
- Options Active faults
- Options Active warnings
- parameters in group 04 Warnings and faults (page 142).

For previously occurred faults and warnings, see

- Menu Diagnostics Fault & event log
- parameters in group 04 Warnings and faults (page 142).

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 - Primary settings - System info - QR code.

# 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), 26 Torque reference chain (torque control) or 28 Frequency reference chain (frequency control). Also check parameters 46.01 Speed scaling, 46.02 Frequency scaling and 46.03 Torque scaling. Check motor and motor cable (including phasing and delta/star connection). Check for an earth fault in motor or motor cables by measuring the insulation resistances of motor and motor cable. See chapter Electrical installation, section Checking the insulation of the assembly in the Hardware manual of the drive. Check there are no contactors opening and closing in motor cable. Check that the start-up data in parameter group 99 Motor data corresponds to the motor rating plate. Check that there are no power factor correction capacitors or surge absorbers in motor cable.
A2B3	Earth leakage	Drive has detected load unbalance typically due to earth fault in motor or motor cable.	Check there are no power factor correction capacitors or surge absorbers in motor cable. Check for an earth fault in motor or motor cables by measuring the insulation resistances of motor and motor cable. See chapter <i>Electrical installation</i> , section <i>Checking the insulation of the assembly</i> in the <i>Hardware manual</i> of the drive. If an earth fault is found, fix or change the motor cable and/or motor. If no earth fault can be detected, contact your local ABB representative.

Code (hex)	Warning / Aux. code	Cause	What to do
A2B4	Short circuit	Short-circuit in motor cable(s) or motor.	Check motor and motor cable for cabling errors. Check motor and motor cable (including phasing and delta/star connection). Check for an earth fault in motor or motor cables by measuring the insulation resistances of motor and motor cable. See chapter Electrical installation, section Checking the insulation of the assembly in the Hardware manual of the drive. Check there are no power factor correction capacitors or surge absorbers in motor cable.
A2BA	IGBT overload	Excessive IGBT junction to case temperature. This warning protects the IGBT(s) and can be activated by a short circuit in the motor cable.	Check motor cable. Check ambient conditions. Check air flow and fan operation. Check heatsink fins for dust pick-up. Check motor power against drive power.
A3A1	DC link overvoltage	Intermediate circuit DC voltage too high (when the drive is stopped).	Check the supply voltage setting (parameter 95.01 Supply voltage). Note that the wrong setting of the parameter
A3A2	DC link undervoltage	Intermediate circuit DC voltage too low (when the drive is stopped).	may cause the motor to rush uncontrollably, or may overload the brake chopper or resistor. Check the supply voltage.
АЗАА	DC not charged	The voltage of the intermediate DC circuit has not yet risen to operating level.	If the problem persists, contact your local ABB representative.
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).
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).
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 (frames R5R9) or if it exceeds 50 °C /122 °F (frames R6R9), ensure that load current does not exceed derated load capacity of drive. 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.

Code (hex)	Warning / Aux. code	Cause	What to do
A4B0	Excess temperature	Power unit module temperature is excessive.	Check ambient conditions. Check air flow and fan operation. Check heatsink fins for dust pick-up. Check motor power against drive power.
A4B1	Excess temperature difference	High temperature difference between the IGBTs of different phases.	Check the motor cabling. Check cooling of drive module(s).
A4F6	IGBT temperature	Drive IGBT temperature is excessive.	Check ambient conditions. Check air flow and fan operation. Check heatsink fins for dust pick-up. Check motor power against drive power.
A580	PU communication	Communication errors detected between the drive control unit and the power unit.	Check the connections between the drive control unit and the power unit. Check the value of parameter 95.04 Control board supply.
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 231).  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.
A5EC	PU communication internal	Communication errors detected between the drive control unit and the power unit.	Check the connections between the drive control unit and the power unit.
A5ED	Measurement circuit ADC	Measurement circuit fault.	Contact your local ABB representative.
A5EE	Measurement circuit DFF	Measurement circuit fault.	Contact your local ABB representative.
A5EF	PU state feedback	State feedback from output phases does not match control signals.	Contact your local ABB representative.
A5F0	Charging feedback	Charging feedback signal missing.	Check the feedback signal coming from the charging system.
A6A4	Motor nominal value	The motor parameters are set incorrectly.	Check the settings of the motor configuration parameters in group 99.
		The drive is not dimensioned correctly.	Check that the drive is sized correctly for the motor.
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.

Code (hex)	Warning / Aux. code	Cause	What to do
A6D1	FBA A parameter conflict	The drive does not have a functionality requested by a PLC, or requested functionality has not been activated.	Check PLC programming. Check settings of parameter groups 50 Fieldbus adapter (FBA).
A6E5	Al parametrization	The current/voltage hardware setting of an analog input does not correspond to parameter settings.	Check the event log for an auxiliary code. The code identifies the analog input whose settings are in conflict.  Adjust either the hardware setting (on the drive control unit) or parameter 12.15/12.25.  Note: Control board reboot (either by cycling the power or through parameter 96.08 Control board boot) is required to validate any changes in the hardware settings.
A780	Motor stall Programmable warning: 31.24 Stall function	Motor is operating in stall region because of e.g. excessive load or insufficient motor power.	Check motor load and drive ratings. Check fault function parameters.
A791	Brake resistor	Brake resistor broken or not connected.	Check that a brake resistor has been connected. Check the condition of the brake resistor.
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.
A794	BR data	Brake resistor data has not been given.	Check the resistor data settings (parameters 43.0843.10).
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.
A7AB	Extension I/O configuration failure	Installed CMOD module is not the same as configured.	Check that the installed module (shown by parameter 15.02 Detected extension module) is the same as selected by parameter 15.01 Extension module type.

Code (hex)	Warning / Aux. code	Cause	What to do
A7C1	FBA A communication Programmable warning: 50.02 FBA A comm loss func	Cyclical communication between drive and fieldbus adapter module A or between PLC and fieldbus adapter module A is lost.	Check status of fieldbus communication. See user documentation of fieldbus interface. Check settings of parameter groups 50 Fieldbus adapter (FBA), 51 FBA A settings, 52 FBA A data in and 53 FBA A data out. Check cable connections. Check if communication master is able to communicate.
A7CE	EFB comm loss Programmable warning: 58.14 Communication loss action	Communication break in embedded fieldbus (EFB) communication.	Check the status of the fieldbus master (online/offline/error etc.). Check cable connections to the EIA-485/X5 terminals 29, 30 and 31 on the control unit.
A7EE	Panel loss Programmable warning: 49.05 Communication loss action	Control panel or PC tool selected as active control location for drive has ceased communicating.	Check PC tool or control panel connection. Check control panel connector. Check mounting platform if being used. Disconnect and reconnect the control panel.
A8A0	Al supervision Programmable warning: 12.03 Al supervision function	An analog signal is outside the limits specified for the analog input.	Check signal level at the analog input. Check the wiring connected to the input. Check the minimum and maximum limits of the input in parameter group 12 Standard Al.
A8A1	RO life warning	The relay has changed states more than the recommended number of times.	Change the control board or stop using the relay output.
	0001	Relay output 1	Change the control board or stop using relay output 1.
	0002	Relay output 2	Change the control board or stop using relay output 2.
	0003	Relay output 3	Change the control board or stop using relay output 3.
A8A2	RO toggle warning	The relay output is changing states faster than recommended, eg. if a fast changing frequency signal is connected to it. The relay lifetime will be exceeded shortly.	Replace the signal connected to the relay output source with a less frequently changing signal.
	0001	Relay output 1	Select a different signal with parameter 10.24 RO1 source.
	0002	Relay output 2	Select a different signal with parameter 10.27 RO2 source.
	0003	Relay output 3	Select a different signal with parameter 10.30 RO3 source.
A8B0	Signal supervision (Editable message text) Programmable warning: 32.06 Supervision 1 action	Warning generated by the signal supervision function 1.	Check the source of the warning (parameter 32.07 Supervision 1 signal).

