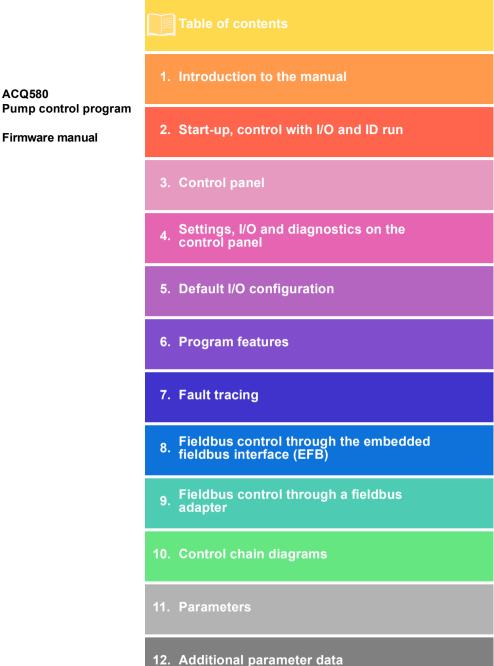


ABB DRIVES FOR WATER

# ACQ580 Pump control program Firmware manual



Related documents are listed on page 15.



**ACQ580** 

Firmware manual

3AXD50000035867 Rev G ΕN

EFFECTIVE: 2023-03-14

## **Table of contents**

1. Introduction to the manual	
Contents of this chapter  Applicability  Safety instructions  Target audience  Purpose of the manual  Contents of this manual  Related documents  Cybersecurity disclaimer	13 13 14 14 14 15
2. Start-up, control with I/O and ID run	
Contents of this chapter	22
How to control the drive through the I/O interface  How to perform the ID run  ID run procedure with the ID Run assistant	29
3. Control panel	
Contents of this chapter  Removing and reinstalling the control panel  Layout of the control panel  Layout of the control panel display  Home view displays  IPC and Level control additional Home view displays  Keys  Key shortcuts	35 36 37 40 41 42
4. Settings, I/O and diagnostics on the control panel	
Contents of this chapter Primary settings Assistants Start, stop, reference Motor Pump features PID control Multipump control Ramps Limits Fieldbus	46 47 49 51 53 55 57 60 61 62
Fault functions	66

#### 6 Table of contents

Security	. 67
Advanced functions	68
Clock, region, display	70
Reset to defaults	. 72
I/O menu	74
Diagnostics menu	. 76
System info menu	. 78
Energy efficiency menu	
Backups menu	
Options menu	
5. Default I/O configuration	
Contents of this chapter	83
Water default	
vvator dorault	. 04
6. Program features	
What this chapter contains	07
·	
Local control vs. external control	
Local control	
External control	
Operating modes of the drive	
Drive configuration and programming	
Configuring via default configurations	
Configuring via menus	
Configuring via parameters	
Adaptive programming	92
Control interfaces	95
Programmable analog inputs	95
Programmable analog outputs	95
Programmable digital inputs and outputs	95
Programmable frequency input and output	
Programmable relay outputs	
Programmable I/O extensions	
Fieldbus control	
Control of a line supply unit (LSU)	
Pump control features	. 99
Intelligent pump control (IPC)	. 99
IPC master autochange	
Application example: IPC system with three drives and three pumps	
Single pump control (PFC/SPFC)	
Level control	
Soft pipe fill	
Sensorless flow calculation	
Pump cleaning	
Dry pump protection	
Pump inlet and outlet protection	
Ramps – Quick ramps	
Automatic fault resets	
External events	. 130

Constant speeds/frequencies	
Critical speeds/frequencies	131
Timed functions	132
Cavitation control	133
Pump restart delay	134
Ramps	
Overview	
Functionality	
Process PID control (PID/Loop controller)	
· · · · · · · · · · · · · · · · · · ·	
Limits	
Limits overview	
Interlocks	
Overview	
Configuration	143
Wiring connections	144
Functionality	144
Run permissives	
Overview	
Configuration	
Wiring connections	
Functionality	
Application accorded to Value and a significant	140
Application example 1: Valve opening	
Motor control	
Frequency control mode	
Scalar motor control	
Speed control mode	
Vector motor control	
Autophasing	149
Motor types	150
Motor identification	
U/f ratio	
Flux braking	
Start methods – DC magnetization	
Switching frequency	
Motor thermal protection	
Motor overload protection	
Speed control performance figures	
Torque control performance figures	
Motor potentiometer	
DC voltage control	
Overvoltage control	
Undervoltage control (power loss ride-through)	170
Voltage control and trip limits	171
Brake chopper	
Supervisory	
Signal supervision	
User load curve (Condition monitoring)	
Energy efficiency	
Energy optimization	
Energy saving calculators	
Load analyzer	179

8 Table of contents	
User parameter sets  System safety and protections  Fixed/Standard protections  Programmable protection functions  Emergency stop  Diagnostics  Diagnostics menu  Miscellaneous  Backup and restore  Data storage parameters  Parameter checksum calculation  User lock  Sine filter support  Al dead band	180 181 181 182 184 185 185 186 186 187 188
7. Fault tracing  What this chapter contains Safety Indications Warnings and faults Pure events Editable messages Warning/fault history Event log Viewing warning/fault information QR code generation for mobile service application Warning messages Fault messages Auxiliary codes for the LSU supply unit warnings Auxiliary codes for the LSU supply unit faults	193 194 209 225
8. Fieldbus control through the embedded fieldbus interface (EFB)  What this chapter contains System overview  Connecting the drive to the fieldbus Setting up the embedded fieldbus interface Setting the drive control parameters Basics of the embedded fieldbus interface Control word and Status word References	229 229 230 230 231 232 234

Actual values .....

 Data input/outputs
 235

 Register addressing
 235

 About the control profiles
 237

 Control Word
 238

 Control Word for the ABB Drives profile
 238

 Control Word for the DCU Profile
 239

 Status Word
 242

235

Status Word for the ABB Drives profile	
State transition diagrams	
State transition diagram for the ABB Drives profile	
References	
References for the ABB Drives profile and DCU Profile	
Actual values	
Actual values for the ABB Drives profile and DCU Profile	
Modbus holding register addresses	250
Modbus holding register addresses for the ABB Drives profile and DCU Profile	
Modbus function codes	251
Exception codes	252
Coils (0xxxx reference set)	253
Discrete inputs (1xxxx reference set)	
Error code registers (holding registers 400090400100)	257
9. Fieldbus control through a fieldbus adapter	
What this chapter contains	259
System overview	259
Basics of the fieldbus control interface	261
Control word and Status word	261
References	262
Actual values	
Contents of the fieldbus Control word (ABB Drives profile)	
Contents of the fieldbus Status word (ABB Drives profile)	
The state diagram	
Setting up the drive for fieldbus control	
Parameter setting example: FPBA (PROFIBUS DP) with ABB Drives profile	
Parameter setting example: FPBA (PROFIBUS DP) with PROFIdrive profile	
Automatic drive configuration for fieldbus control	272
10. Control chain diagrams	
Contents of this chapter	273
Frequency reference selection	
Frequency reference modification	
Speed reference source selection II	
Speed reference ramping and shaping	
Speed error calculation	278
Speed feedback	279
Speed controller	280
Torque limitation	281
PID flow calculation	282
PID setpoint compensation	
Process PID setpoint and feedback source selection	284
Process PID controller	
External PID setpoint and feedback source selection	
External PID controller	287
Direction lock	288



#### 11. Parameters

What this chapter contains	289
Terms and abbreviations	290
Summary of parameter groups	291
Parameter listing	293
01 Actual values	293
03 Input references	297
04 Warnings and faults	298
05 Diagnostics	300
06 Control and status words	303
07 System info	312
10 Standard DI, RO	314
11 Standard DIO, FI, FO	324
12 Standard Al	325
13 Standard AO	331
15 I/O extension module	337
19 Operation mode	361
20 Start/stop/direction	362
21 Start/stop mode	373
22 Speed reference selection	382
·	390
·	392
	392
	397
	404
	412
****	423
·	436
	444
·	456
	459
	462
	479
	482
	483
	488
	491
	493
·	494
,	498
	500
	500
	501
	509
	509
	509
	509
	512
	526
	528
80 Flow calculation	J20

81 Sensor settings	. 535
82 Pump protections	
83 Pump cleaning	
86 Cavitation control	. 544
94 LSU control	. 547
95 HW configuration	549
96 System	. 553
97 Motor control	. 565
98 User motor parameters	. 570
99 Motor data	. 571
Differences in the default values between 50 Hz and 60 Hz supply frequency settings	577
Parameters supported by Modbus legacy compatibility	579
12. Additional parameter data	
What this chapter contains	. 583
Terms and abbreviations	
Fieldbus addresses	. 584
Parameter groups 19	
Parameter groups 1099	
Further information	

### Introduction to the manual

#### Contents of this chapter

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

#### **Applicability**

The manual applies to the ACQ580 pump control program (version 2.18 and later).

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

For ACQ580-31 and ACQ580-34, to check the LSU firmware version in use, select Menu > Options > Select drive > QCON-21 and then select Menu > System info > Drive, or see parameters 07.106 LSU loading package name and 07.107 LSU loading package version on the control panel.

#### Safety instructions

Follow all safety instructions.

- Read the complete safety instructions in the Hardware manual of the drive before you install, commission, or use the drive.
- Read the firmware function-specific warnings and notes before changing parameter values. These warnings and notes are included in the parameter descriptions presented in chapter *Parameters* on page 191.

#### 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

This manual consists of the following chapters:

- Introduction to the manual (this chapter) 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 21) describes how to start up the drive
  as well as how to start, change the direction of the motor rotation and adjust the
  motor speed through the I/O interface.
- Control panel (page 35) contains instructions for removing and reinstalling the
  assistant control panel and briefly describes its display, keys, key shortcuts and
  home view displays.
- Settings, I/O and diagnostics on the control panel (page 45) describes the simplified settings and diagnostic functions provided on the assistant control panel.
- Default I/O configuration (page 83) contains the connection diagram of the Water default configuration together with a connection diagram. The predefined default configuration will save the user time when configuring the drive.
- Program features (page 87) describes program features with lists of related user settings, actual signals, and fault and warning messages.
- Fieldbus control through the embedded fieldbus interface (EFB) (page 229)
  describes the communication to and from a fieldbus network using the drive
  embedded fieldbus interface with the Modbus RTU protocol.
- Fieldbus control through a fieldbus adapter (page 259) describes the communication to and from a fieldbus network using an optional fieldbus adapter module.
- Fault tracing (page 191) lists the warning and fault messages with possible causes and remedies.
- Control chain diagrams (page 273) describes the parameter structure within the drive.
- Parameters (page 191) describes the parameters used to program the drive.

- Additional parameter data (page 583) contains further information on the parameters.
- Further information (inside of the back cover, page 629) 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

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

Drive manuals and guides	Code (English)	
Safety instructions	3AXD50000037978	
ACQ580 pump control program firmware manual	3AXD50000035867	
ACQ580-01 (0.75 to 250 kW, 1.0 to 350 hp) hardware manual for frames R1-R9	3AXD50000044862	
ACQ580-04 drive modules (250 to 500 kW) hardware manual	3AXD50000048677	
ACQ580-07 drives (75 to 500 kW) hardware manual	3AXD50000045817	
ACQ580-31 hardware manual	3AXD50000045935	
ACQ580-34 hardware manual	3AXD50000420025	
ACQ580-01 drives quick installation and start-up guide for global (IEC) product types	3AXD50000758692	
ACQ580-01 drives quick installation and start-up guide for North American (NEC) product types	3AXD50000788309	
ACQ580-04 drive modules (250 to 500 kW) quick installation guide	3AXD50000823284	
ACQ580-31 drives quick installation and start-up guide	3AXD50000803057	
ACQ580-34 drive modules quick installation and start- up guide	3AXD50000424634	
ACQ580-01 Quick Start Guide, US	3AXD50000049128	
ACQ580 Quick installation guide	3AXD50000048773	
ACQ580-34 drive modules quick installation and start- up guide	3AXD50000424634	
Adaptive programming Application Guide	3AXD50000028574	
ACS-AP-I, -S, -W and ACH-AP-H, -W Assistant control panels user's manual	3AUA0000085685	
Option manuals and guides		
CPTC-02 ATEX-certified thermistor protection module, Ex II (2) GD (option +L537+Q971) user's manual	3AXD50000030058	
CDPI-01/-02 panel bus adapter user's manual	3AXD50000009929	
FCAN-01 CANopen adapter module user's manual	3AFE68615500	
FDNA-01 DeviceNet Adapter User's Manual	3AFE68573360	
FEIP-21 EtherNet/IP fieldbus adapter module User's manual	3AXD50000158621	
FENA-01/-11/-21 Ethernet adapter module user's manual	3AUA0000093568	

FMBT-21 Modbus/TCP Adapter Module User's Manual	3AXD50000158607
FPBA-01 PROFIBUS DP adapter module user's manual	3AFE68573271
FPNO-21 PROFINET IO fieldbus adapter module user's manual	3AXD50000158614
FSCA-01 RS-485 adapter module user's manual	3AUA0000109533
ACS580-01, ACH580-01 and ACQ580-01 +C135 frames R1 to R3 flange mounting kit quick installation guide	3AXD50000119172
ACS580-01+C135, ACH580-01+C135 and ACQ580-01+C135 frames R4 and R5 flange mounting kit quick installation guide	3AXD50000287093
ACS880-01+C135, ACS580-01+C135, ACH580+C135 and ACQ580-01+C135 frames R6 to R9 flange mounting kit quick installation guide	3AXD50000019099
ACS880-11, ACS880-31, ACH580-31 and ACQ580-31 +C135 frame R3 flange mounting kit quick installation guide	3AXD50000181506
ACS880-11+C135, ACS880-31+C135, ACH580- 31+C135 and ACQ580-31+C135 frames R6 and R8 flange mounting kit quick installation guide	3AXD50000133611
ACS580, ACH580 and ACQ580+P940 and +P944 drive modules supplement	3AXD50000210305
Main switch and EMC C1 filter options (+F278, +F316, +E223), IP55 frames R1 to R5 ACS580-01, ACH580-01 and ACQ580-01 drives installation supplement	3AXD50000155132
ACS880-11, ACS880-31, ACH580-31 and ACQ580-31 UK gland plate (+H358) installation guide	3AXD50000110711

#### Tool and maintenance manuals and guides

Drive composer start-up and maintenance PC tool user's manual	3AUA0000094606
Capacitor reforming instructions	3BFE64059629
NETA-21 remote monitoring tool user's manual	3AUA0000096939
NETA-21 remote monitoring tool installation and start- up guide	3AUA0000096881

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



ACQ580-01 manuals



ACQ580-04 manuals



ACQ580-07 manuals



ACQ580-31 manuals



ACQ580-34 manuals

Categorization by frame (size)

The ACQ580 is manufactured in several frames (frame sizes), which are denoted as RN, where N is an integer. Some information which only concern certain frames are marked with the symbol of the frame (RN).

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

#### Terms and abbreviations

Term/abbreviation	Explanation
ACx-AP-x	Assistant control panel, advanced operator keypad for communication with the drive.
	The default assistant control panel for the ACQ580 is ACH-AP-H (Hand-Off-Auto control panel).
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.
CAIO-01	CAIO-01 optional bipolar analog input and unipolar analog output extension module
Control board	Circuit board in which the control program runs.
CCA-01	Cold configuration adapter
CDPI-01	Communication 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)
CPTC-02	Optional multifunction extension module (external 24 V and ATEX certified PTC interface)
CRC	Cyclic redundancy check. The IPC checks the parameter group validity in terms of CRC.
DC link	DC circuit between rectifier and inverter
DC link capacitors	Energy storage which stabilizes the intermediate circuit DC voltage
DDCS	Distributed drives communication system; a protocol used in communication between ABB drive equipment, used for ACQ580-31 and ACQ580-34 drives.
DI	Digital input; interface for digital input signals
DO	Digital output; interface for digital output signals
DPMP-01	Mounting platform for ACx-AP control panel (flange mounting)
DPMP-02/03	Mounting platform for ACx-AP control panel (surface mounting)
Drive	Frequency converter for controlling AC motors
EFB	Embedded fieldbus
FBA	Fieldbus adapter
FCAN-01	Optional CANopen adapter module

Term/abbreviation	Explanation
FDNA-01	Optional DeviceNet adapter module
FEIP-21	Optional Ethernet/IP adapter module
FENA-21	Optional Ethernet adapter module for EtherNet/IP, Modbus TCP and PROFINET IO protocols
FMBA-01	Optional Modbus RTU adapter module
FMBT-21	Optional Modbus/TCP adapter module
FPBA-01	Optional PROFIBUS DP adapter module
FPNO-21	Optional PROFINET adapter module
Frame (size)	Refers to drive physical size, for example, R1 and R2. 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
IPC	Intelligent pump control
LSW	Least significant word
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="https://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])
	FEIP-21 Ethernet/IP adapter module user's manual     (3AXD50000158621 [English]).
Parameter	User-adjustable operation instruction to the drive, or signal measured or calculated by the drive
PFC	Single pump control. One drive controls multiple pumps with motors.
PID/Loop controller	Proportional-integral-derivative controller, also known as closed loop 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

Term/abbreviation	Explanation
PTC	Positive temperature coefficient, thermistor whose resistance is dependent on temperature.
R1, R2 R11	Frame (size)
RO	Relay output; interface for a digital output signal. Implemented with a relay.
Rectifier	Converts alternating current and voltage to direct current and voltage.
SPFC	Soft pump control. One drive controls multiple pumps with motors.
STO	Safe torque off. See chapter <i>The Safe torque off function</i> in the <i>Hardware manual</i> of the drive.

#### Cybersecurity disclaimer

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

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

#### Contents of this chapter

The chapter describes how to:

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

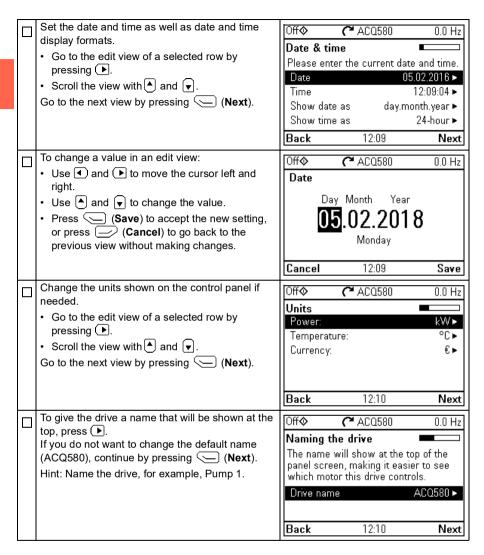
#### How to start up the drive

Note: Automatic selection of supply voltage is not supported in ACQ580-31 and ACQ580-34. You must select the supply voltage manually using parameter 95.01 Supply voltage. Follow the instructions below.

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

	Safety		
Hai	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		
dar	mage to the equipment.		
	Check the installation. See chapter <i>Installation che</i> drive.	cklist in the Hardware manual of the	
	Make sure there is no active start on (DI1 in configuration). The drive will start up automore command is on and the drive is in the extern Check that the starting of the motor does not cause	atically at power-up if the external run nal control mode.	
	De-couple the driven machine if	sany dangen.	
	there is a risk of damage in case of an incorrect of the case of the	direction of rotation, or	
	<ul> <li>a Normal ID run is required during the drive star than 20% or the machinery is not able to withstar the ID run.</li> </ul>		
	Hints 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 ACx-AP-x assistant control panels user's manual (3AUA0000085685 [English]).		
	1 – First start assistant guided settings:     Language, date and time, and motor nominal values		
	Have the motor or pump name plate data at hand.		
	Power up the drive.		

The First start assistant guides you through the first start-up.  The assistant begins automatically. Wait until the control panel enters the view shown on the right. Select the language you want to use by highlighting it (if not already highlighted) and pressing (OK).	English Deutsch Suomi Français Italiano Svenska Español	OK >
ACQ580-31 and ACQ580-34 drives: Select the supply voltage with parameter 95.01 Supply voltage:  In the First start assistant menu, select Exit and press (Next).  In the Home view, press (Menu) to enter the Main menu.	Off♦	0.0 Hz
<ul> <li>In the Main menu, go to Parameters &gt;         Complete list &gt; 95 HW configuration by selecting the correct row and pressing (Select) repeatedly.</li> <li>Select parameter 95.01 Supply voltage and press (Edit).</li> <li>Select supply voltage 380415 or 440480 using keys A and Press (Save).</li> <li>Go back to the Main menu by pressing (Back) repeatedly.</li> <li>In the Main menu, select First start assistant and press (Select) to enter the First start assistant menu.</li> <li>Continue with the following steps for commissioning the ACQ580.</li> </ul>	<b>Cancel</b> 12:09	Save
Select <b>Start set-up</b> and press (Next).	Off	0.0 Hz
	12:09	Next



Copies all settings into a backup file

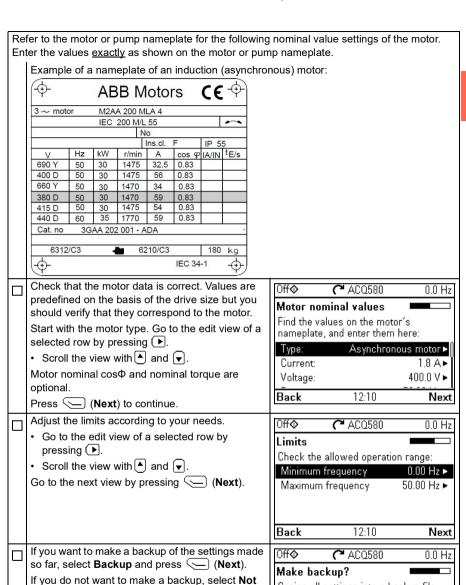
Backup Not now

Back

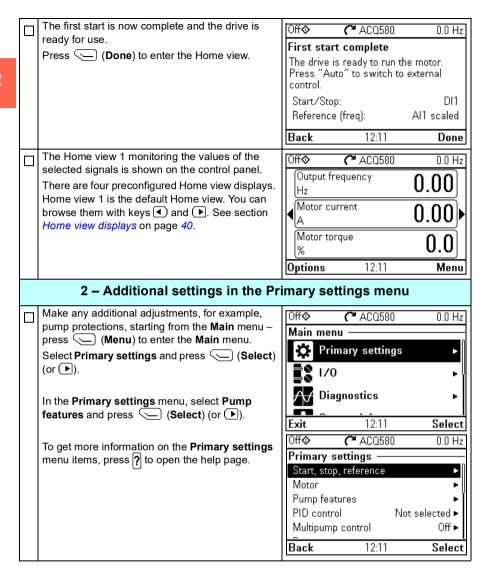
stored in the control panel. To restore a backup, go to Menu > Backups.

12:10

Next



now and press (Next).



#### 3 - Hand/Off/Auto operation

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

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

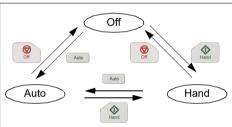
· Top row of the view shows Auto.

Local control: Drive is controlled from the control panel.

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

Symbol ♦ on the top row indicates that you can change the reference with (\*) and (\*).

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



Note: If fault 7081 Control panel loss is active and the drive is powered down, the mode changes to Auto when power is reapplied.

Deration	
Auto C ACQ580	30.0 Hz
Output frequency Hz	30.00
Motor current	0.46
Motor torque %	8.9
<b>Options</b> 12:30	Menu
Off <b>♦ (~</b> ACQ58)	0.0 Hz
Output frequency Hz	0.00
<b>√</b> Motor current A	0.00
Motor torque %	0.0
<b>Options</b> 12:37	Menu
Hand <b>♦ Č</b> ACQ580	0 \$30.0 Hz
Output frequency Hz	30.00
<b>√</b> Motor current A	0.46
Motor torque %	8.8
Reference 12:38	Menu
Off	0.0 Hz
Fault 7	00 0000
Control panel loss	12:41:43
Control panel loss faul	t
Hide 12:42	Reset

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

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

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

#### Preliminary settings

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

Default settings only allow forward direction.

Note: Efficient pump cleaning can require reverse speed.

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

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

See section Water default on page 84.

In external control, the control panel display shows text **Auto** at the top left

#### Starting and controlling the speed of the motor

Start by switching digital input DI1 on.

The arrow starts rotating. It is dotted until the setpoint

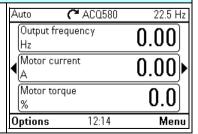
Regulate the drive output frequency (motor speed) by adjusting voltage of analog input Al1.

Note: If the drive will not start, check that the start interlock 1 (parameter 20.41) is active (1). For the Water default, the start interlock 1 is connected to DI4 by default.

Auto ()	, ACQ580	22.5 H	łz
Output freque Hz	ency	7.03	
√ <mark>Motor curren</mark> A	t	0.41	▶
Motor torque %		-0.1	
Options	12:13	Men	u

#### Stopping the motor

Switch digital input DI1 off. The arrow stops rotating.



#### How to perform the ID run

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

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

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

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

Do the ID run with the ID run assistant by selecting Menu > Primary settings > Motor > ID run (see page 30).

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

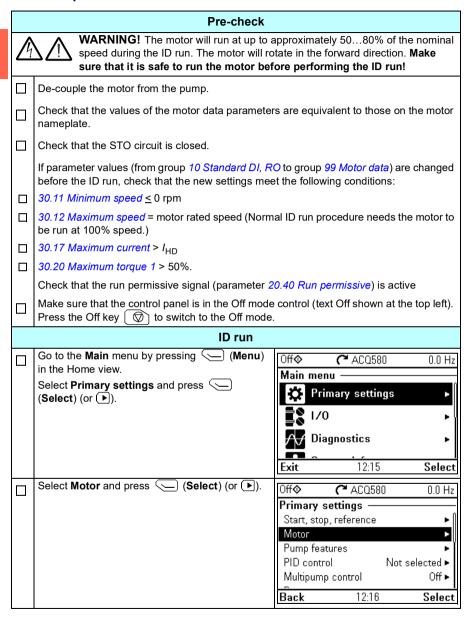
Note: If you have already parameterized your application using the scalar motor control mode (99.04 Motor control mode is set to Scalar) and you need to change motor control mode to Vector.

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

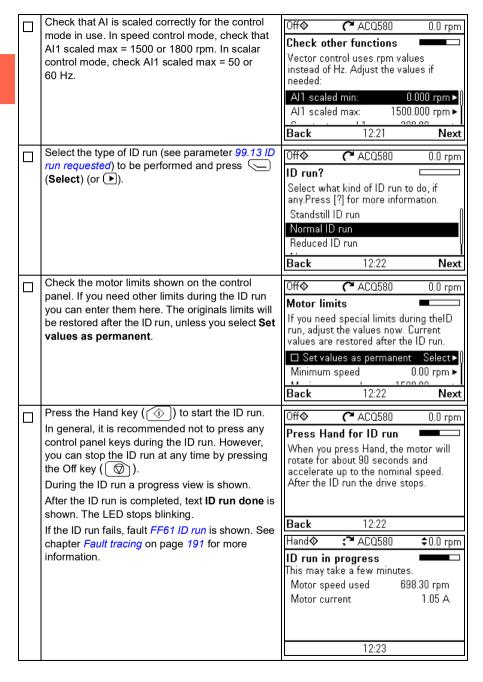
or

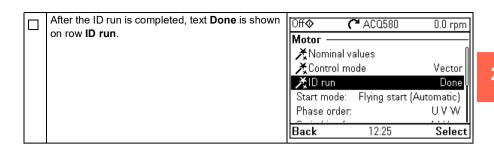
- set parameter 99.04 Motor control mode to Vector, and
  - for I/O controlled drive, check parameters in groups 22 Speed reference selection, 23 Speed reference ramp, 12 Standard AI, 30 Limits and 46 Monitoring/scaling settings.

#### ID run procedure with the ID Run assistant



If the control modes is scalar, select <b>Control</b> mode and press (Select) (or ) and	Off♦ Motor —	C ACQ580	0.0 Hz
continue to the next step.	<b>X</b> Nomina	al values	ſ
	<b>★</b> Control		Scalar
	Start mod Phase ord		rt (Normal)   UVW
		frequency	4 kHz ►
	Back	12:16	Select
Select <b>Vector control</b> and press (Select) (or (F)).	Off <b>�</b>	<b>~</b> ACQ580	0.0 Hz
(or ( <u>v</u> )).	Control m		
	mode. If yo	ngs depend on ti ou change the mo Il help you to adju	ode, the
	Vector cor		
	Back	12:16	Select
Warning message <b>Identification run</b> is shown	Off <b></b>	<b>(~</b> ACQ580	0.0 rpm
for a moment.	<b>↑</b> Wa	arning AFF6	
	ڪ <sub>Au</sub> Identifica	x code: 0000 000	0 12:17:09
		ntification run ab	
	performed		
		1017	
Objects the second district. The following second	Hide	12:17	How to fix
Check the motor speed limits. The following must be true:	Off <b></b>	<b>(~</b> ACQ580	0.0 rpm
<ul> <li>Minimum speed ≤ 0 rpm</li> </ul>	Check mo		
Maximum speed = motor rated speed.		or limits apply to just the values if	
	Minimum	•	0.00 rpm ►
	Maximum Maximum	•	00.00 rpm ►    3.24 A ►
	Back	12:20	Next
Check the motor current as well as torque limits.			
The following must be true:	Off <b></b>	<b>~</b> ACQ580	0.0 rpm
• Maximum current > I <sub>HD</sub>	Check mo	<b>itor limits</b> or limits apply to	vector
• Maximum torque > 50%.		just the values if	
	Maximum	'	00.00 rpm ►
	Maximum		3.24 A ► -300.0 % ►
	Minimum Back	torque 1 12:21	-300.0 % ▶ Next
	Dack	14.41	IACYſ





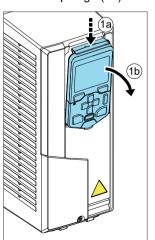
## **Control panel**

#### Contents of this chapter

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

#### Removing and reinstalling the control panel

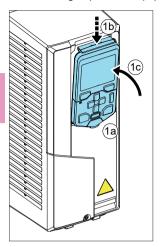
To remove the control panel, press the retaining clip at the top (1a) and pull it forward from the top edge (1b).