Code (hex)	Warning / Aux. code	Cause	What to do
A8B1	Signal supervision (Editable message text) Programmable warning: 32.16 Supervision 2 action	Warning generated by the signal supervision function 2.	Check the source of the warning (parameter 32.17 Supervision 2 signal).
A8B2	Signal supervision (Editable message text) Programmable warning: 32.26 Supervision 3 action	Warning generated by the signal supervision function 3.	Check the source of the warning (parameter 32.27 Supervision 3 signal).
A8B3	Signal supervision (Editable message text) Programmable warning: 32.36 Supervision 4 action	Warning generated by the signal supervision function 4.	Check the source of the warning (parameter 32.37 Supervision 4 signal).
A8B4	Signal supervision (Editable message text) Programmable warning: 32.46 Supervision 5 action	Warning generated by the signal supervision function 5.	Check the source of the warning (parameter 32.47 Supervision 5 signal).
A8B5	Signal supervision (Editable message text) Programmable warning: 32.56 Supervision 6 action	Warning generated by the signal supervision function 6.	Check the source of the warning (parameter 32.57 Supervision 6 signal).
A8C0	ULC invalid speed table	User load curve: X-axis points (speed) are not valid.	Check that points fulfill conditions. See parameter 37.11 ULC speed table point 1.
A8C1	ULC overload warning	User load curve: Signal has been too long over the overload curve.	See parameter 37.03 ULC overload actions.
A8C4	ULC underload warning	User load curve: Signal has been too long under the underload curve.	See parameter 37.04 ULC underload actions.
A8C5	ULC invalid underload table	User load curve: Underload curve points are not valid.	Check that points fulfill conditions. See parameter 37.21 ULC underload point 1.
A8C6	ULC invalid overload table	User load curve: Overload curve points are not valid.	Check that points fulfill conditions. See parameter 37.31 ULC overload point 1.
A8C8	ULC invalid frequency table	User load curve: X-axis points (frequency) are not valid.	Check that points fulfill conditions $500.0 \text{ Hz} \le 37.16 < 37.17 < 37.18 < 37.19 < 37.20 \le 500.0 \text{ Hz}. See parameter 37.16 \text{ ULC frequency table point 1}.$
A981	External warning 1 (Editable message text) Programmable warning: 31.01 External event 1 source 31.02 External event 1 type	Fault in external device 1.	Check the external device. Check setting of parameter 31.01 External event 1 source.
A982	External warning 2 (Editable message text) Programmable warning: 31.03 External event 2 source 31.04 External event 2 type	Fault in external device 2.	Check the external device. Check setting of parameter 31.03 External event 2 source.

Code (hex)	Warning / Aux. code	Cause	What to do
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 5.	Check the external device. Check setting of parameter 31.07 External event 4 source.
A985	External warning 5 (Editable message text) Programmable warning: 31.09 External event 5 source 31.10 External event 5 type	Fault in external device 5.	Check the external device. Check setting of parameter 31.09 External event 5 source.
AF88	Season configuration warning	You have configured a season which starts before the previous season.	Configure the seasons with increasing start dates, see parameters 34.60 Season 1 start date34.63 Season 4 start date.
AF8C	Process PID sleep mode	The drive is entering sleep mode.	Informative warning. See section Sleep and boost functions for process PID control (page 112), and parameters 40.4340.48.
AFAA	Autoreset	A fault is about to be autoreset.	Informative warning. See the settings in parameter group <i>31 Fault functions</i> .
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.
AFEA	Enable start signal missing (Editable message text)	No enable start signal received.	Check the setting of (and the source selected by) parameter 20.19 Enable start command.
AFE9	Start delay	The start delay is active and the drive will start the motor after a predefined delay.	Informative warning. See parameter 21.22 Start delay.
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.
AFEC	External power signal missing	95.04 Control board supply is set to External 24V but no voltage is connected to the control unit.	Check the external 24 V DC power supply to the control unit, or change the setting of parameter 95.04.

Code (hex)	Warning / Aux. code	Cause	What to do
AFED	Enable to rotate	Signal enable to rotate has not been received within a fixed time delay.	Switch enable to rotate signal on (eg. 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.
B5A0	STO event Programmable event: 31.22 STO indication run/stop	Safe torque off function is active, ie. safety circuit signal(s) connected to connector STO is lost.	Check safety circuit connections. For more information, see chapter <i>The Safe torque off function</i> in the <i>Hardware manual</i> of the drive and description of parameter 31.22 STO indication run/stop (page 231).

# Fault messages

Code (hex)	Fault / Aux. code	Cause	What to do
1080	Backup/Restore timeout	Panel or PC tool has failed to communicate with the drive when backup was being made or restored.	Request backup or restore again.
1081	Rating ID fault	Drive software has not been able to read the rating ID of the drive.	Reset the fault to make the drive try to reread the rating ID.  If the fault reappears, cycle the power to the drive. You may have to be repeat this. If the fault persists, contact your local ABB representative.
2281	Calibration	Measured offset of output phase current measurement or difference between output phase U2 and W2 current measurement is too great (the values are updated during current calibration).	Try performing the current calibration again (select <i>Current measurement calibration</i> at parameter 99.13). If the fault persists, contact your local ABB representative.
2310	Overcurrent	Output current has exceeded internal fault limit. In addition to an actual overcurrent situation, this fault may also be caused by an earth fault or supply phase loss.	Check motor load. Check acceleration times in parameter group 23 Speed reference ramp (speed control), 26 Torque reference chain (torque control) or 28 Frequency reference chain (frequency control). Also check parameters 46.01 Speed scaling, 46.02 Frequency scaling and 46.03 Torque scaling. Check motor and motor cable (including phasing and delta/star connection). Check there are no contactors opening and closing in motor cable. Check that the start-up data in parameter group 99 corresponds to the motor rating plate. Check that there are no power factor correction capacitors or surge absorbers in motor cable. Check for an earth fault in motor or motor cables by measuring the insulation resistances of motor and motor cable. See chapter Electrical installation, section Checking the insulation of the assembly in the Hardware manual of the drive.
2330	Earth leakage Programmable fault: 31.20 Earth fault	Drive has detected load unbalance typically due to earth fault in motor or motor cable.	Check there are no power factor correction capacitors or surge absorbers in motor cable.  Check for an earth fault in motor or motor cables by measuring the insulation resistances of motor and motor cable. Try running the motor in scalar control mode if allowed. (See parameter 99.04 Motor control mode.)  If no earth fault can be detected, contact your local ABB representative.

Code (hex)	Fault / Aux. code	Cause	What to do
2340	Short circuit	Short-circuit in motor cable(s) or motor	Check motor and motor cable for cabling errors. Check there are no power factor correction capacitors or surge absorbers in motor cable. Cycle the power to the drive.
2381	IGBT overload	Excessive IGBT junction to case temperature. This fault protects the IGBT(s) and can be activated by a short circuit in the motor cable.	Check motor cable. Check ambient conditions. Check air flow and fan operation. Check heatsink fins for dust pick-up. Check motor power against drive power.
3130	Input phase loss Programmable fault: 31.21 Supply phase loss	Intermediate circuit DC voltage is oscillating due to missing input power line phase or blown fuse.	Check input power line fuses. Check for loose power cable connections. Check for input power supply imbalance.
3181	Wiring or earth fault Programmable fault: 31.23 Wiring or earth fault	Incorrect input power and motor cable connection (ie. input power cable is connected to drive motor connection).	Check input power connections.
3210	DC link overvoltage	Excessive intermediate circuit DC voltage.	Check that overvoltage control is on (parameter 30.30 Overvoltage control). Check that the supply voltage matches the nominal input voltage of the drive. Check the supply line for static or transient overvoltage. Check 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 board temperature is too high.	Check proper cooling of the drive. Check the auxiliary cooling fan.
4210	IGBT overtemperature	Estimated drive IGBT temperature is excessive.	Check ambient conditions. Check air flow and fan operation. Check heatsink fins for dust pick-up. Check motor power against drive power.