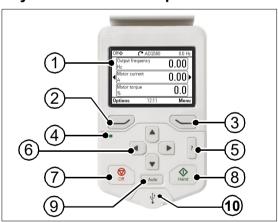




To reinstall the control panel, put the bottom of the container in position (1a), press the retaining clip at the top (1b) and push the control panel in at the top edge (1c).



### Layout of the control panel

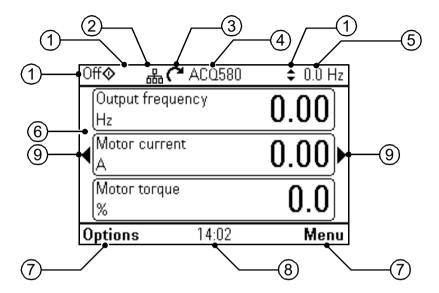


1	Layout of the control panel display
2	Left softkey
3	Right softkey
4	Status LED, see chapter Maintenance and hardware diagnostics, section LEDs in the Hardware manual of the drive.
5	Help

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

# Layout of the control panel display

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



- 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 control 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/Ico	ons		Starting from this control panel	Stopping from this control panel	Giving reference from this control panel
Off	<b>\lambda</b>	<b>‡</b>	Allowed	Drive is stopped	Not allowed
Hand	<b></b>	<b>‡</b>	Allowed	Allowed	Allowed

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

Text/Icons	Starting from this control panel	Stopping from this control panel	Giving reference from this control panel
Auto	Allowed 1)	Allowed 1)	Not allowed
Auto 🚖	Not allowed	Allowed	Allowed

This action can be Not allowed by changing parameters 19.18 HAND/OFF disable source and 19.19 HAND/OFF disable action.

- 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
でせた	Blinking	Stopped, start command given but start inhibited. See <b>Menu &gt; Diagnostics</b> on the control panel
<b>%</b>	Blinking	Faulted
<b>C</b> +→	Blinking	Running, at reference, but the reference value is 0
(S+K)	Rotating	Running, not at reference
G →J	Rotating	Running, at reference
∭	-	Pre-heating (motor heating) active
$\mathbf{Z}_{\!$	-	PID sleep mode active

- Drive name: If a name has been given, it is displayed in the top pane. By default, it is "ACQ580". You can change the name on the control panel by selecting Menu > Primary settings > Clock, region, display (see page 70).
- 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 53).
- 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 37 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.

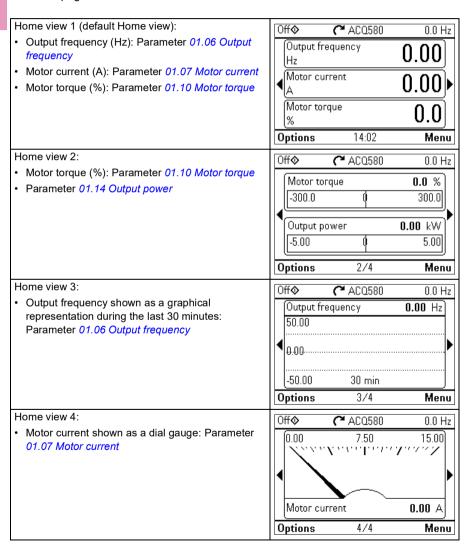
- 8. Clock: The clock displays the current time. You can change the time and time format on the control panel by selecting Menu > Primary settings > Clock, region, display (see page 70).
- 9. Side arrows: When side arrows are visible, you can browse other Home views with the arrow keys (◀) and ▶).

You can adjust the display contrast and back light functionality on the control panel by selecting Menu > Primary settings > Clock, region, display (see page 70).

# Home view displays

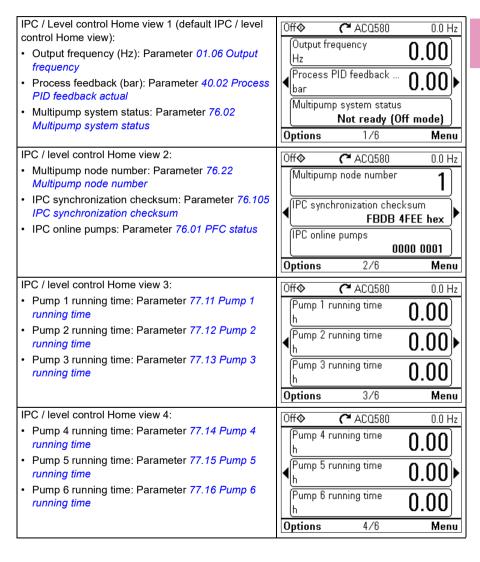
There are four different preconfigured basic Home view displays. In addition, there are six preconfigured IPC Home views and seven preconfigured Level control Home views (see section *IPC and Level control additional Home view displays* on page 41).

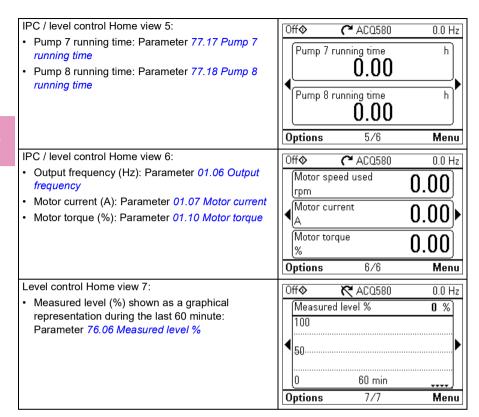
Home view 1 is the default Home view. You can browse them with the arrow keys (◀) and ♠). To edit Home views, press the Option softkey (♠), see section *Options menu* on page *81*.



## IPC and Level control additional Home view displays

There are six preconfigured IPC Home views and seven preconfigured Level control Home views, of which the first six are the same as IPC home views. You can browse them with the arrow keys ( and ). To edit Home views, press the Option softkey ( ), see section Options menu on page 81.





# **Keys**

The keys of the control panel are described below.



## Left softkey

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

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

#### Right softkey

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

#### The arrow kevs

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

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

#### Help

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

#### Hand, Off and Auto

The ACQ580 can be in local or external control. The local control has two modes: Hand and Off. See also the diagram in section Local control vs. external control on page 87.

Hand key ( \( \bar{\psi} \):

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

Off key ( ):

Stops the drive and switches to the Off mode.

Auto key ( Auto

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

# **Key shortcuts**

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

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

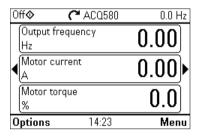
Shortcut	Available in	Effect
+ ♠, + ▼	any view	Adjust backlight brightness.
<b>→ →</b> , <b>→ →</b>	any view	Adjust display contrast.
▲ or ▼	Home view	Adjust reference.
<b>▲</b> + <b>▼</b>	parameter edit views	Revert an editable parameter to its default value.
4+•	view showing a list of selections for 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.

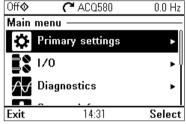
# Settings, I/O and diagnostics on the control panel

# Contents of this chapter

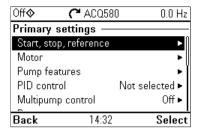
This chapter provides detailed information about the Primary settings, I/O, Diagnostics, System info, Energy efficiency and Backups menus using the control panel.

To get to these menus from the Home view, first select **Menu** to go the **Main** menu, and in the Main menu, select the menu you want.





# **Primary settings**



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

After using the guided settings with the first start assistant, you may want to select another default configuration by selecting Start, stop, reference > Basic operations set-up and Start, stop, reference > Basic control set-up and following the set-up assistants to configure process and control settings.

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

With the **Primary settings** menu, you can also adjust settings related to the motor, pump functionalities, fieldbus communication, PID, fault functions, advanced functions and clock, region and display. In addition, you can reset the fault and event logs, control 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 enables you to program the majority of the drive functionality or features: more advanced configuration is done via the parameters: Select Menu > Parameters. For more information on the different parameters, see chapter *Parameters* on page 289.

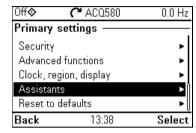
In the **Setting** menu, the \( \bar{\Lambda}\) symbol indicates multiple connected signals/parameters.

The X symbol indicates that the setting provides an assistant when modifying the parameters. When using an assistant make sure that all the set values are saved by completing the assistant.

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

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

#### Assistants



The Assistants submenu includes a variety of assistants that can be used to configure the drive.

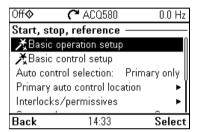
The table below provides detailed information about the available setting items in the Assistants submenu.

Menu item	Description	Corresponding parameter
⊁First start assistant	Runs the same First start assistant that is used to commission the drive.	
<b>X</b> Basic operation	Equipment type?	
setup	Blower	
	• Ramps	
	Control setup	
	Pump	
	Submersible/turbine	
	Quick ramp stage 1	
	Quick ramp stage 2	
	Normal ramp stage 3	
	Control setup	
	Other	
	• Ramps	
	Control setup	

Menu item	Description	Corresponding parameter
<b>X</b> Basic control setup	How do you control?	
	<u>SCADA</u>	
	Reference (Al1) scaling	
	Relay outputs	
	"Start interlock signal"	
	"Run permissive signal"	
	Direct control via I/O (Water default configuration)	
	Reference (Al1) scaling	
	Relay outputs	
	"Start interlock signal"	
	"Run permissive signal"	
	Direct control via fieldbus comm.	
	Communication settings	
	PID control, single motor	
	Feedback (Al2) scaling	
	Setpoint source	
	Constant setpoint	
Xnominal values	Enter the motor's nominal values from the motor's nameplate.	99.03 Motor type 99.12 Motor nominal
	Selects whether to use scalar or vector control mode.	torque
	For information on scalar control mode, see section	
	Scalar motor control on page 147.	
	For information on vector control mode, see section <i>Vector motor control</i> on page <i>148</i>	
.≵ID run	Perform the Identification run described in section  How to perform the ID run (page 29).	99.13 ID run requested
∦PID assistant	Configures secondary control location to use PID control.	
	<u>Feedback:</u> Al2. Adjust the scaling of Al2 signal for feedback, if required.	
	Setpoint: Select a constant value, control panel or Al1. If you selected Al2, adjust the scaling of Al1 signal for setpoint.	
	Start/stop: DI	
Security	See section Security (page 67).	
XControl mode	Selects whether to use scalar or vector control	99.04 Motor control mode
	mode.	ouc
	For information on scalar control mode, see section Scalar motor control on page 147.	
	For information on vector control mode, see	
	section <i>Vector motor control</i> on page <i>148</i> .	

Menu item	Description	Corresponding parameter
★Synchronization settings	Runs the Synchronization settings assistant.	96.20 Time sync primary source
XSet HQ curve points	Runs the assistant for HQ performance curve for flow calculation.	80.13 Flow feedback function
	<b>Note</b> : This menu item is only visible if the parameter <i>80.13</i> value has been set to <i>HQ curve</i> .	
XSet PQ curve points	Runs the assistant for PQ performance curve for flow calculation.	80.13 Flow feedback function
	<b>Note</b> : This menu item is only visible if the parameter 80.13 value has been set to PQ curve.	

## 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.

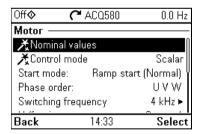
The table below provides detailed information about the available setting items in the Start, stop, reference submenu.

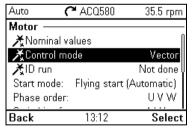
Menu item	Description	Corresponding parameter
<b>≵</b> Basic operation	Equipment type?	
setup	Blower	
	Ramps	
	Control setup	
	Pump	
	Submersible/turbine	
	Quick ramp stage 1	
	Quick ramp stage 2	
	Normal ramp stage 3	
	Control setup	
	Other	
	Ramps	
	Control setup	

Menu item	Description	Corresponding parameter
<b>X</b> Basic control setup	How do you control?	
	<u>SCADA</u>	
	Reference (Al1) scaling	
	Relay outputs	
	"Start interlock signal"	
	• "Run permissive signal"	
	Direct control via I/O (Water default configuration)	
	Reference (Al1) scaling	
	Relay outputs	
	"Start interlock signal"	
	"Run permissive signal"	
	Direct control via fieldbus comm.	
	Communication settings	
	PID control, single motor	
	Feedback (Al2) scaling	
	Setpoint source	
	Constant setpoint	
	Hand mode	
Auto control	Where the drive gets the signal to switch between	19.11 Ext1/Ext2
selection:	control locations (Ext1 and Ext2).	selection
Primary auto control	Settings for the primary remote control location,	12.17 AI1 min
location	Ext1. Enabling Ext or 1 gives a second set of	12.18 Al1 max
	start/stop/reference sources for remote control.	
Secondary auto	Settings for the secondary remote control location,	19.11 Ext1/Ext2 selection
control location	Ext2. These settings include reference source, start, stop, direction and command sources for	28.15 Ext2 frequency
	Ext2.	ref1 or
	By default, Ext2 is set to <b>Off</b> .	22.18 Ext2 speed ref1 12.17 Al1 min
	By dordain, Ext2 is set to Oil.	12.18 Al1 max
		12.27 AI2 min
		12.28 AI2 max 20.06 Ext2 commands
		20.08 Ext2 in1 source
		20.09 Ext2 in2 source
Interlocks/	Settings to prevent the drive from running or	20.40 Run permissive
permissives	starting when a specific digital input is low.	20.41 Start interlock 1
	You can enter a custom text to use instead of "Run	20.42 Start interlock 2
	permissive", "Use start interlock 1", "Use start	20.43 Start interlock 3 20.44 Start interlock 4
	interlock 2", "Use start interlock 3" and "Use start	20.45 Start interlock 4
	interlock 4".	stop mode
	See section <i>Interlocks</i> on page <i>143</i> .	
Stop mode:	Sets how the drive stops the motor: with ramp or	21.03 Stop mode
	coast stop.	

Menu item	Description	Corresponding parameter
Constant speeds / Constant frequencies	These settings are for using a constant value as the reference. By default, <b>constant freq/speed 1</b> is activated by DI3.  See section <i>Constant speeds/frequencies</i> on page 130.	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
Start mode:	Sets how the drive starts the motor.  Fast  Constant time pre-magnetization  Ramp start with torque boost  Flying start  Flying start + torque boost  Automatic + boost  Flying start (automatic)	21.01 Start mode 21.02 Magnetization time
Start delay:	Sets how the drive starts the motor.	21.22 Start delay

#### 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.

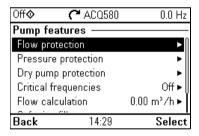
Three assistants are available: Control mode, Nominal value and ID run (for vector control mode only).

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

Menu item	Description	Corresponding parameter
<b>X</b> Nominal values	Enter the motor's nominal values from the motor's nameplate.	99.03 Motor type 99.12 Motor nominal torque
XControl mode	Selects whether to use scalar or vector control mode.	99.04 Motor control mode
	For information on scalar control mode, see section <i>Scalar motor control</i> on page <i>147</i> .	
	For information on vector control mode, see section <i>Vector motor control</i> on page <i>148</i> .	
Start mode:	Sets how the drive starts the motor (for example, pre-magnetize or not).  • Fast	21 Start/stop mode 21.02 Magnetization time
	Constant time pre-magnetization     Automatic	
	Ramp start with torque boost	
	Automatic + boost     This makes the second se	
	<ul><li>Flying start</li><li>Flying start + torque boost</li></ul>	
Phase order:	If the forward direction of the motor is wrong, change this setting to fix the direction instead of changing the phase order on the motor cable.	99.16 Motor phase order
Switching frequency	Sets the target and lowest allowed switching frequencies. For more information, see section Switching frequency on page 154.	97.01 Switching frequency reference 97.02 Minimum switching frequency
U/f ratio:	The form of voltage to frequency ratio below field weakening point. For more information, see section <i>U/f ratio</i> on page 150.	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 section <i>IR compensation for scalar motor control</i> on page 147.	97.13 IR compensation
Pre-heating	Settings for motor preheating. 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. For more information, see section Start methods – DC magnetization on page 152.	21.14 Pre-heating input source 21.16 Pre-heating current

Menu item	Description	Corresponding parameter
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 section <i>Motor thermal protection</i> on page <i>154</i> .	
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 section <i>Motor thermal protection</i> on page <i>154</i> .	
Stall protection	The settings in this submenu are meant to protect the motor in a stall situation. You can adjust the supervision limits (current, frequency and time) and choose how the drive reacts to a motor stall condition. For more information, see section <i>Stall protection (parameters 31.2431.28)</i> on page 182.	31.24 Stall function 31.25 Stall current limit 31.26 Stall speed limit 31.27 Stall frequency limit 31.28 Stall time

# Pump features



Use the **Pump features** submenu to adjust pump-related settings, such as pump protection functionalities, soft pipe fill or pump cleaning configurations.

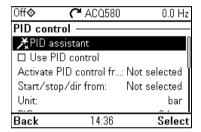
The table below provides detailed information about the available setting items in the Pump features submenu.

Menu item	Description	Corresponding parameter
Flow protection	Configures the maximum and minimum values for	80.15 Maximum flow
	the flow and flow protection.	80.16 Minimum flow 80.17 Maximum flow protection
		80.18 Minimum flow protection 80.19 Flow check delay

Menu item	Description	Corresponding parameter
Pressure protection	Configures settings for protection of the pump from too high or low pressure.	81.10 Inlet pressure source 81.11 Outlet pressure source 82.30 Outlet minimum pressure protection 82.31 Outlet minimum pressure warning level 82.35 Outlet maximum pressure protection 82.37 Outlet maximum pressure warning level 82.40 Inlet minimum pressure protection 82.41 Inlet minimum pressure warning level 82.45 Pressure check delay
Dry pump protection	Configures settings for dry pump protection. Dry pump protection function ensures that the water pump is not running without water and protects the pump from damaging.	82.20 Dry run protection 82.21 Dry run source
Critical speeds/frequencies	Enables or disables the critical frequencies function.  Determines whether the specified ranges are effective in both rotating directions or not.  See also section <i>Critical speeds/frequencies</i> on page 131.	28.51 Critical frequency function 28.52 Critical frequency 1 low 28.53 Critical frequency 1 high 28.54 Critical frequency 2 low 28.55 Critical frequency 2 high 28.56 Critical frequency 3 low 28.57 Critical frequency 3 high
Flow calculation	Configures the settings for sensor based or sensorless flow calculation functionality. Flow calculation measures the amount of water flowing based on the sensor feedback or without sensor based on the pump curve data.	80.12 Flow feedback 2 source 80.13 Flow feedback function 80.14 Flow feedback multiplier
Soft pipe fill	Configures settings for filling the pipeline with a gentle approach. This helps to avoid sudden pressure peaks and reduces the risk of water hammer which can cause damage to the water pipes.	40.14 Set 1 setpoint scaling 40.28 Set 1 setpoint increase time 40.29 Set 1 setpoint decrease time 82.25 Soft pipe fill supervision

Menu item	Description	Corresponding parameter
Pump cleaning	Configures the adjustments for pump cleaning functionality. Pump cleaning makes it possible to clean the pumps automatically when needed. This function reduces downtime and lowers manual cleaning costs. It also lowers pump's total running costs due to higher pump average operating efficiency.	83.11 Pump cleaning triggers 83.16 Cycles in cleaning program 83.20 Cleaning speed step 83.25 Time to cleaning speed 83.26 Time to zero-speed 83.27 Cleaning on time 83.28 Cleaning off time

#### PID control



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

See also section Process PID control (PID/Loop controller) on page 139.

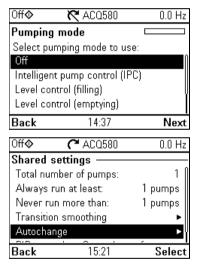
The table below provides detailed information about the available setting items in the PID submenu.

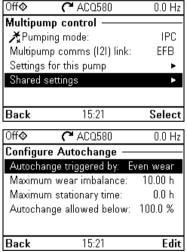
Menu item	Description	Corresponding parameter
XPID assistant	Configures secondary control location to use PID control.	
	Feedback: Al2. Adjust the scaling of Al2 signal for feedback, if required.	
	<u>Setpoint:</u> Select a constant value, control panel or Al1. If you selected Al2, adjust the scaling of Al1 signal for setpoint.	
	Start/stop: DI	
Use PID control:	Select if PID control is used or not.	40.07 Process PID operation mode
Activate PID control from	Sets where the drive gets the signal to switch between control locations (Ext1 and Ext2)	19.11 Ext1/Ext2 selection

Menu item	Description	Corresponding parameter
Start/stop/dir from:	Selects the source for start, stop and direction.	20.01 Ext1 commands
'		20.02 Ext1 start trigger
		type
		20.03 Ext1 in1 source
		20.04 Ext1 in2 source 20.05 Ext1 in3 source
		20.06 Ext2 commands
		20.07 Ext2 start trigger
		type
		20.08 Ext2 in1 source
		20.09 Ext2 in2 source
		20.10 Ext2 in3 source
Unit:	PID unit 1 (PID customer unit). Sets the text shown as the unit for setpoint, feedback and deviation.	
PID status:	View process PID status.	40.06 Process PID
i ib status.	view process i ib status.	status word
Feedback:	View or configure process PID feedback, ie, the measured value.	40.02 Process PID feedback actual
	induction value.	40.08 Set 1 feedback 1
		source
		40.11 Set 1 feedback filter time
Setpoint:	View or configure the process PID setpoint, ie, the	40.03 Process PID
	target process value.	setpoint actual 40.16 Set 1 setpoint 1
	You can also use a constant setpoint value instead	source
	of (or in addition to) an external setpoint source.	40.26 Set 1 setpoint min
	When a constant setpoint is active, it overrides the	40.27 Set 1 setpoint
	normal setpoint.	max .
Tuning	The <b>Tuning</b> submenu contains settings for gain,	40.04 Process PID deviation actual
	integration time and derivation time.	40.32 Set 1 gain
	1. Make sure it is safe to start the motor and run the	40.33 Set 1 integration
	actual process.	time
	2. Start the motor in remote control.	40.34 Set 1 derivation time
	3. Change setpoint by a small amount.	40.35 Set 1 derivation
	4. Watch how feedback reacts.	filter time
	5. Adjust gain/integration/derivation.	
	6. Repeat steps 3-5 until feedback reacts as	
	desired.	
Increase output:	Select whether deviation means "feedback minus setpoint" or "setpoint minus feedback":	40.31 Set 1 deviation inversion
	Feedback < Setpoint: Drive increases motor	
	speed when feedback signal is below setpoint.	
	Examples: Supply fan or pump.	
	<ul> <li>Feedback &gt; Setpoint: Drive increases motor</li> </ul>	
	speed when feedback signal is greater than	
	setpoint. Example: Cooling tower.	

Menu item	Description	Corresponding parameter
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
Sleep function	stopping the motor during low demand. By default, sleep function is disabled. If enabled, the motor	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

## Multipump control





Multipump (IPC, intelligent pump control) systems allows up to 8 drives to be connected to each other. This menu contains programming assistants for load sharing, balancing the run time between the pumps and keeping each pump running optimally.

If the active pumps cannot meet the demand, the system automatically starts or stops pumps one by one. Pump order can be set by the efficiency class of each pump (e.g. pumps with high efficiency are primarily used) or in order to balance the runtime (pumps which run the least, start first). This saves energy and extends the pump life time.

See also section Pump control features on page 99.

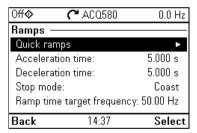
The table below provides detailed information about the available setting items in the Multipump control submenu.

Menu item	Description	Corresponding parameter
ĂPumping mode	Selects the pumping mode.  Off  Intelligent pump control (IPC)  Level control (filling) (LC)  Level control (emptying) (LC)  Single pump control (PC)  Soft pump control (SPC)	76.21 Multipump configuration
For intelligent pump control (IPC) and level control (LC): Pump node number	Node number:	76.22 Multipump node number
For intelligent pump control (IPC) and level control (LC): 121 configuration / Multipump comms (I2I) link	Selects if EFB or FMBA-01 via FBA is used for communication.	76.24 IPC communication port
For intelligent pump control (IPC) and level control (LC): Settings for this pump	Drive name Node number Can be master Prefer this pump	76.22 Multipump node number 76.23 Master enable 76.77 Pump priority
For intelligent pump control (IPC) and level control (LC): Shared settings	XSynchronization settings Total number of pumps Efficient speed Always run at least: 1 pumps (for IPC) Never run more than: 8 pumps (for IPC) Start/stop from: (for level control) Level feedback (for level control)	76.25 Number of motors 76.53 LC efficient speed 76.26 Min number of motors allowed 76.27 Max number of motors allowed
	Measured level Measured level % Level source Al1 scaling Al2 scaling Level unit	76.05 Measured level 76.06 Measured level % 76.51 LC level source 76.52 LC level unit

Menu item	Description	Corresponding parameter
For intelligent pump	Start/stop speeds (for IPC) /	
control (IPC) and	Start/stop levels (for level control)	
level control (LC):	Start 2nd pump at:	76.30 Start point 1
Shared settings		 76.36 Start point 7
	Start xth pump at: (as an example x = 4 = Total number of pumps)	76.41 Stop point 1
	Stop xth pump at:	76.47 Stop point 7
	Stop Xtii puilip at.	
	 Otan 4.4 managa at	
	Stop 1st pump at:	76.55 Start delay
	Run full speed at: (for level control)	76.56 Stop delay
	Maximum time between levels: (for level control)	
	Transition smoothing (for IPC)	76.70 PFC Autochange 76.72 Maximum wear
	Ignore demand spikes under	imbalance
	Ignore demand dips under	76.76 Max stationary
	Autochange	time
	Autochange triggered by: Even wear	76.73 Autochange level
	Maximum wear imbalance: 10.00 h	
	Maximum stationary time: 0.0 h	
	Autochange only below: 45 Hz (for IPC)	
	PID control (for IPC)	
	See PID control submenu on page 55.	
For single pump	Number of motors:	76.25 Number of motors
control (PC):	Include drive motor	76.59 PFC contactor
Configure pump		delay
control I/O	Contactor delay	10.24 RO1 source 10.27 RO2 source
33.11.51.17.5	Configure RO:s	10.30 RO3 source
	PC2 is controlled by:	15.07 RO4 source
		15.10 RO5 source
	PC6 is controlled by:	15.13 RO6 source
	Configure interlocks	76.81 PFC 1 interlock
	PC1 is interlocked by:	76.82 PFC 2 interlock
		76.83 PFC 3 interlock
	PC6 is interlocked by	76.84 PFC 4 interlock
	Check I/O configuration	76.85 PFC 5 interlock 76.86 PFC 6 interlock
	See I/O menu on page 74.	. s.ss i i o o monoun

Menu item	Description	Corresponding parameter
For soft pump control	PC Start, stop, reference	
(SPC):	Secondary auto control location	
Configure pump	Start/stop from:	
control	Reference from:	
	Configure Process PID:	
	See PID control submenu on page 55.	
	Aux motors started at:	
	Aux motors stopped at:	
	Start delay:	76.55 Start delay
	Stop delay:	76.56 Stop delay
For single pump	Autochange triggered by:	76.70 PFC Autochange
control (PC) and for soft pump control (SPC): Configure Autochange	Fixed interval: (for fixed interval)	76.71 PFC Autochange interval
	Maximum wear imbalance: (for even wear)	76.72 Maximum wear
	Autochange allowed below:	imbalance

## Ramps



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

See also section Ramps on page 136.

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

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

Menu item	Description	Corresponding parameter
Quick ramps	The quick ramp function allows you to use two additional ramp sets to accelerate or decelerate the pump.  See also section Ramps – Quick ramps on page 127.	82.01 Quick ramp accel. mode 82.05 1st quick ramp accel. time 82.06 Final quick ramp decel. time 82.07 1st quick ramp accel. limit 82.10 2nd quick ramp accel. time 82.11 2nd quick ramp decel. time 82.12 2nd quick ramp decel. time 82.12 2nd quick ramp decel. time
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
Stop mode:	Sets how the drive stops the motor.	21.03 Stop mode
Ramp time target frequency:	Sets the maximum frequency for acceleration = the initial frequency for deceleration. For scalar control mode.	46.02 Frequency scaling
Ramp time target speed:	Sets the maximum speed for acceleration = the initial speed for deceleration. For vector control mode	46.01 Speed scaling

#### Limits

Off <b>�</b>	<b>~</b> ACQ580	0.0 Hz
Limits —		
Minimum	frequency:	0.00 Hz
Maximum	frequency:	50.00 Hz
Maximum	current:	2.92 A
Back	14:37	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. See section Fieldbus on page 62.

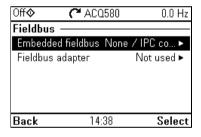
See also section *Limits* on page 142.

Note: These limit parameters have no effect on ramps.

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

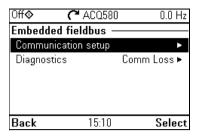
Menu item		Corresponding parameter
Minimum frequency:	Sets the minimum operating frequency. Affects scalar control only.	30.13 Minimum frequency
Maximum frequency:	poto the maximum operating mediation, miceta	30.14 Maximum frequency
Minimum speed:	Sets the minimum operating speed. Affects vector control 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

# Fieldbus

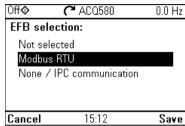


Use the Fieldbus menu to set up and view communication through embedded fieldbus or fieldbus adapter.

#### Embedded fieldbus



O <b>H⊘</b>	<b>(~</b> ACQ580	0.0 Hz
Communi	cation setup	
EFB selec	tion:	Not selected
Back	15:11	Edit



Use the settings in the **Embedded fieldbus** submenu to use the drive with the Modbus RTU protocol.

You can also configure all the embedded fieldbus related settings via the parameters (parameter group 58 Embedded fieldbus), but the purpose of the Embedded fieldbus submenu is to make the protocol configurations easier.