Code (hex)	Fault / Aux. code	Cause	What to do
4290	Cooling	Drive module temperature is excessive.	Check ambient temperature. If it exceeds 40 °C/104 °F (frames R5R9) or if it exceeds 50 °C /122 °F (frames R0R9), ensure that load current does not exceed derated load capacity of drive. See chapter <i>Technical data</i> , section <i>Derating</i> in the <i>Hardware manual</i> of the drive. Check drive module cooling air flow and fan operation. Check inside of cabinet and heatsink of drive module for dust pick-up. Clean whenever necessary.
42F1	IGBT temperature	Drive IGBT temperature is excessive.	Check ambient conditions. Check air flow and fan operation. Check heatsink fins for dust pick-up. Check motor power against drive power.
4310	Excess temperature	Power unit module temperature is excessive.	Check ambient conditions. Check air flow and fan operation. Check heatsink fins for dust pick-up. Check motor power against drive power.
4380	Excess temperature difference	High temperature difference between the IGBTs of different phases.	Check the motor cabling. Check cooling of drive module(s).
4981	External temperature 1 (Editable message text)	Measured temperature 1 has exceeded fault limit.	Check the value of parameter 35.02  Measured temperature 1.  Check the cooling of the motor (or other equipment whose temperature is being measured).
4982	External temperature 2 (Editable message text)	Measured temperature 2 has exceeded fault limit.	Check the value of parameter 35.03  Measured temperature 2.  Check the cooling of the motor (or other equipment whose temperature is being measured).
5081	Auxiliary fan broken	An auxiliary cooling fan (connected to the fan connectors on the control unit) is stuck or disconnected.	Check auxiliary fan(s) and connection(s). Replace fan if faulty. Make sure the front cover of the drive module is in place and tightened. Reboot the control unit (using parameter 96.08 Control board boot) or by cycling power.
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 231).  Check the value of parameter 95.04 Control board supply.
5092	PU logic error	Power unit memory has cleared.	Contact your local ABB representative.

Code (hex)	Fault / Aux. code	Cause	What to do
5093	Rating ID mismatch	The hardware of the drive does not match the information stored in the memory. This may occur eg. after a firmware update.	Cycle the power to the drive. You may have to be repeat this.
5094	Measurement circuit temperature	Problem with internal temperature measurement of the drive.	Contact your local ABB representative.
50A0	Fan	Cooling fan stuck or disconnected.	Check fan operation and connection. Replace fan if faulty.
5681	PU communication	Communication errors detected between the drive control unit and the power unit.	Check the connection between the drive control unit and the power unit. Check the value of parameter 95.04 Control board supply.
5682	Power unit lost	Connection between the drive control unit and the power unit is lost.	Check the connection between the control unit and the power unit.
5690	PU communication internal	Internal communication error.	Contact your local ABB representative.
5691	Measurement circuit ADC	Measurement circuit fault.	Contact your local ABB representative.
5692	PU board powerfail	Power unit power supply failure.	Contact your local ABB representative.
5693	Measurement circuit DFF	Measurement circuit fault.	Contact your local ABB representative.
5696	PU state feedback	State feedback from output phases does not match control signals.	Contact your local ABB representative.
5697	Charging feedback	Charging feedback signal missing.	Check the feedback signal coming from the charging system
6181	FPGA version incompatible	Firmware and FPGA versions are incompatible.	Reboot the control unit (using parameter 96.08 Control board boot) or by cycling power. If the problem persists, contact your local ABB representative
6306	FBA A mapping file	Fieldbus adapter A mapping file read error.	Contact your local ABB representative.
6481	Task overload	Internal fault.	Reboot the control unit (using parameter 96.08 Control board boot) or by cycling power. If the problem persists, contact your local ABB representative
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

Code (hex)	Fault / Aux. code	Cause	What to do
64B2	User set fault	Loading of user parameter set failed because requested set does not exist set is not compatible with control program drive was switched off during loading.	Ensure that a valid user parameter set exists. Reload if uncertain.
64E1	Kernel overload	Operating system error.	Reboot the control unit (using parameter 96.08 Control board boot) or by cycling power. If the problem persists, contact your local ABB representative
6581	Parameter system	Parameter load or save failed.	Try forcing a save using parameter 96.07  Parameter save manually. Retry.
65A1	FBA A parameter conflict	The drive does not have a functionality requested by PLC, or requested functionality has not been activated.	Check PLC programming. Check settings of parameter groups 50 Fieldbus adapter (FBA) and 51 FBA A settings.
6681	EFB comm loss Programmable fault: 58.14 Communication loss action	Communication break in embedded fieldbus (EFB) communication.	Check the status of the fieldbus master (online/offline/error etc.). Check cable connections to the EIA-485/X5 terminals 29, 30 and 31 on the control unit.
6682	EFB config file	Embedded fieldbus (EFB) configuration file could not be read.	Contact your local ABB representative.
6683	EFB invalid parameterization	Embedded fieldbus (EFB) parameter settings inconsistent or not compatible with selected protocol.	Check the settings in parameter group 58 Embedded fieldbus.
6684	EFB load fault	Embedded fieldbus (EFB) protocol firmware could not be loaded.	Contact your local ABB representative.
		Version mismatch between EFB protocol firmware and drive firmware.	
6685	EFB fault 2	Fault reserved for the EFB protocol application.	Check the documentation of the protocol.
6686	EFB fault 3	Fault reserved for the EFB protocol application.	Check the documentation of the protocol.
6882	Text 32-bit table overflow	Internal fault.	Reset the fault. Contact your local ABB representative if the fault persists.
6885	Text file overflow	Internal fault.	Reset the fault. Contact your local ABB representative if the fault persists.
7081	Control panel loss Programmable fault: 49.05 Communication loss action	Control panel or PC tool selected as active control location for drive has ceased communicating.	Check PC tool or control panel connection. Check control panel connector. Disconnect and reconnect the control panel.
7121	Motor stall Programmable fault: 31.24 Stall function	Motor is operating in stall region because of e.g. excessive load or insufficient motor power.	Check motor load and drive ratings. Check fault function parameters.

Code (hex)	Fault / Aux. code	Cause	What to do
7181	Brake resistor	Brake resistor broken or not connected.	Check that a brake resistor has been connected. Check the condition of the brake resistor. Check the dimensioning of the brake resistor.
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.
7184	Brake resistor wiring	Brake resistor short circuit or brake chopper control fault.	Check brake chopper and brake resistor connection. Ensure brake resistor is not damaged.
7191	BC short circuit	Short circuit in brake chopper IGBT.	Ensure brake resistor is connected and not damaged. Check the electrical specifications of the brake resistor against chapter <i>Resistor braking</i> in the <i>Hardware manual</i> of the drive. Replace brake chopper (if replaceable).
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 applicability of torque control. Check need for brake chopper and resistor(s).
73B0	Emergency ramp failed	Emergency stop did not finish within expected time.	Check the settings of parameters 31.32 Emergency ramp supervision and 31.33 Emergency ramp supervision delay. Check the predefined ramp times (23.1123.15 for mode Off1, 23.23 for mode Off3).

Code (hex)	Fault / Aux. code	Cause	What to do
7510	FBA A communication Programmable fault: 50.02 FBA A comm loss func	Cyclical communication between drive and fieldbus adapter module A or between PLC and fieldbus adapter module A is lost.	Check status of fieldbus communication. See user documentation of fieldbus interface. Check settings of parameter groups 50 Fieldbus adapter (FBA), 51 FBA A settings, 52 FBA A data in and 53 FBA A data out. Check cable connections. Check if communication master is able to communicate.
8001	ULC underload fault	User load curve: Signal has been too long under the underload curve.	See parameter 37.04 ULC underload actions.
8002	ULC overload fault	User load curve: Signal has been too long over the overload curve.	See parameter 37.03 ULC overload actions.
80A0	Al supervision Programmable fault: 12.03 Al supervision function	An analog signal is outside the limits specified for the analog input.	Check signal level at the analog input. Check the wiring connected to the input. Check the minimum and maximum limits of the input in parameter group 12 Standard AI.
80B0	Signal supervision (Editable message text) Programmable fault: 32.06 Supervision 1 action	Fault generated by the signal supervision function 1.	Check the source of the fault (parameter 32.07 Supervision 1 signal).
80B1	Signal supervision (Editable message text) Programmable fault: 32.16 Supervision 2 action	Fault generated by the signal supervision function 2.	Check the source of the fault (parameter 32.17 Supervision 2 signal).
80B2	Signal supervision (Editable message text) Programmable fault: 32.26 Supervision 3 action	Fault generated by the signal supervision function 4.	Check the source of the fault (parameter 32.27 Supervision 3 signal).
80B3	Signal supervision (Editable message text) Programmable fault: 32.36 Supervision 4 action	Fault generated by the signal supervision function 4.	Check the source of the fault (parameter 32.37 Supervision 4 signal).
80B4	Signal supervision (Editable message text) Programmable fault: 32.46 Supervision 5 action	Fault generated by the signal supervision function 5.	Check the source of the fault (parameter 32.47 Supervision 5 signal).
80B5	Signal supervision (Editable message text) Programmable fault: 32.56 Supervision 6 action	Fault generated by the signal supervision function66.	Check the source of the fault (parameter 32.57 Supervision 6 signal).
9081	External fault 1 (Editable message text) Programmable fault: 31.01 External event 1 source 31.02 External event 1 type	Fault in external device 1.	Check the external device. Check setting of parameter 31.01 External event 1 source.
9082	External fault 2 (Editable message text) Programmable fault: 31.03 External event 2 source 31.04 External event 2 type	Fault in external device 2.	Check the external device. Check setting of parameter 31.03 External event 2 source.

Code (hex)	Fault / Aux. code	Cause	What to do
9083	External fault 3 (Editable message text) Programmable fault: 31.05 External event 3 source 31.06 External event 3 type	Fault in external device 3.	Check the external device. Check setting of parameter 31.05 External event 3 source.
9084	External fault 4 (Editable message text) Programmable fault: 31.07 External event 4 source 31.08 External event 4 type	Fault in external device 5.	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 231). 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.
FF81	FB A force trip	A fault trip command has been received through fieldbus adapter A.	Check the fault information provided by the PLC.
FF8E	EFB force trip	A fault trip command has been received through the embedded fieldbus interface.	Check the fault information provided by the PLC.



# Fieldbus control through the embedded fieldbus interface (EFB)

# What this chapter contains

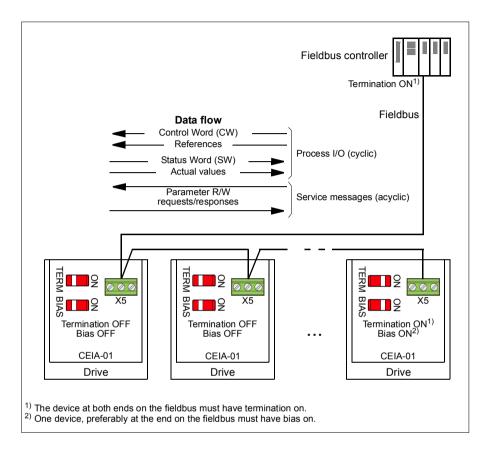
The chapter describes how the drive can be controlled by external devices over a communication network (fieldbus) using the embedded fieldbus interface.

# System overview

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

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

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



# Connecting the fieldbus to the drive

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

To be added

# Setting up the embedded fieldbus interface

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	COMMUNICATION INITIALIZATION					
58.01	Protocol enable	Modbus RTU	Initializes embedded fieldbus communication.			
EMBED	DDED MODBUS CO	ONFIGURATION				
58.03	Node address	1 (default)	Node address. There must be no two nodes with the same node address online.			
58.04	Baud rate	19.2 kbps (default)	Defines the communication speed of the link. Use the same setting as in the master station.			
58.05	Parity	8 EVEN 1 (default)	Selects the parity and stop bit setting. Use the same setting as in the master station.			
58.14	Communication loss action	Fault (default)	Defines the action taken when a communication loss is detected.			
58.15	Communication loss mode	Cw / Ref1 / Ref2 (default)	Enables/disables communication loss monitoring and defines the means for resetting the counter of the communication loss delay.			
58.16	Communication loss time	3.0 s (default)	Defines the timeout limit for the communication monitoring.			
58.17	Transmit delay	0 ms (default)	Defines a response delay for the drive.			
58.25	Control profile	ABB Drives (default)	Selects the control profile used by the drive. See section <i>Basics of the embedded fieldbus interface</i> (page 382).			
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, Torque, 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 commands	Embedded fieldbus	Selects fieldbus as the source for the start and stop commands when EXT1 is selected as the active control location.	

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

### OTHER SELECTIONS

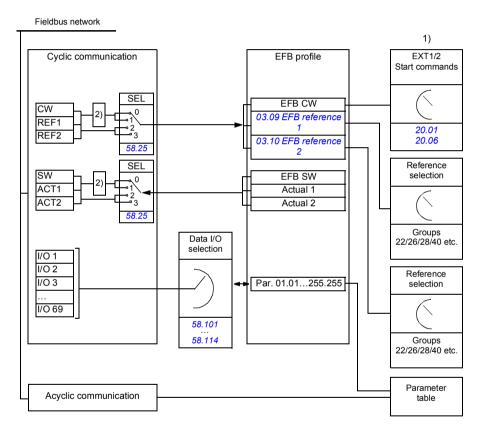
EFB references can be selected as the source at virtually any signal selector parameter by selecting *Other*, then either 03.09 EFB reference 1 or 03.10 EFB reference 2.

SYSTEM CONTROL INPUTS				
96.07 Parameter save manually	Save (reverts to Done)	Saves parameter value changes (including those made through fieldbus control) to permanent memory.		

## Basics of the embedded fieldbus interface

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

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



- 1. See also other parameters which can be controlled through fieldbus.
- 2. Data conversion if parameter 58.25 Control profile is set to ABB Drives. See section About the control profiles (page 385).

#### 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 385).

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 385).

#### 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 385).

#### 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 385).

## 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.

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

# About the control profiles

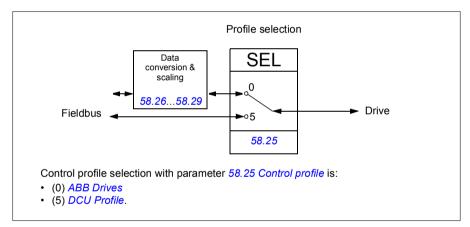
A control profile defines the rules for data transfer between the drive and the fieldbus master, for example:

- 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 393.