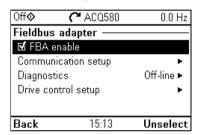
See also chapter Fieldbus control through a fieldbus adapter on page 229.

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

Menu item	Description	Corresponding parameter
EFB selection	Select the protocol you want to use.	58.01 Protocol enable
Communication setup	To set up communication between the drive and the fieldbus master, define these settings and then select Apply settings to embedded fieldbus module.	58 Embedded fieldbus 58.03 Node address (Station ID) 58.04 Baud rate Modbus RTU: 58.05 Parity Modbus RTU: 58.25 Control profile 58.15 Communication loss mode 58.16 Communication loss time 58.06 Communication

Menu item	Description	Corresponding parameter
Diagnostics	Diagnose embedded fieldbus communication, such as status, load of communication and message counters.	58.07 Communication diagnostics
	<ul> <li>Actual status:</li> <li>Status value:</li> <li>EFB data from client</li> <li>View what the drive EFB receives from the fieldbus master (PLC/SCADA).</li> </ul>	58.08 Received packets 58.11 UART errors 58.12 CRC errors 58.18 EFB control word 03.09 EFB reference 1
	<ul> <li>EFB data to client</li> <li>View what the drive EFB sends to the fieldbus master (PLC/SCADA).</li> </ul>	58.09 Transmitted packets 58.19 EFB status word

## Fieldbus adapter



Use the settings in the Fieldbus adapter submenu to use the drive with the following fieldbus protocols, shown with the optional fieldbus adapter module required:

- CANopen: FCAN-01 adapter
- DeviceNet: FDNA-01 adapter
- Ethernet/IP: FEIP-21 adapter, FENA-21 adapter
- ModbusTCP: FMBT-21 adapter, FENA-21 adapter
- PROFIBUS-DB: FBPA-01 adapter
- PROFINET IO: FPNO-21 adapter, FENA-21 adapter
- Ethernet/IP: FENA-21 adapter

Check the supported fieldbus modules with your ABB representative.

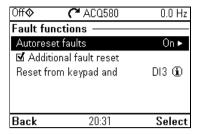
You can also configure all the fieldbus related settings via the parameters (parameter groups 50 Fieldbus adapter (FBA), 51 FBA A settings, 52 FBA A data in, 53 FBA A data out, 58 Embedded fieldbus, but the purpose of the Fieldbus adapter submenu is to make the protocol configurations easier.

See also chapter Fieldbus control through a fieldbus adapter on page 259.

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

Menu item	Description	Corresponding parameter
Fieldbus adapter	FBA enable: Select this if you want to use the drive with a fieldbus adapter.	50.01 FBA A enable
Communication setup	Select the module (protocol).  To set up communication between the drive and the fieldbus master, define these settings and then select Apply settings to fieldbus module.	51.01 FBA A type 58.01 Protocol enable 51 FBA A settings 51.01 FBA A type 51.02 FBA A Par2 51.27 FBA A par refresh 51.31 D2FBA A comm status 50.13 FBA A control word 50.16 FBA A status
Diagnostics	Diagnose fieldbus communication, such as status, load of communication and message counters.  Information on FBAA data from master and to master.	word 51.27 FBA A par refresh
Drive control setup	Sets how a fieldbus master can control this drive, and how the drive reacts if the fieldbus communication fails.  Define these settings and then select Apply settings to fieldbus module.	20.01 Ext1 commands 19.11 Ext1/Ext2 selection 22.11 Ext1 speed ref1 28.11 Ext1 frequency ref1 22.41 Speed ref safe 22.41 Frequency ref safe 50.03 FBA A comm loss t out 46.01 Speed scaling 46.02 Frequency scaling 23.12 Acceleration time 1 28.73 Freq acceleration time 1 28.73 Freq deceleration time 1 51.27 FBA A par refresh

## **Fault functions**



The Fault functions submenu contains settings for resetting faults automatically or manually.

Menu item	Description	Corresponding parameter
Autoreset faults	Reset faults automatically. For more information, see section <i>Sleep and boost functions for process PID control</i> on page 139.	31.12 Autoreset selection 31.14 Number of trials 31.15 Total trials time 31.16 Delay time
Additional fault reset	You can reset an active fault via I/O: a rising pulse in the selected input means reset.	31.11 Fault reset selection
	A fault can be reset from the fieldbus even if <b>Reset</b> faults manually is unselected.	
Reset from keypad and	Define from where you want to reset faults manually. Note that this submenu is active only if you have selected to reset faults manually.	31.11 Fault reset selection
If EFB communication fails:	Define action to be taken if EFB communication fails.	58.14 Communication loss action
If EFB communication under monitoring:	Define which message types reset the timeout counter for detecting an EFB communication loss.	58.15 Communication loss mode
Ignore EFB failures shorter than:	Define a timeout for EFB communication. If a communication break lasts longer than the timeout, the action specified in <i>If EFB communication fails:</i> is taken.	58.16 Communication loss time

## Security



The Security submenu is a protected menu that you can open with the user pass code. The menu lets you prevent actions and functionalities with the user lock. You can also change the user lock pass code.

See also section *User lock* on page 187.

Menu item	Description	Corresponding parameter
Unlock this menu / Lock this menu	You have to enter the user passcode to unlock the menu. The default passcode is "10000000". While you have the user lock open, warning A6B0 User lock is open is active.	96.02 Pass code
	After making your changes in the menu, select row Lock this menu and press <b>Select</b> .	
Lock all parameters		96.102 User lock
Disable backup and restore		functionality
Disable OEM access level		
Disable ABB access level		
Disable file download		
XChange security passcode	<b>Note:</b> You must change the default user pass code to maintain a high level of cybersecurity. Store the code in a safe place – <b>ABB CANNOT UNLOCK THE</b>	96.02 Pass code 96.100 Change user pass code
	DRIVE ONCE YOU CHANGE THE PASS CODE.	96.101 Confirm user pass code
	Enter first the new passcode and then re-enter the new passcode to confirm it.	pass code

#### **Advanced functions**



The Advanced functions submenu contains settings for advanced functions, such as triggering or resetting custom faults via I/O, signal supervision, using the drive with timed functions, or switching between several entire sets of settings. In addition you can run the First start assistant from this submenu.

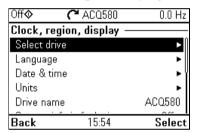
The table below provides detailed information about the available setting items in the Advanced functions submenu.

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.  For more information, see section <i>External events</i> on page 130.	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 31.07 External event 4 source 31.08 External event 4 type 31.09 External event 5 source 31.10 External event 5 type

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 423.  For more information, see section Signal supervision on page 176.	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 hysteresis 32.25 Supervision 3 function 32.26 Supervision 3 action 32.27 Supervision 3 signal 32.29 Supervision 3 low 32.30 Supervision 3 high 32.31 Supervision 3 hysteresis
Timed functions	Enables using the drive with timed functions. For complete settings, see group 34 Timed functions on page 436.  For more information, see section Timed functions on page 132.	34.100 Timed function 1 34.101 Timed function 2 34.102 Timed function 3 34.111 Boost time activation source 34.112 Boost time duration 34.11 Timed functions enable 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
User sets	This submenu enables you to save four sets of settings for easy switching.  For more information about user sets, see section Data storage parameters on page 186.	96.11 User set save/load 96.10 User set status 96.12 User set I/O mode in1 96.13 User set I/O mode in2

Menu item	Description	Corresponding parameter
Confirmation for HAND/OFF	Selects if you want to add confirmation for Hand and Off buttons so that they need to be pressed twice within five seconds to operate. The control panel shows a message about pressing twice after the first press.	
	This selection can be used to prevent accidental Hand and Off button presses.	
	If Hand and/or Off buttons are disabled with parameters 19.18 HAND/OFF disable source and 19.19 HAND/OFF disable action, this setting has no effect.	
Energy optimizer:	Enables/disables the energy optimization function.	45.11 Energy optimizer

## 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 submenu.

Menu item	Description	Corresponding parameter
Select drive	If more than one drive is connected to this control panel, select the drive to be controlled here.  To see the other drives, set <i>Panel bus</i> to <i>On</i> and enable networking in the parameters of each drive.	
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
	Available languages vary depending on the drive firmware language package installed: Standard language package, European language package or Asian language package. Parameter 07.10 Language file set shows the language package in use.	
Date & time	Set the time and date, and their formats.	

Menu item	Description	Corresponding parameter
Units	Select the units used for power, temperature,	96.16 Unit selection
	torque and currency.	
Drive name	The drive name defined in this setting is shown in the PC tool and at the status bar at the top of the control panel 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 control panel screen (in addition to the fault-specific information).	
Edit texts	Set the drive name, adjust currency unit and PID unit, and edit Start interlocks 14, Run permissive, Signal supervisions 13, External events 13, Contact info.	
Display settings	Adjust the brightness, contrast and display power save delay of the control panel screen or to invert white and black.	
Show in lists	Show or hide the numeric IDs of:	
	parameters and groups	
	option list items	
	• bits	
	<ul> <li>devices in Options &gt; Select drive</li> </ul>	
Edit Home view	Select the parameters displayed in the Home view, with display style, decimals, name, unit, minimum and maximum.	
Show inhibit pop-up	Enables or disables pop-up views showing information on inhibits, for example, when you try to start the drive but it is prevented.	

## Reset to defaults



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

Menu item	Description	Corresponding parameter
Reset fault and event logs	Clears all events from the drive's fault and event logs.	96.51 Clear fault and event logger
Reset home view layout	Restores the home view layout back to show the values of the default parameters defined by the selected control macro.	96.06 Parameter restore, selection Reset home view
Reset non-HW parameters	Restores all editable parameter values to default values, except  motor data and ID run results  I/O extension module settings  end user texts, such as customized warnings and faults, and the drive name  control panel/PC communication settings  fieldbus adapter settings  parameter 95.01 Supply voltage  parameters 95.20 HW options word 1 and 95.21 HW options word 2  user lock configuration parameters 96.10096.102.	96.06 Parameter restore, selection Restore defaults
Reset all fieldbus settings	Restores all fieldbus and communication related settings to default values.  Note: Fieldbus, control panel and PC tool communication are interrupted during the restore.	96.06 Parameter restore, selection Reset all fieldbus settings
Reset motor data and ID run results	Restores all motor nominal values and motor ID run results to default values.	96.06 Parameter restore, selection Reset motor data

Menu item	Description	Corresponding parameter
Reset all parameters	Restores all editable parameter values to default values, except	96.06 Parameter restore, selection Clear all
	<ul> <li>end user texts, such as customized warnings and faults, and the drive name</li> </ul>	
	control panel/PC communication settings	
	• parameter 95.01 Supply voltage	
	<ul> <li>differentiated defaults implemented by parameters 95.20 HW options word 1 and 95.21 HW options word 2 and the differentiated</li> </ul>	
	defaults implemented by them	
	• user lock configuration parameters 96.10096.102	
	<ul> <li>group 49 Panel port communication parameters.</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
	<b>Note:</b> PID unit is reset only if it is user editable text, that is, parameter 40.79 Set 1 units is set to User text.	
Reset first start	Resets the first start assistant so that at the next	
assistant	time drive is powered on the first start assistant is shown.	
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>parameters 95.20 HW options word 1 and 95.21 HW options word 2 and the differentiated defaults implemented by them.</li> </ul>	,

## I/O menu

Off <b>�</b>	<b>~</b> ACQ580	0.0 Hz
1/0		
DI1: 1	Sta	art/stop ►
DI2: 0	V	lot used ►
DI3: 0	Used in severa	l places ►
DI4: 0	N	lot used ►
DI5: 1	N	lot used ►
D10 -		I
Back	15:54	Select

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?

You can configure, add and remove use of inputs and outputs.

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 Al2 as input.	
RO1	This submenu lists what information goes into relay output 1.	
RO2	This submenu lists what information goes into relay output 2.	
RO3	This submenu lists what information goes into relay output 3.	
AO1	This submenu lists what information goes into AO1.	
AO2	This submenu lists what information goes into AO2.	
I/O extension	This submenu has the following submenus:	
RO4	This submenu lists what information goes into relay output 4.	

Menu item	Description	
RO5	This submenu lists what information goes into relay output 5.	
RO6	This submenu lists what information goes into relay output 6.	
RO7	This submenu lists what information goes into relay output 7.	
DO1	This submenu lists what information goes into digital output 1.	

# 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.

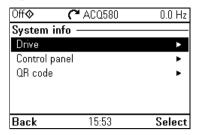
To clear the fault and event logger, select Menu > Primary settings > Reset to defaults > Reset fault and event logs, or set parameter 96.51 Clear fault and event logger to value Reset.

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

Menu item	Description	
Drive actual values	Shows actual values: 01.01 Motor speed used, 01.06 Output frequency, 01.07 Motor current, 01.10 Motor torque, 01.11 DC voltage, 01.13 Output voltage, 01.14 Output power, 06.01 Main control word, 06.11 Main status word, 19.01 Actual operation mode, 05.01 On-time counter, 05.02 Run-time counter, 05.04 Fan on-time counter, 05.10 Control board temperature, 05.11 Inverter temperature, 35.01 Motor estimated temperature, 35.02 Measured temperature 1, 35.03 Measured temperature 2, 40.01 Process PID output actual, 40.02 Process PID feedback actual, 40.03 Process PID setpoint actual, 40.04 Process PID deviation actual, 40.07 Process PID operation mode.	
Active faults	This view shows the currently active faults and provides instructions on how to fix and reset them.	
Active warnings	This view shows the currently active warnings and provides instructions on how to fix them.	
Active inhibits	This view shows up to five simultaneous active start inhibits and how to fix them.	
Fault & event log	This view lists the faults, warnings and other events that have occurred the drive.	
	Press <b>Details</b> to see, for each stored fault, the fault code, time and values of nine parameters (actual signals and status words) stored at the time of the fault. The values of the parameters for the latest fault are in parameters 05.8005.89.	

Menu item	Description	
Start, stop, reference summary	This view shows where the drive is currently taking its start and stop commands and reference. The view is updated in real time.	
	If the drive is not starting or stopping as expected, or runs at an undesired speed, use this view to find out where the control comes from.	
Limit status	This view describes any limits currently affecting operation.	
	If the drive is running at undesired speed, use this view to find out if any limitations are active.	
Load profile	This view shows results of the load analyzer. Amplitude loggers show load distribution diagrams: how much of the drive's running time was spent at each load level. The peak value logger lists maximum momentary load levels.	
Communication status	This view provides status information and sent and received data from fieldbus for troubleshooting.	
Motor summary	This view provides motor information: nominal values, control mode and whether ID run has been completed.	

# System info menu



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

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

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

Menu item	Description	Corresponding parameter
Drive	Panel bus id:	
	Serial number:	
	Manufacturing date:	
	Product name:	
	Product type:	
	LP version:	07.07 Loading package
	Backup version:	version 07.05 Firmware version
	FW version:	or.oor innware version
	<b>Note:</b> If no data was loaded in the factory, some information (for example, serial number) will not appear in the drive information.	
Control panel	Product type:	
	HW version:	
	FW version:	
	Serial number:	
	Manufacturing date:	
QR code	The drive generates a QR code (or a series of QR codes), which contains drive identification data, information on the latest events, and values of status and counter parameters. You can read the QR code with a mobile device containing the ABB application, which then sends the QR code to ABB for analysis.	