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

Bit	Name	Value	STATE/Description
8	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	10 REMOTE_ CMD	1	Fieldbus control enabled.
		0	Control Word <> 0 or Reference <> 0: Retain last Control Word and Reference.
			Control Word = 0 and Reference = 0: Fieldbus control enabled. 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. See in the table below how this bit and sign of the reference effect the direction of the motor direction.		
			Sign of the reference		
				Positive (+)	Negative (-)
			Bit REVERSE = 0 Bit REVERSE = 1	Forward Reverse	Reverse Forward
			Bit REVERSE - 1	Reverse	Folwald
		0	(no op)		
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 AST	1	Coast stop mode.		
		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.		
		0	Select ramp set 1 (Acceleration time 1 / Deceleration time 1) when parameter 23.11 Ramp set selection is set to EFB.		
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.		

Bit	Name	Value	State/Description	
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.	
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 for application-specific functionality.	
23	USER_1			
24	USER_2		]	
25	USER_3		1	
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 393.

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.	
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	<b>OPERATING.</b> 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		7	
14	USER_3			
15	Reserved	•		

# Status Word for the DCU Profile

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

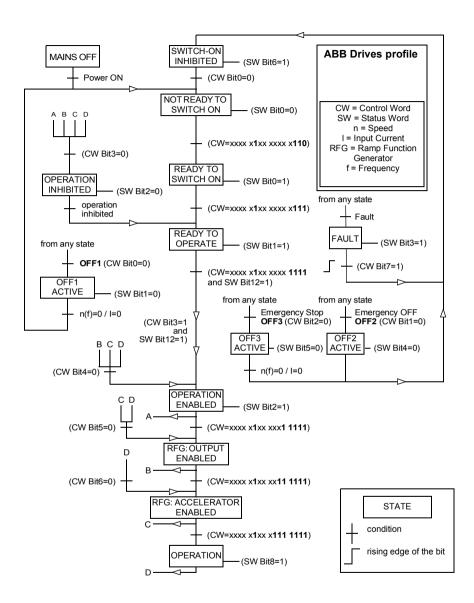
Bit	Name	Value	State/Description	
0	READY	1	Drive is ready to receive the start command.	
		0	Drive is not ready.	
1	ENABLED	1	External run enable signal is active.	
		0	External run enable signal is not active.	
2	Reserved for ENABLED_TO_R OTATE		Not yet implemented.	
3	RUNNING	1	Drive is modulating.	
		0	Drive is not modulating.	
4	ZERO_SPEED	1	Drive is at zero speed.	
		0	Drive is not at zero speed.	
5	ACCELERATING	1	Drive speed is increasing.	
		0	Drive speed is not increasing.	
6	DECELERATING	1	Drive speed is decreasing.	
		0	Drive speed is not decreasing.	
7	AT_SETPOINT	1	Drive is at setpoint.	
		0	Drive is not at setpoint.	
8	LIMIT	1	Drive operation is limited.	
		0	Drive operation is not limited.	
9	SUPERVISION	1	Actual value (speed, frequency or torque) is above a limit. Limit is set with parameters 46.3146.33	
		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 AL	1	Fieldbus is in local control mode.	
		0	Fieldbus is not in local control mode.	
14	EXT2_ACT	1	External control location EXT2 is active.	
		0	External control location EXT1 is active.	
15	FAULT	1	Drive is faulted.	
		0	Drive is not faulted.	

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

### State transition diagrams

### State transition diagram for the ABB Drives profile

The diagram below shows the state transitions in the drive when the drive is using the ABB Drives profile and the drive is configured to follow the commands of the control word from the embedded fieldbus interface. The upper case texts refer to the states which are used in the tables representing the fieldbus Control and Status words. See sections Control Word for the ABB Drives profile on page 386 and Status Word for the ABB Drives profile on page 390.

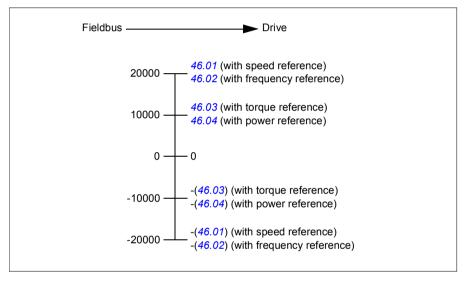


#### References

#### 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 294).



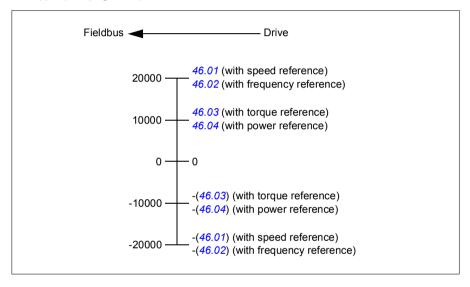
The scaled references are shown by parameters 03.09 EFB reference 1 and 03.10 EFB reference 2.

#### **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 295).



### 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 386) and Control Word for the DCU Profile (page 387).	
	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 ABB Drives profile (page 390) and Status Word for the DCL (page 391).		
	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 7 58.114 Data I/O 14.	
400015400089	Unused	
400090400100	Error code access. See section <i>Error code registers (holding registers 400090400100)</i> (page 404).	
400101465536	Parameter read/write. Parameters are mapped to register addresses according to parameters. 38.33 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
		OAh Clear Counters and Diagnostic Register
		OBh Return Bus Message Count     Obb Return Bus Counts
		OCh Return Bus Comm. Error Count     ORL Between Bus Franchise Franchises
		ODh Return Bus Exception Error Count     OFh Return Clave Magazine Count
		OEh Return Slave Message Count     OEh Return Slave No Research 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	OEh 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, "ASCCL")
		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: ("ACS580").

### **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 <i>404</i> .

### 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	ENABLED
100003	RDY_REF	Reserved
100004	TRIPPED	RUNNING
100005	OFF_2_STATUS	ZERO_SPEED
100006	OFF_3_STATUS	Reserved
100007	SWC_ON_INHIB	Reserved
100008	ALARM	AT_SETPOINT
100009	AT_SETPOINT	LIMIT
100010	REMOTE	SUPERVISION
100011	ABOVE_LIMIT	Reserved
100012	USER_0	Reserved
100013	USER_1	PANEL_LOCAL
100014	USER_2	FIELDBUS_LOCAL
100015	USER_3	EXT2_ACT
100016	Reserved	FAULT
100017	Reserved	ALARM
100018	Reserved	Reserved
100019	Reserved	Reserved
100020	Reserved	Reserved
100021	Reserved	Reserved
100022	Reserved	Reserved
100023	Reserved	USER_0
100024	Reserved	USER_1
100025	Reserved	USER_2
100026	Reserved	USER_3
100027	Reserved	REQ_CTL
100028	Reserved	Reserved
100029	Reserved	Reserved
100030	Reserved	Reserved
100031	Reserved	Reserved
100032	Reserved	Reserved

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

### Error code registers (holding registers 400090...400100)

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

Reference	Name	Description
400090	Reset Error Registers	1 = Reset internal error registers (9195). 0 = Do nothing.
400091	Error Function Code	Function code of the failed query.
400092	Error Code	Set when exception code 04h is generated (see table above).  • 00h No error  • 02h Low/High limit exceeded  • 03h Faulty Index: Unavailable index of an array parameter  • 05h Incorrect Data Type: Value does not match the data type of the parameter  • 65h General Error: Undefined error when handling query
400093	Failed Register	The last register (discrete input, coil, input register or holding register) that failed to be read or written.
400094	Last Register Written Successfully	The last register (discrete input, coil, input register or holding register) that was written successfully.
400095	Last Register Read Successfully	The last register (discrete input, coil, input register or holding register) that was read successfully.