# **Energy efficiency menu**

Off <b>♦ (~</b> A	CQ580	0.0 Hz
Energy efficiend	;у ———	
Total energy save	ed 0.0	kWh►
Used, last hour	0.00	kWh▶
Used, last day	0.00	kWh►
Used, last month	0.00	kWh⊳¦
Used, total	0.0	kWh►
F 1		<u> </u>
Back	15:53	Select

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

Use the **Energy efficiency** menu to view energy and power values, view and change settings of the load analyzer (= amplitude and peak value loggers), for example, view graphical representation of the two amplitude loggers, as well as and change energy calculation settings.

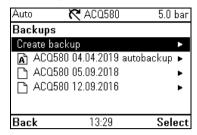
See also sections *Energy efficiency* on page 178 and *Load analyzer* on page 179.

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

Menu item	Description	Corresponding parameter	
Total energy saved	Energy saved in kWh compared to direct-on-line motor connection.	45.04 Saved energy 45.07 Saved amount	
	Corresponding money saved.	45.10 Total saved CO2	
	Corresponding CO <sub>2</sub> saved.		
Used, last hour	Energy used during the last hour (the last 60 minutes).	45.26 Hourly total energy (resettable)	
	Average power during the last hour (value of 45.26 divided by one hour).		
Used, last day	sed, last day  Energy used during the previous day (between midnight of the previous day and midnight of the present day).		
	Average power during the last day (value of 45.30 divided by 24 hours).		
Used, last month	I, last month Energy used during the previous month (between midnight of the first day or the previous month and midnight of the first day of the present month).		
	Average power during the last month (value of 45.30 divided by 732 hours).		
Used, total	All-time total used energy	01.54 Cumulative	
	Resettable total used energy	inverter energy 01.58 Cumulative inverter energy (resettable)	

Menu item	Description	Corresponding parameter
Peak power	Hourly peak power (during the last 60 minutes) Time of the hourly peak power Daily peak power (during the previous day) Time of the daily peak power Monthly peak power (during the previous month) Time of the monthly peak power Date of the monthly peak power All-time peak power Time of all time peak power Date of all time peak power	45.24 Hourly peak power value 45.25 Hourly peak power time 45.27 Daily peak power value (resettable) 45.28 Daily peak power time 45.31 Monthly peak power value (resettable) 45.33 Monthly peak power time 45.32 Monthly peak power date 45.36 Lifetime peak power value 45.38 Lifetime peak power time 45.37 Lifetime peak power time 45.37 Lifetime peak power time 45.38 Lifetime peak power time
Load profile	Motor current logger (graphical representation) Load profile logger (graphical representation) These loggers show load distribution diagrams: how much of the drive's running time was spent at each load level. Load profile configuration Peak value logger The peak value logger lists maximum momentary load levels.	36.06 AL2 signal source 36.07 AL2 signal scaling 36.09 Reset loggers 36.01 PVL signal source 36.02 PVL filter time 36.10 PVL peak value 36.11 PVL peak date 36.12 PVL peak time 36.13 PVL current at peak 36.14 PVL DC voltage at peak 36.15 PVL speed at peak 36.16 PVL reset date 36.17 PVL reset time
Calculation settings	Energy optimizer Energy tariff 1 Energy tariff 2 Tariff selection CO <sub>2</sub> conversion Comparison power Reset saved energy counters	45.11 Energy optimizer (Disable or Enable) 45.12 Energy tariff 1 45.13 Energy tariff 2 45.14 Tariff selection 45.18 CO2 conversion factor 45.19 Comparison power 45.21 Energy
	Reset total used counter	calculations reset Enter 0 to 01.58 Inverter kWh counter (resettable)

# Backups menu

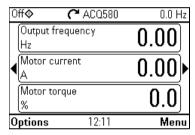




To go to the **Backups** menu from the Home view, select **Backups**.

For backups and restores, see section Backup and restore on page 185.

# **Options menu**





To go to the **Options** menu, press the **Options** softkey () in any of the Home view displays. The table below provides information about the different options available in the **Options** menu.

Menu item	Description	Description
Reference	You can change the reference, which is visible on the top right corner of	
	the panel displays.	
Direction change	Alters the sign of active reference between positive and negative.	
	Absolute value of reference is not changed.	
Select drive	You can select a drive that you want to monitor or control from the list of	
	drives showing the drives connected on the	e panel bus. You can also clear
	the list of drives.	

Menu item	Description	Description	
Edit Home view	<ul><li>to the Home view you want which of the current parameter(s)</li></ul>	plays. Scroll with the arrow keys ( and to edit. Select the display slot, that is, ) you want to edit (Home views show one arameter and how you want to display it.	
		00 00	
	A	<del></del>	
	Auto C ACQ580 8  Display slot — Motor ct	81.1 °C  urrent ()	
		meric 2	
	Min: 0	0.00 A	
	<b>Done</b> 13:57	Edit	
Active faults	Shows the active faults.		
Active warnings	Shows the active warnings.	Shows the active warnings.	
Active inhibits	Shows the active inhibits.	Shows the active inhibits.	

# **Default I/O configuration**

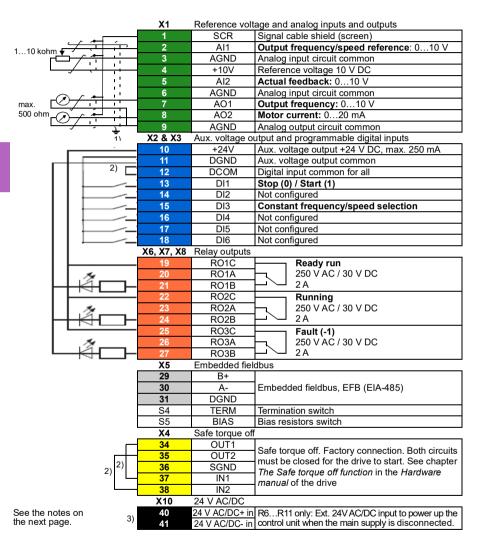
# Contents of this chapter

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

## Water default

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

#### Default control connections for the Water default



#### Terminal sizes:

R1...R5: 0.2...2.5 mm<sup>2</sup> (24...14 AWG): Terminals +24V, DGND, DCOM, B+, A-, DGND, Fxt 24V 0.14...1.5 mm<sup>2</sup> (26...16 AWG): Terminals DI. AI. AO. AGND. RO. STO

R6...R11:0.14...2.5 mm<sup>2</sup> (26...16 AWG): All terminals

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

#### Notes:

- 1) Ground the outer shield of the cable 360 degrees under the grounding clamp on the grounding shelf for the control cables.
- <sup>2)</sup> Connected with jumpers at the factory.
- 3) Only frames R6...R11 have terminals 40 and 41 for external 24 V AC/DC input.

## Input signals

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

#### **Output signals**

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



# Program features

# What this chapter contains

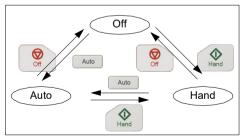
This chapter describes some of the more important functions within the control program, how to use them and how to program them to operate. It also explains the control locations and operating modes.

## Local control vs. external control

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

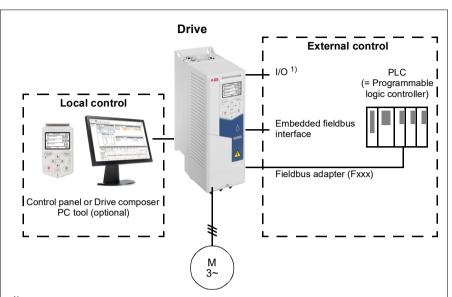
In the Off mode, the drive is stopped. In the Hand mode, the drive is running. The initial reference in the Hand mode is copied from the drive reference.

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



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

Note: If fault 7081 Control panel loss is active and the drive is powered down, the mode changes to Auto when power is reapplied.



1) Extra inputs/outputs can be added by installing an optional I/O extension module (CMOD-01, CMOD-02, CHDI-01, CPTC-02, or CAIO-01) in drive slot.

#### Local control

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

- the control panel keypad
- a PC equipped with Drive composer PC tool.

Speed control mode is available in vector motor control mode; frequency mode is available when scalar motor control mode is used.

Local control is mainly used during commissioning and maintenance. The control panel always overrides the external control signal sources when used in local control. Changing the control location to local can be prevented by parameter 19.18 HAND/OFF disable source.

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

#### External control

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

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

Two external control locations, EXT1 and EXT2, are available. The user can select the sources of the start and stop commands separately for each location by setting parameters 20.01 Ext1 commands...20.09 Ext2 in2 source. The operating mode can be selected separately for each location, which enables guick switching between different operating modes, for example, speed and process PID control. Selection between EXT1 and EXT2 is done via any binary source such as a digital input or fieldbus control word (parameter 19.11 Ext1/Ext2 selection). The source of reference is selectable for each operating mode separately.

#### Communication fail functionality

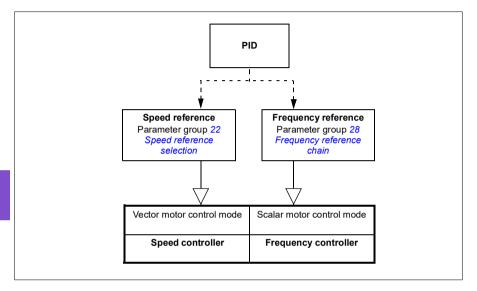
The communication fail functionality ensures continuous process without interruptions. If there is a communication loss, the drive automatically changes the control location from EXT1 to EXT2. This enables process to be controlled, for example, with the drive PID controller. When the original control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

#### Settings

 Parameters 19.11 Ext1/Ext2 selection (page 361); 20.01 Ext1 commands...20.09 Ext2 in2 source (page 362).

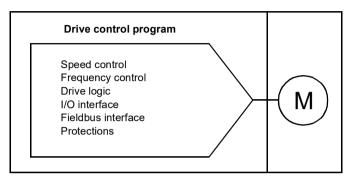
# Operating modes of the drive

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.



# Drive configuration and programming

The drive control program performs the main control functions, including speed 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 default configurations

Default configurations are predefined I/O configurations. See chapter Default I/O configuration (page 83).

## Configuring via menus

The drive can be configured using the **Primary settings** and other menus on the control panel. They effectively change parameters but they guide you with assistants, and you do not have to know the parameter names and numbers. See chapter Settings, I/O and diagnostics on the control panel (page 45).

## 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* (see page 35)
- 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) (see page 229) and Fieldbus control through a fieldbus adapter (see page 259).

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

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

## Adaptive programming

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

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

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

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

#### **Example:**

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

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

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

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

Inputs available to the adaptive program				
Input	Source			
Status				
Enabled	06.16 Drive status word 1, bit 0			
Inhibited	06.16 Drive status word 1, bit 1			
Ready to start	06.16 Drive status word 1, bit 3			
Tripped	06.11 Main status word, bit 3			
At setpoint	06.11 Main status word, bit 8			
Limiting	06.16 Drive status word 1, bit 7			
Ext1 active	06.16 Drive status word 1, bit 10			
Ext2 active	06.16 Drive status word 1, bit 11			
Data storage				
Data storage 1 real32	47.01 Data storage 1 real32			
Data storage 2 real32	47.02 Data storage 2 real32			
Data storage 3 real32	47.03 Data storage 3 real32			
Data storage 4 real32	47.04 Data storage 4 real32			

Output	Target	
1/0	1 - 3	
RO1	10.24 RO1 source	
RO2	10.27 RO2 source	
RO3	10.30 RO3 source	
AO1	13.12 AO1 source	
AO2	13.22 AO2 source	
Start control		
Ext1/Ext2 selection	19.11 Ext1/Ext2 selection	
Ext1 in1 cmd	20.03 Ext1 in1 source	
Ext1 in2 cmd	20.04 Ext1 in2 source	
Ext2 in1 cmd	20.08 Ext2 in1 source	
Ext2 in2 cmd	20.09 Ext2 in2 source	
Fault reset	31.11 Fault reset selection	
Speed control	<u> </u>	
Ext1 speed reference	22.11 Ext1 speed ref1	
Speed proportional gain	25.02 Speed proportional gain	
Speed integration time	25.03 Speed integration time	
Acceleration time 1	23.12 Acceleration time 1	
Deceleration time 1	23.13 Deceleration time 1	
Frequency control	<u> </u>	
Ext1 frequency reference	28.11 Ext1 frequency ref1	
Events	·	
External event 1	31.01 External event 1 source	
External event 2	31.03 External event 2 source	
External event 3	31.05 External event 3 source	
External event 4	31.07 External event 4 source	
External event 5	31.09 External event 5 source	
Data Storage		
Data storage 1 real32	47.01 Data storage 1 real32	
Data storage 2 real32	47.02 Data storage 2 real32	
Data storage 3 real32	47.03 Data storage 3 real32	

Outputs available to the adaptive program				
Output	Target			
Data storage 4 real32	47.04 Data storage 4 real32			
Process PID				
Set 1 setpoint 1	40.16 Set 1 setpoint 1 source			
Set 1 setpoint 2	40.17 Set 1 setpoint 2 source			
Set 1 feedback 1	40.08 Set 1 feedback 1 source			
Set 1 feedback 2	40.09 Set 1 feedback 2 source			
Set 1 gain	40.32 Set 1 gain			
Set 1 integration time	40.33 Set 1 integration time			
Set 1 tracking mode	40.49 Set 1 tracking mode			
Set 1 track reference	40.50 Set 1 tracking ref selection			

#### Adaptive program fault and aux code formats

The format of the aux code:

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

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

See fault 64A6 Adaptive program on page 215.

#### Sequence program

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

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

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

## Control interfaces

## Programmable analog inputs

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

#### Settinas

Parameter group 12 Standard AI (page 325).

## Programmable analog outputs

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

#### Settings

Parameter group 13 Standard AO (page 331).

## Programmable digital inputs and outputs

The control unit has six digital inputs.

Digital input DI5 can be used as a frequency input.

Digital input DI6 can be used as a thermistor 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.

## Settinas

 Parameter groups 10 Standard DI, RO (page 314) and 11 Standard DIO, FI, FO (page 324).

# Programmable frequency input and output

Digital input DI5 can be configured as a frequency input.

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

#### Settings

 Parameter groups 10 Standard DI, RO (page 314) and 11 Standard DIO, FI, FO (page 324).

# 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 314).

## Programmable I/O extensions

Inputs and outputs can be added by using a CMOD-01 or CMOD-02 multifunction extension module, a CHDI-01 115/230 V digital input extension module, or a CAIO-01 analog input and output 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, CMOD-02, CHDI-01, and CAIO-01 modules.

Location	Digital inputs (DI)	Digital outputs (DO)	Analog inputs (AI)	Analog outputs (AO)	Relay outputs (RO)
Control unit	6	-	2	2	3
CMOD-01	-	1	-	-	2
CMOD-02	-	-	-	-	1 (non- configurable)
CHDI-01	6 (115/230 V)	-	-	-	2
CAIO-01	-	-	3	2	-

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

The CMOD-02 offers, in addition to the relay output (non-configurable), a +24VDC/AC input and a thermistor input.

CAIO-01 analog inputs are bipolar whereas analog outputs are unipolar.

**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.

**Note:** With the CHDI, you can use up to six additional digital inputs. The CHDI does in no way affect the fixed digital inputs on the control board.

**Note**: With any extension IO module connected/selected in parameter 15.01 (*Extension module type*), only the corresponding module parameters will be visible in group 15.

## **Settings**

Parameter group 15 I/O extension module (page 337), 15 I/O extension module (page 337)

#### 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 229) and Fieldbus control through a fieldbus adapter (page 259).

#### Settinas

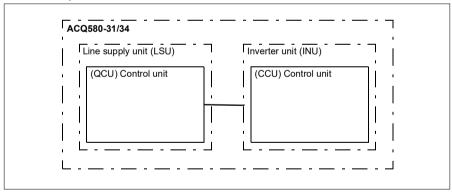
 Parameter groups 50 Fieldbus adapter (FBA) (page 494), 51 FBA A settings (page 498), 52 FBA A data in (page 500), and 53 FBA A data out (page 500) and 58 Embedded fieldbus (page 501).

## Control of a line supply unit (LSU)

#### Overview

This feature is only supported for ACQ580-31 and ACQ580-34 drives.

ACQ580-31 and ACQ580-34 drives consist of one line supply unit (LSU) and one inverter unit (INU). The control units of the supply unit and the inverter unit are connected by an internal communication bus.



The supply unit can be controlled through the inverter unit. For example, the inverter unit can send a control word and references to the supply unit, enabling the control of both units from the interfaces of one control program.

It is possible to send a DC voltage and/or reactive power reference to the supply unit (if there is enough capacity) from the inverter parameter group 94 LSU control. A supply unit sends actual signals to the inverter unit which are visible in parameter group 01 Actual values.

## Settings

- Parameters in groups:
  - 01 Actual values (page 293): 01.102...01.164
  - 05 Diagnostics (page 300): 05.111...05.121
  - 06 Control and status words (page 303): 06.36...06.39, 06.116...06.118
  - 07 System info (page 312): 07.106...07.107
  - 30 Limits (page 404): 30.101...30.149
  - 31 Fault functions (page 412): 31.120...31.121
  - 96 System (page 553): 96.108 LSU control board boot.
- Parameter groups 60 DDCS communication (page 509), 61 D2D and DDCS transmit data (page 509) and 62 D2D and DDCS receive data (page 509).

# **Pump control features**

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

## Intelligent pump control (IPC)

Multipump/fan systems consist of several pumps or fans, each connected to a separate drive. This arrangement enables a high flexibility in load sharing, balancing the run time between the pumps or fans and keeping each pump or fan running optimally. If the active pumps or fans cannot meet the demand, the system automatically starts pumps or fans one by one. Similarly, if the demand decreases. the system automatically stops pumps or fans one by one in order to keep the remaining pumps or fans running at optimal efficiency.

The IPC system at first increases the first, or lead, pump's speed. If this is not sufficient, the IPC will start lag pump(s) in sequence to meet the process demand. While starting a new pump, the speed of the already running pumps is reduced to allow smooth flow of liquid.

The order of the pumps or fans used can be defined to balance the run time better (pumps or fans that have run the least, start first) or can be set by the efficiency class of each pump or fan (for example, pumps or fans with high efficiency are primarily used).

**Note**: Node numbers of the drives must be sequential starting from 1.

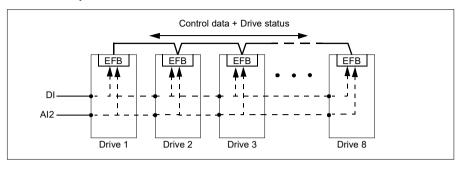
Multipump/fan systems achieve high levels of up-time and reliability, if one pump or fan fails or requires maintenance, other pumps or fans can take over the operation. Efficiency, continuous operation and easy maintenance are reasons why multipump/fan systems can be found in a variety of different applications in the HVAC and W/WW industries.

In the IPC system one drive at a time acts as a master and you can use up to seven follower drives. With a moving master strategy each of the drives in the team can be selected to be eligible as master. The master drive controls the whole multi-pumpsystem and has the following tasks:

- activating and deactivating the follower drives
- regulating the systems speed with its internal PID loop control according to an internal set-point
- processing the I/O signals (set-point and feedback signals).

The IPC system can be enabled using primary settings or parameter 76.21 Multipump configuration.

In an IPC system, the drives communicates through inverter-to-inverter link on embedded fieldbus. Each drive in the system requires a run command for the IPC logic to function and use the drive if needed. By default in Auto mode this is done by using DI1. Note that settings for setpoint and actual value are not copied through the inverter-to-inverter link. These signals must be externally sent to each drive to ensure a redundant system.



#### Starting the IPC system

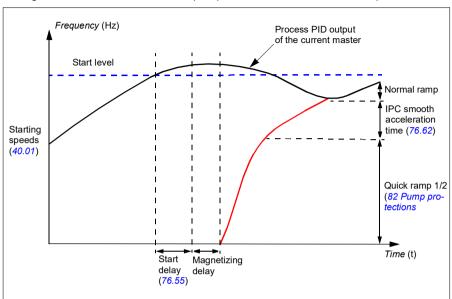
The IPC system starts operation when the drive receives a start command from external control location EXT2 (parameter 20.08 Ext2 in1 source). The start command indicates that the pump is available to the IPC system. However, the system sends the actual start command to the follower drives based on the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

If all drives in the system receive a start command simultaneously, then, by default, the drive with the least run time and that is ready to run, will start as the master drive. See parameter 76.22 Multipump node number. For optimal energy operation, you can combine the PID sleep function with IPC system. For information on PID sleep function, see Sleep and boost functions for process PID control (page 139).

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

#### Smooth pump transitions

The figure below shows the smooth pump transitions with different ramp times.



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

- 1. The IPC system starts a new pump after the start delay time (76.55 Start delay) is elapsed.
- 2. After the motor is magnetized and starts rotating, the new pump accelerates using quick ramp 1 and 2 to reach productive zone (see section Ramps - Quick ramps on page 127).

**Note:** This operation is effective only when quick ramp mode is enabled with parameter 82.01 Quick ramp accel. mode.

The new pump then accelerates to the master speed along IPC smooth ramp time defined with parameter 76.62 IPC smooth acceleration time.

- 3. When a new pump is accelerating, the other pumps decelerate to maintain the stable output of the system, shown as Normal ramp in the diagram.
- 4. After the new pump reaches the speed of the current master pump, the new pump becomes the new master.
- 5. The new master and all the remaining pumps will start to follow the master drive speed defined by the process PID of the master drive.

## **Pump priorities**

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

- High more energy efficient pumps
- Normal less energy efficient pumps
- Low pumps which do not run unless process demands

You can select the pump priority with parameter 76.77 Pump priority. The IPC system prefers high priority pumps over normal and low priority pumps. You can limit the time a pump is not run with parameter 76.76 Max stationary time, so that even the low priority pumps are exercised often enough to keep them in operational condition. Pressure-maintenance pumps (Jockey pumps) should be controlled separately to provide the necessary control.

#### Master-follower change principle

- 1. The master controls the process until the follower has reached the setpoint. There is no master follower change if the setpoint is not achieved.
- This allows, for example, the pump cleaning function for the follower pump at start-up without confusing the system.
- Max stationary time is followed (if that is set).
   This has high priority because it makes sure the pump is kept in good condition and it just does not stay inoperative.
- After checking the max stationary time, the pump priorities are followed.This makes sure the pumps with high priority are operated the most often.
- 4. If none of the above conditions are set, the system tries to balance the operation time between all the pumps.

## Automatic parameter synchronization

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

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

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

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

You can monitor changes in the drive configuration with Parameter checksum calculation, see section Parameter checksum calculation on page 186.

## IPC master autochange

An IPC system consists of several pumps (drives) but has only one active master pump. The master pump controls the IPC system by starting and stopping the follower pumps when necessary, and by sending the reference to all follower pumps over the IPC network.

Usually the pump that was started first is the first active master. If multiple drives are started at the same time, the pump with the smallest node number will be the active master. The autochange feature is used to transfer this master status on the IPC system to the next pump in the specified sequence. This way the autochange will also affect the start order of the follower pumps.

Note: Node numbers of the drives must be sequential starting from 1.

Autochange can be triggered in several ways. The trigger is selected with parameter 76.70 PFC Autochange. These triggers include digital inputs, timed functions, fixed intervals of time, when all pumps are stopped or whenever wear logic determines it is time to change the master. Even when this trigger is active, PID feedback must be at the set point and pump speed must be below parameter 76.73 Autochange level before autochange can occur.

If autochange is not possible because of the above reasons, the system will remember the request and will perform autochange when all the requirements have been fulfilled.

Autochange can be done using two possible sequences: either with even wear or fixed sequence.

For IPC, the default value for parameter 76.70 PFC Autochange is Even wear. If the parameter value is *Not selected* or *Selected*, the system will automatically select Even wear.

If the 76.70 PFC Autochange value is other than Not selected, Selected or Even wear, the fixed sequence will be used. The fixed interval time can be specified with parameter 76.71 PFC Autochange interval.

Even wear is the default value after selecting IPC configuration. With even wear, the master status is transferred to a follower pump fulfilling the necessary requirements. These requirements include (from the highest to the lowest priority):

- maximum stationary time (parameter 76.76)
- pump priority (parameter 76.77)
- maximum wear imbalance (parameter 76.72)
- run time (parameters 77.10...77.18)
- node number (parameter 76.22).

Fixed sequence transfers the master status to the next node number. For example, if pump 1 is the master and the start order is 1-2-3-4, then after autochange pump 2 will be the master and the start order becomes 2-3-4-1. If the next master pump is not running when autochange is triggered, it will be started and master status will be transferred to that pump when it has completed start up ramping.

Note that fixed sequence autochange requires that one pump can be started or that all pumps (the number of pumps equals the maximum pump count) are running before autochange can be done. For example, if you have 8 pumps and the maximum has been set to 3, and 3 pumps are running, autochange will not occur until the third pump is stopped, because otherwise the start order would not be correct (it is not possible to exceed the maximum number of pumps). However, in this example, if the maximum has been set to 8 and all 8 pumps are running, autochange will occur.

If you do not want some specific pump to be a master (for example if the pump does not have process feedback connected), set parameter 76.23 *Master enable* for that pump to *False*. This way the pump will be bypassed when transferring master status during the autochange.

The master enable parameter can also be connected to other bit sources, for example supervision, to prevent the pump from being a master after some event has occurred (if for example AI was broken).

If the running master loses its ability to be the master, the system tries to recover from this as fast as possible by selecting the new master and starting new pumps if needed.

The IPC system communicates via the I2I bus connected to EFB by sending reference, status, run time and other system information between the pumps. If there is a communication loss between pumps when using fixed sequence, the pump with the lowest node number becomes the new master for a network segment that did not yet have an active master. With even wear, the next master selection is based on the even wear logic. When pumps can again communicate with each other, the master pump with the lowest node number remains the master while the active master from the other network segment releases the master status after some delay.

If a pump does not see any other pumps, it will wait for the time defined in parameter 40.33 Set 1 integration time before it starts pumping. If the system is at setpoint when

the time has passed, the single pump will not start in order to not interfere with the system.

## Pump cleaning and autochange

Pump cleaning can affect the autochange functionality. If the next master in sequence is performing pump cleaning when autochange is triggered, it will be bypassed and the next pump after it becomes the active master.

Also, the master does not stop a pump that is performing pump cleaning during autochange, but waits until pump cleaning has finished. If the active master is triggered to start pump cleaning, it does the autochange automatically. If the next master pump is configured to trigger pump cleaning at every start and autochange is triggered when that pump is not running, the currently active master will wait until pump cleaning has been completed before the master status is changed.

## Settings

- Parameter group 76 Multipump configuration (page 512)
- Parameter group 77 Multipump maintenance and monitoring (page 526).

## Application example: IPC system with three drives and three pumps

In this example three drives with three pumps are connected to work in cooperation. The example simulates how the pressure sensor controls the system. The external pressure sensor needs to be connected to the system and it will send the information to the drive, which controls the operation of the pump as well as the follower drives.

The individual pumps can be tested in Hand mode (local control) which gives the ability to set the speed from the control panel. The drives can be started and stopped via Hand and Off buttons on the control panel.

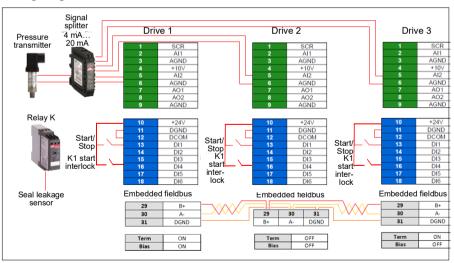
To operate the IPC system, the system needs to be operated in Auto mode (remote control) and with PID closed loop control. PID setpoint is set as constant setpoint and the pressure transmitter used as process feedback is wired to analog input 2.

To start the system, the following digital inputs are used: DI1 Enable start of the system (Start / Stop) and DI4 Start interlock (dry pump sensor connection).

#### Notes:

- If any interlock is not satisfied (see parameters 20.40 Run permissive ... 20.44 Start interlock 4) the drive will not be allowed to run.
- IPC system requires that all the drives are programmed with the same firmware version. Drives with a different firmware version from the master will generate an IPC version mismatch warning because the internal checksum will have a mismatch

## Wiring diagram



**Note:** If a current signal is used, use a signal splitter to connect the sensor signal to all drives that may take on the master role.

Voltage signal can also be used for sensor feedback. This allows chaining the sensor signal. The distance should be a consideration on the signal type.

## Quick steps - Programming summary

Start up all three drives normally (see section How to start up the drive on page 22).

#### Configure IPC in the first drive

By setting up the first drive you can replicate the drive parameters using the synchronization feature under Select Shared settings below. This speeds up the commissioning process and helps to avoid mistakes.

## Menu > Primary settings > Pump features

- Select Multipump control
- Select and edit **Pumping mode**: Intelligent pump control (IPC)
- Press Next
  - Edit Node number: (This number must be unique for each drive in the IPC system. In this example, we are using 1 for the first drive, 2 for the second drive and 3 for the third drive.)
  - Press Next
- Select Settings for this pump
  - Edit **Drive name:** (Keep the default name or give a unique name.)
  - Edit **Node number**: (Enter Node number if not already given above.)
  - Select **Can be master**. (In this example all three drives can act as a master. Redundant operation requires moving master. If this is not selected, the drive can only operate as a follower.)
  - Edit **Prefer this pump**: *Medium*. (The pumps can be prioritized based on energy efficiency and process demand: High - more energy efficient pumps, Medium - less energy efficient pumps, Low - pumps which do not run unless process demands. Similar pumps are recommended to be used in booster applications.)
  - Press Back
- Select Shared settings
  - Select Synchronization settings
    - Edit Do you want to allow synchronization of settings with other drives?: Yes. (Synchronization will save significant amount of time for the total system configuration. It also ensures that values within selected parameter groups are equal and copied according to last changed parameter.)
    - Press Next
    - Edit Select settings to copy between all drives:
    - Select ✓ Al settings

- Select PID settings
- Select IPC shared settings
- Press Next
- Edit Total number of pumps: 3
- Edit Always run at least: 1 pump
- Edit **Never more than:** *3 pumps* (These three pieces of information are synchronized over the inverter-to-inverter link between all drives.)
- Select Start/stop speeds (Define when a pump should be started or stopped by the system in order to meet the demand, keeping the target pressure. Example values:

Edit Start 2nd pump at: 48 Hz
Edit Start 3rd pump at: 48 Hz
Edit Stop 3rd pump at: 25 Hz
Edit Stop 2nd pump at: 25 Hz

If the first pump cannot keep the pressure and exceeds 48 Hz, the second pump will be activated. If the demand is still rising and both pumps exceed 48 Hz the third pump will be activated.