# Fieldbus control through a fieldbus adapter

#### What this chapter contains

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

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

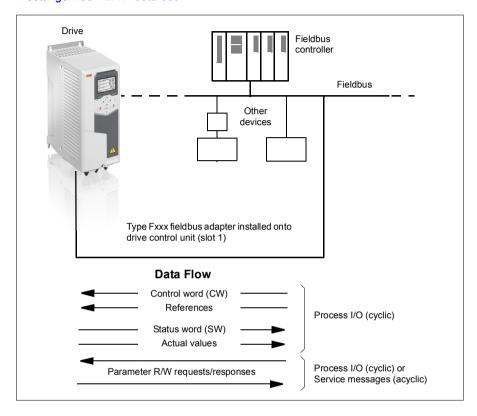
### System overview

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

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

- PROFIBUS DP (FPBA-01 adapter)
- CANopen (FCAN-01 adapter)
- DeviceNet<sup>TM</sup> (FDNA-01 adapter)
- EtherNet/IP<sup>TM</sup> (FENA-11 adapter)

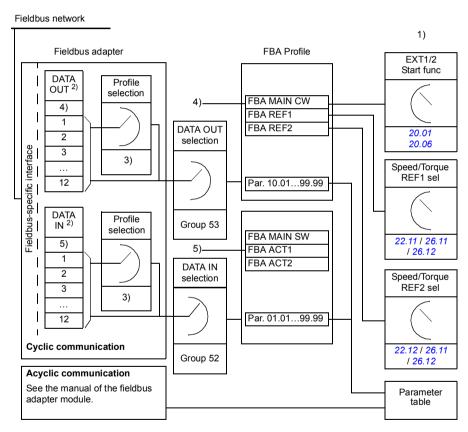
**Note:** The text and examples in this chapter describe the configuration of one fieldbus adapter (FBA A) by parameters 50.01...50.18 and parameter groups 51 FBA A settings...53 FBA A data out.



#### Basics of the fieldbus control interface

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

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



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

#### Control word and Status word

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

The contents of the Control word and the Status word are detailed on pages 411 and 413 respectively. The drive states are presented in the state diagram (page 414).

#### Debugging the network words

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

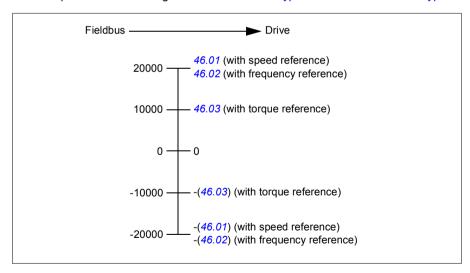
ABB drives can receive control information from multiple sources including analog and digital inputs, the drive control panel and a fieldbus adapter module. In order to have the drive controlled through the fieldbus, the module must be defined as the source for control information such as reference. 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 or Normal, the references received from the fieldbus are displayed by 50.14 FBA A reference 1 and 50.15 FBA A reference 2.

#### Scaling of references

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



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

#### Actual values

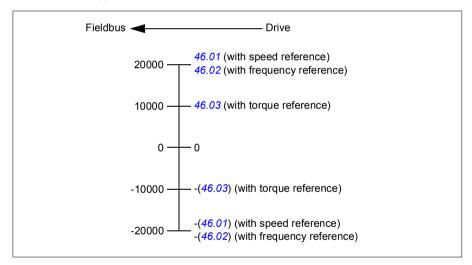
Actual values are 16-bit words containing information on the operation of the drive. The types of the monitored signals are selected by parameters 50.07 FBA A actual 1 type and 50.08 FBA A actual 2 type.

#### Debugging the network words

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

#### Scaling of actual values

The actual values are scaled as defined by parameters 46.01...46.04; which scaling is in use depends on the setting of parameters 50.07 FBA A actual 1 type and 50.08 FBA A actual 2 type.



### **Contents of the fieldbus Control word**

The upper case boldface text refers to the states shown in the state diagram (page 414).

Bit	Name	Value	STATE/Description
0	Off1 control	1	Proceed to READY TO OPERATE.
		0	Stop along currently active deceleration ramp. Proceed to <b>OFF1 ACTIVE</b> ; proceed to <b>READY TO SWITCH ON</b> unless other interlocks (OFF2, OFF3) are active.
1	Off2 control	1	Continue operation (OFF2 inactive).
		0	Emergency OFF, coast to a stop. Proceed to <b>OFF2 ACTIVE</b> , proceed to <b>SWITCH-ON INHIBITED</b> .
2	Off3 control	1	Continue operation (OFF3 inactive).
		0	Emergency stop, stop within time defined by drive parameter. Proceed to OFF3 ACTIVE; proceed to SWITCH-ON INHIBITED.  WARNING: Ensure motor and driven machine can be stopped using this stop mode.
3	Run	1	Proceed to <b>OPERATION ENABLED</b> . <b>Note:</b> Run enable signal must be active; see drive documentation. If the drive is set to receive the Run enable signal from the fieldbus, this bit activates the signal.
		0	Inhibit operation. Proceed to OPERATION INHIBITED.
4	Ramp out zero	1	Normal operation. Proceed to RAMP FUNCTION GENERATOR: OUTPUT 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	Enable 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 <b>OPERATING</b> . <b>Note:</b> 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	0	Accelerate to inching (jogging) setpoint 1.  Notes:  Bits 46 must be 0.  See also section <i>Rush control</i> (page 98).  Inching (jogging) 1 disabled.
9	Inching 2	1	Accelerate to inching (jogging) setpoint 2. See notes at bit 8.
10	D	0	Inching (jogging) 2 disabled.
10	Remote cmd	0	Fieldbus control enabled.  Control word and reference not getting through to the drive, except for bits 02.
11	Ext ctrl loc	1	Select External Control Location EXT2. Effective if control location is parameterized to be selected from fieldbus.
		0	Select External Control Location EXT1. Effective if control location is parameterized to be selected from fieldbus.
12	User bit 0	1	TBA
L		0	TBA
13	User bit 1	1	TBA
		0	TBA

### 412 Fieldbus control through a fieldbus adapter

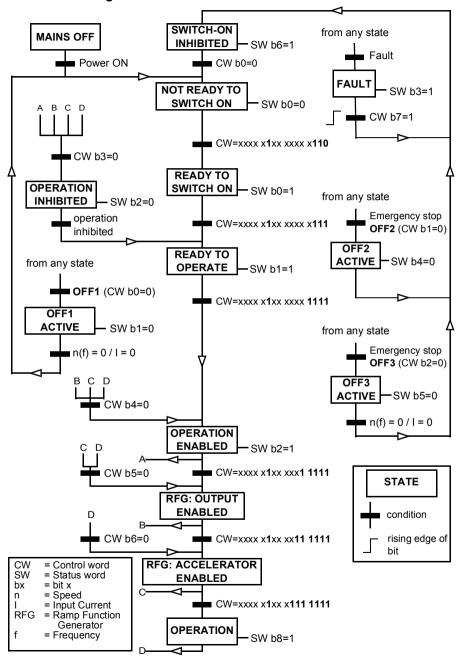
Bit	Name	Value	STATE/Description
14	User bit 2	1	TBA
		0	TBA
15	User bit 3	1	TBA
		0	TBA

### Contents of the fieldbus Status word

The upper case boldface text refers to the states shown in the state diagram (page 414).

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.
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	<b>OPERATING.</b> Actual value equals reference = is within tolerance limits (see parameters 46.2146.23).
		0	Actual value differs from reference = is outside tolerance limits.
9	Remote	1	Drive control location: REMOTE (EXT1 or EXT2).
		0	Drive control location: LOCAL.
10	Above limit	-	See bit 10 of 06.17 Drive status word 2.
11	User bit 0	-	See parameter 06.30 MSW bit 11 selection.
12	User bit 1	-	See parameter 06.31 MSW bit 12 selection.
13	User bit 2	-	See parameter 06.32 MSW bit 13 selection.
14	User bit 3	-	See parameter 06.33 MSW bit 14 selection.
15	Reserved		

#### The state diagram



### Setting up the drive for fieldbus control

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

#### Parameter setting example: FPBA (PROFIBUS DP)

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

The reference values sent over the fieldbus have to be scaled within the drive so they have the desired effect. The reference value  $\pm 16384$  (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 current DC voltage		ge	

The table below gives the recommended drive parameter settings.

recommended drive	
drives	Description
1 = [slot number]	Enables communication between the drive and the fieldbus adapter module.
4 = Speed	Selects the fieldbus A reference 1 type and scaling.
<b>0</b> = Speed or frequency	Selects the actual value type and scaling according to the currently active Ref1 mode defined in parameter 50.04.
<b>1</b> = FPBA <sup>1)</sup>	Displays the type of the fieldbus adapter module.
3 <sup>2)</sup>	Defines the PROFIBUS node address of the fieldbus adapter module.
12000 <sup>1)</sup>	Displays the current baud rate on the PROFIBUS network in kbit/s.
<b>1</b> = PPO1 <sup>1)</sup>	Displays the telegram type selected by the PLC configuration tool.
0 = PROFIdrive	Selects the Control word according to the PROFIdrive profile (speed control mode).
0 = Disabled	Disables the RPBA emulation mode.
<b>4</b> = SW 16bit <sup>1)</sup>	Status word
<b>5</b> = Act1 16bit	Actual value 1
01.07 <sup>2)</sup>	Motor current
0	
01.11 <sup>2)</sup>	DC voltage
01.11 <sup>2)</sup>	DC voltage
	Setting for ACS580 drives  1 = [slot number]  4 = Speed  0 = Speed or frequency  1 = FPBA <sup>1)</sup> 3 <sup>2)</sup> 12000 <sup>1)</sup> 1 = PPO1 <sup>1)</sup> 0 = PROFIdrive  0 = Disabled  4 = SW 16bit <sup>1)</sup> 5 = Act1 16bit

Drive parameter	Setting for ACS580 drives	Description
53.05 FBA data out5	23.13 <sup>2)</sup>	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	<b>4</b> = FB A ref1	Selects fieldbus A reference 1 as the source for speed reference 1.

<sup>1)</sup> Read-only or automatically detected/set

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

#### Control word:

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

<sup>2)</sup> Example

418	Fieldbus control through a fieldbus adapter

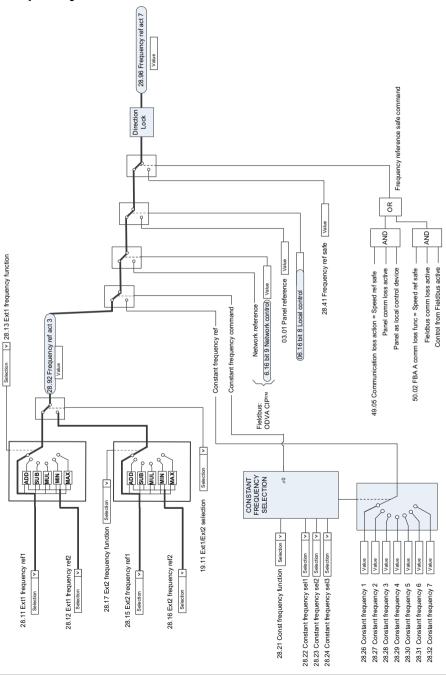
# **Control chain diagrams**

### Contents of this chapter

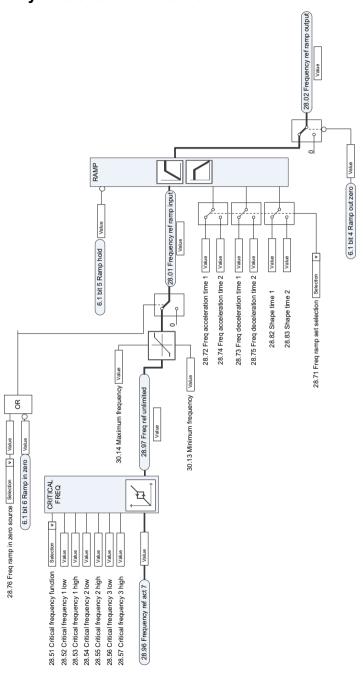
The chapter presents the reference chains of the drive. The control chain diagrams can be used to trace how parameters interact and where parameters have an effect within the drive parameter system.

For a more general diagram, see section Operating modes of the drive (page 89).

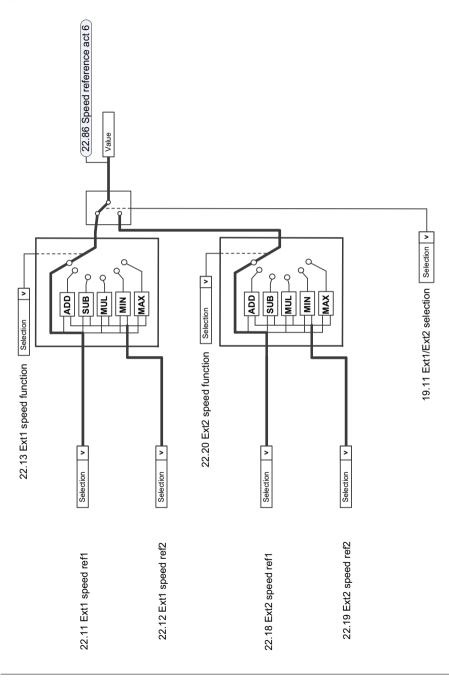
### Frequency reference selection



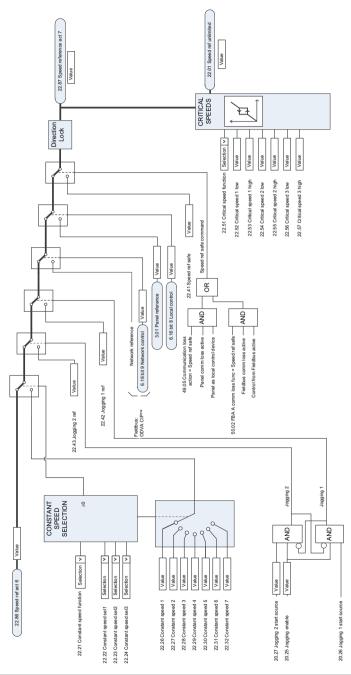
### Frequency reference modification



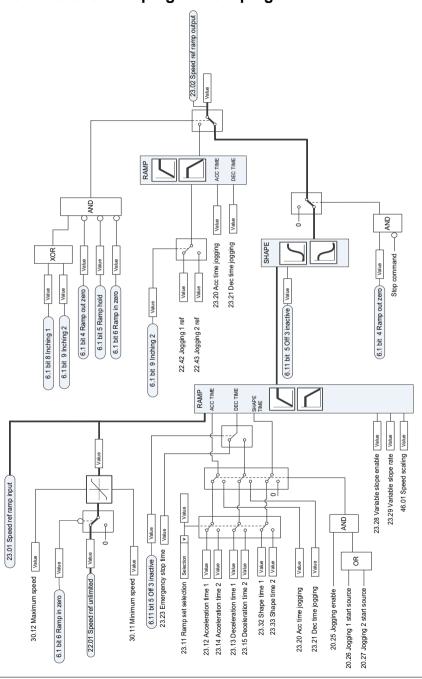
## Speed reference source selection I



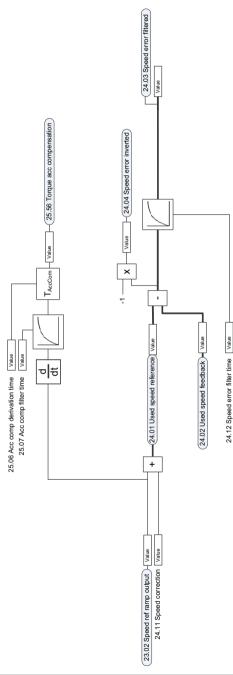
### Speed reference source selection II



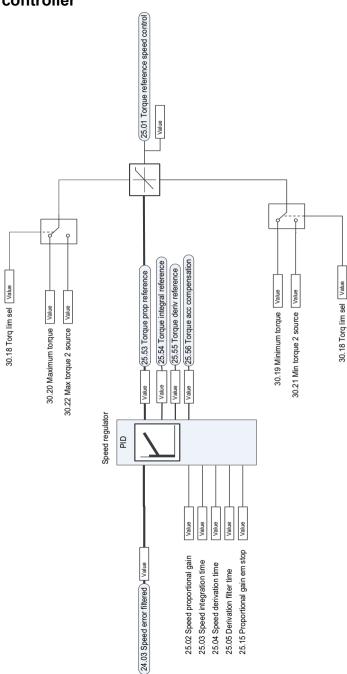
### Speed reference ramping and shaping



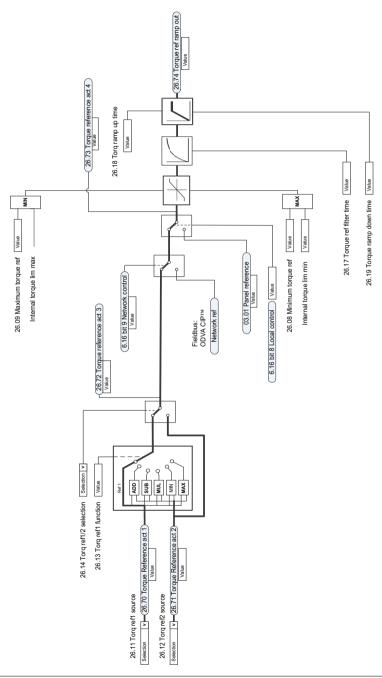
## Speed error calculation



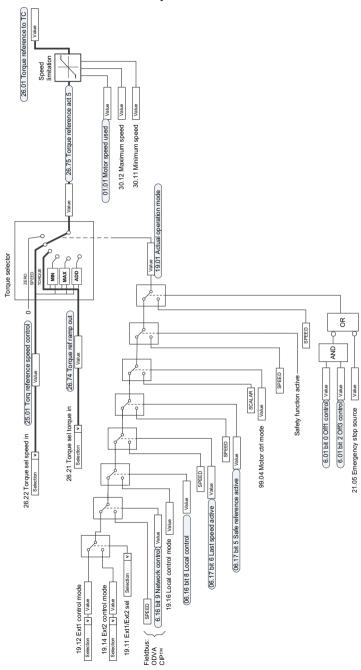
### Speed controller



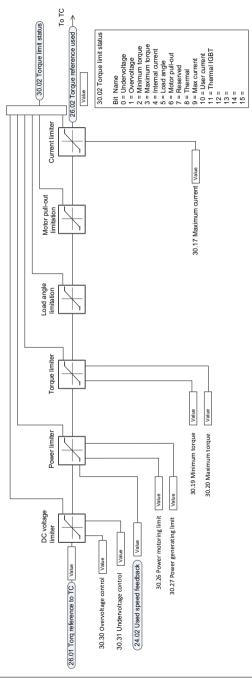
### Torque reference source selection and modification



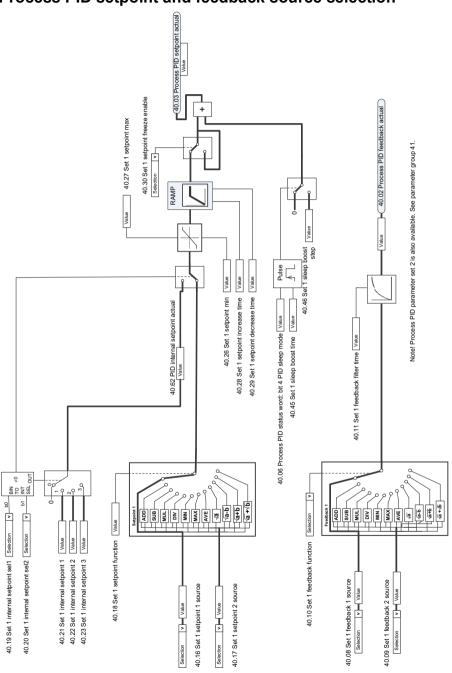
### Reference selection for torque controller



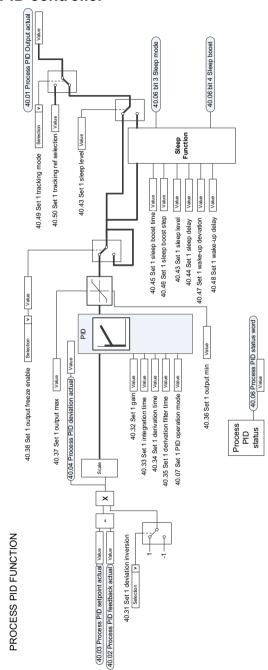
### **Torque limitation**



### Process PID setpoint and feedback source selection

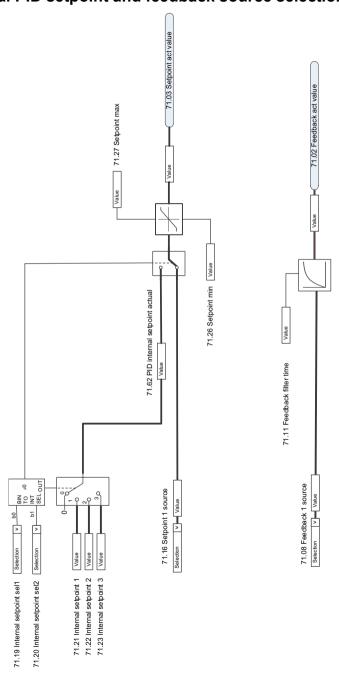


### **Process PID controller**

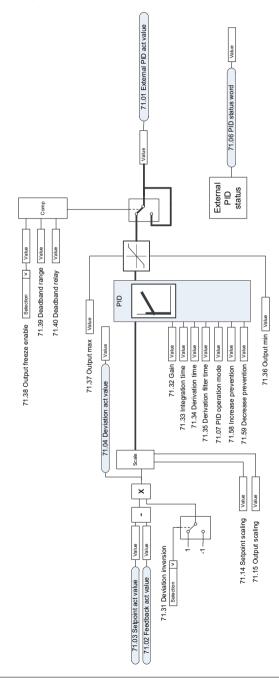


Note! Process PID parameter set 2 is also available. See parameter group 41.

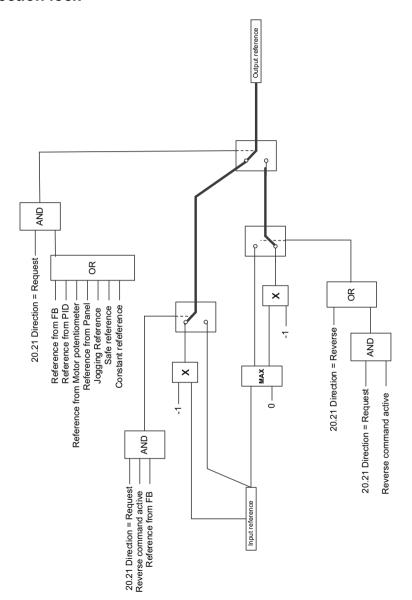
## External PID setpoint and feedback source selection



### **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 <a href="https://www.abb.com/searchchannels">www.abb.com/searchchannels</a>.

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