If the demand declines and the three activated pumps fall under 25 Hz, the third pump will be deactivated. If the demand is still too low and the remaining two pumps fall below 25 Hz, the second pump will be deactivated.

These values **must** be defined according to the system. In many applications the start and stop speeds fall in narrow ranges, for example, 25...30 Hz and 40...45 Hz.

- Press Back
- Select Transition smoothing
  - Edit **Ignore demand spikes under:** 2.00 s (The spike time describes how long the output frequency needs to exceed the start point Hz setting, in this case. 48 Hz until the IPC starts the next drive.)
  - Edit Ignore demand dips under: 3.00 s (The dip time describes how long the frequency needs to stay below 25 Hz until the IPC stops one drive. This smooths the IPC behavior and avoids unnecessary starts and stops of the drives.)
  - Press Back
- Select Autochange. This function ensures, that the run time of all drives in the system is balanced.
  - Edit Maximum wear imbalance: 12 h. (This specifies the maximum difference in the running time between the drives in an IPC system.)

- Edit Maximum stationary time: 0.0 h. (This makes sure the pump get exercised frequently. This protects especially low prioritized pump from pump blockages. Value 0.0 h disables the parameter.)
- Edit Autochange only below: 100%. (This specifies the maximum speed when pump change is allowed. Value 100% allows a pump change action whenever it is needed.)
- Press Back
- Select PID control (Secondary reference, EXT2)
- Select **✓ Use PID control**
- Edit Activate PID control from: Always active
- Edit Start/stop/dir from: DI Start/stop
- Edit Unit: bar
- View PID status: 0 hex
- Select Feedback
  - Actual value: 0.0 bar Edit Source: Al2 scaled
  - Select Al2 scaling
    - Edit Range: 4...20 mA Edit Scaled min: 0.000 bar Edit Scaled max: 6,000 bar
    - Press Back
  - Edit filter time: 0.000 s
  - Press Back Select Setpoint
  - Actual value: 0.0 bar
  - Edit Source: Constant setpoint
- Select Constant setpoints
  - Edit Constant setpoint 1: 4.00 bar
  - Edit Constant setpoint 2: 0.00 bar
  - Edit Minimum: 0.00 bar Edit Maximum: 6.00 bar
  - Press Back
- Select Tuning
  - **Deviation actual value:** 0.00 bar
  - Fdit Gain: 1.00
  - Edit Derivation time: 0.000 s
  - Edit Derivation filter time: 0.0 s

- Press Back
- Edit Increase output: Feedback < Setpoint (Used when filling booster pump or tank. "Feedback > Setpoint" is used, for example, when emptying a tank.)
- Select Output:

Actual value: 0.00Edit Minimum: 0.00

• Edit **Maximum:** 50.00 (US:60.00) (Hz) or 100.0 (%)

· Press Back

· Select and edit Sleep function: Off

Press Back repeatedly to get to Primary settings.

#### Configure the rest of the drives

After starting up and configuring IPC of the first drive in the system, you can then start-up the rest of the drives (see section *How to start up the drive* on page 22).

Then configure each of these drive as follows.

# Menu > Primary settings > Pump features

- Select Multipump control
- Select Pumping mode: Intelligent pump control (IPC)
- Press Next
  - Edit Node number: (The rest of the drives, in this example 2...3.)
  - Press Next
- Select Communication link source
  - Select FFB or FBA
  - Press Next
- Select Settings for this pump
  - Edit Drive name: (Give a unique name.)
  - Edit Node number: (Enter Node number if not already given above.)
  - Select ✓ Can be master
  - Edit Prefer this pump: Medium
  - Press Back
- Select Shared settings
  - Select Synchronization settings
  - Edit Do you want to allow synchronization of settings with other drives?: Yes.
  - · Press Next
  - Edit Select settings to copy between all drives:
  - Select ✓ Al settings
  - Select PID settings

- Select IPC shared settings
- Press Back repeatedly to get to Primary settings.

Now all the above parameter settings are copied to this drive and the system is ready to run.

## Settinas

- Menu > Primary settings > Multipump Control (IPC)
- Parameter group 01 Actual values (page 293)
- Parameter group 40 Process PID set 1 (page 462)
- Parameter groups 76 Multipump configuration (page 512) and 77 Multipump maintenance and monitoring (page 526).

# Single pump control (PFC/SPFC)

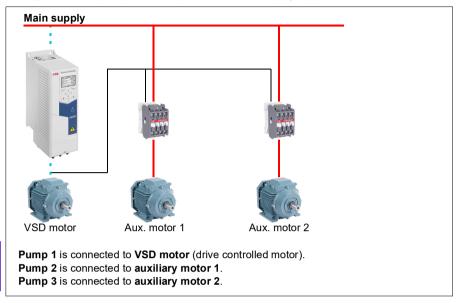
The Single pump control (PFC) is used in pump systems consisting of one drive and multiple pumps. The drive controls the speed of one of the pumps and in addition connects (and disconnects) the other pumps directly to the supply network through contactors.

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

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

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

#### **Example:** Three-pump constant pressure water supply application



Flow consumption vs. pump status			
Consumption	Pump 1	Pump 2	Pump 3
Low	VSD	Off	Off
↓	VSD	DOL	Off
High	VSD	DOL	DOL
$\downarrow$	VSD	DOL	Off
Low	VSD	Off	Off

**VSD** = Controlled by drive, tuning the output speed according to PID control.

**DOL** = Direct On Line. Pump is running at fixed motor nominal speed.

Off = Off-line. Pump stops.

# Soft pump control (SPFC)

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

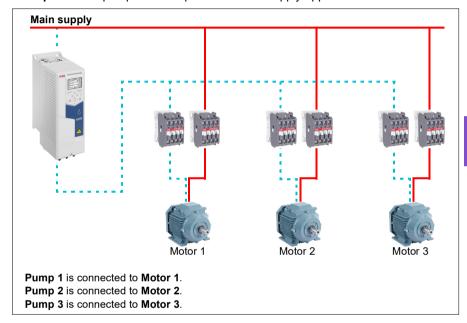
The main difference between traditional PFC and SPFC logic is how the SPFC logic connects auxiliary motors on-line. When the criteria for starting a new motor is fulfilled (see above) the SPFC logic disconnects the drive controlled motor from the drive and immediately connects that motor to the supply network in a flying start, that is, while the motor is still coasting. The drive then connects to the next pump unit to be started

and starts controlling the speed of that one, while the previously controlled unit is now connected directly on line through a contactor.

Further (auxiliary) motors are started in a similar manner. The motor stopping routine is the same as for the normal PFC routine.

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

**Example:** Three-pump constant pressure water supply application



Flow consumption and pump status			
Consumption	Pump 1	Pump 2	Pump 3
Low	VSD	Off	Off
$\downarrow$	DOL	VSD	Off
High	DOL	DOL	VSD
$\downarrow$	DOL	Off	VSD
Low	Off	Off	VSD
$\downarrow$	VSD	Off	DOL
High	DOL	VSD	DOL
$\downarrow$	DOL	VSD	Off
Low	Off	VSD	Off
$\downarrow$	VSD	DOL	Off
High	DOL	DOL	VSD

VSD = Controlled by drive, tuning the output speed according to PID control.

**DOL** = Direct On Line. Pump is running at fixed motor nominal speed.

**Off** = Off-line. Pump stops.

#### Autochange

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

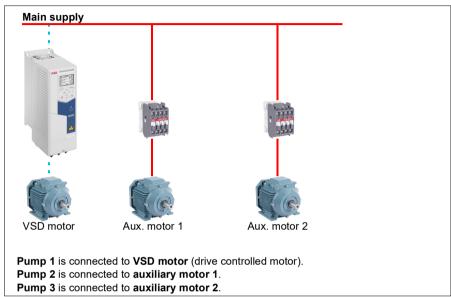
The Autochange can also be triggered by the Timed function (see page 132).

There are three modes of autochange according to what kind of PFC and SPFC together with auxiliary circuit are implemented.

## 1. Autochange PFC with auxiliary motors only

**Example:** Three-pump constant pressure water supply application.

Two pumps fulfill the flow consumption for long term running, and the third pump is reserved for shifting. In this mode, only two auxiliary motors, pump 2 and pump 3. shift working.



Flow consumption and pump status			
Consumption	Pump 1	Pump 2	Pump 3
Low	VSD	Off	Off
Normal	VSD	DOL	Off
↓	VSD	Off	DOL
$\downarrow$	VSD	DOL	Off
Normal	VSD	Off	DOL

**VSD** = Controlled by drive, tuning the output speed according to PID control.

**DOL** = Direct On Line. Pump is running at fixed motor nominal speed.

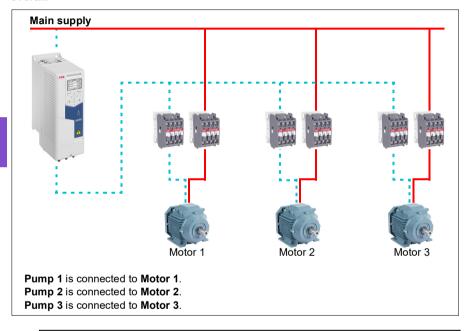
**Off** = Off-line. Pump stops.

### 2. Autochange PFC with all motors

**Example:** Three-pump constant pressure water supply application

Two pumps fulfill the flow consumption for long term running, and the third pump is reserved for shifting. Because all motors will be shifted for autochange routine, special auxiliary circuit is needed, which is the same as for the SPFC system.

In this mode, the VSD motor will move to the next pump one by one, but the auxiliary motor will always be put on-line in DOL mode. However, three pumps are shifted overall.



	Flow consumption and pump status			
	Consumption	Pump 1	Pump 2	Pump 3
	Low	VSD	Off	Off
	Normal	VSD	DOL	Off
	$\downarrow$	Off	VSD	DOL
	$\downarrow$	DOL	Off	VSD
	Normal	VSD	DOL	Off

**VSD** = Controlled by drive, tuning the output speed according to PID control.

**DOL** = Direct On Line. Pump is running at fixed motor nominal speed.

Off = Off-line. Pump stops.

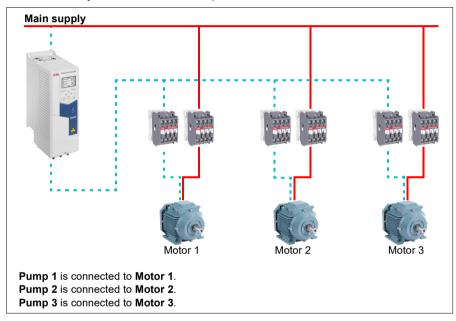
## 3. Autochange with SPFC

Auxiliary motor is meaningless in SPFC. So it does not matter if you select All motors or Aux motor only.

**Example:** Three-pump constant pressure water supply application

Two pumps fulfills the flow consumption for long term running, and the third pump is reserved for shifting.

SPFC system supports autochange naturally. No extra component is needed as long as SPFC is already working there. In this mode, all the pumps are always started by the drive as they are in SPFC normal operation.



	Flow consumption and pump status			
	Consumption	Pump 1	Pump 2	Pump 3
	Low	VSD	Off	Off
	Normal	DOL	VSD	Off
	$\downarrow$	Off	DOL	VSD
	$\downarrow$	VSD	Off	DOL
	Normal	DOL	VSD	Off

**VSD** = Controlled by drive, tuning the output speed according to PID control.

**DOL** = Direct On Line. Pump is running at fixed motor nominal speed.

**Off** = Off-line. Pump stops.

#### 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).

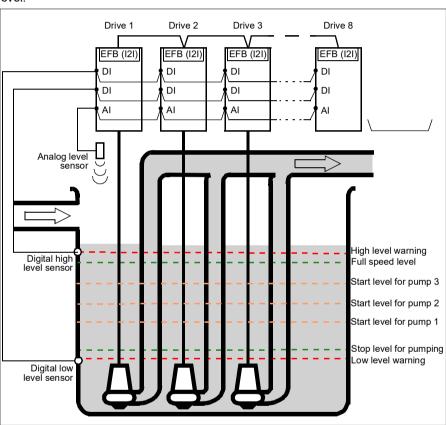
### Settings

- Parameter group 10 Standard DI, RO (page 314)
- Parameter group 40 Process PID set 1 (page 462)
- Parameter groups 76 Multipump configuration (page 512) and 77 Multipump maintenance and monitoring (page 526).

#### Level control

The Level control function can be used to control the water level in tank filling or emptying application. The function supports up to eight pumps. The function can be enabled by setting parameter 76.21 Multipump configuration to Level control -Emptving or Level control - Filling.

The figure below represents a waste water pumping system in emptying mode. The system has varying water level and the pumps will start and stop based on measured level.



The first pump (master) will start when the actual level is above the start point 1. More pumps will start and stop based on the rising (emptying) or falling (filling) water levels of individual pumps. In case of a pump failure or if drive is disconnected for maintenance, the system continues operation with the remaining pumps and drives.

The digital high level and low level sensors can be used to generate a warning or fault when the water level in the container raises or falls to the abnormal operation area. The analog level sensor connected to an analog input measures the water level.

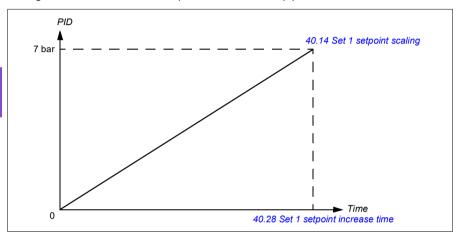
#### Settings

Parameter group 76 Multipump configuration (page 512).

# Soft pipe fill

The Soft pipe fill function can be used to fill an empty pipe softly. The function can avoid sudden charge of water and rise in pressure in a closed valve or a nozzle at the end of the pump system.

The figure below illustrates the operation of the Soft pipe fill function.



If the pumping system is leaking or is damaged then the setpoint will not reach in time. To detect such a condition, you can enable soft pipe fill supervision to generate a warning or a fault. The time is calculated with the last reference change in parameter 40.03 Process PID setpoint actual.

#### Settings

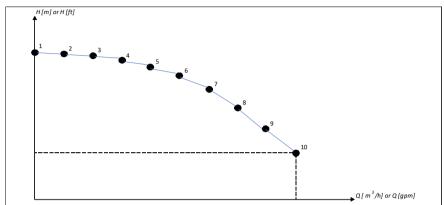
- Menu Primary settings Pump features Soft pipe fill
- Parameter groups 40 Process PID set 1 (page 462) and 82 Pump protections (page 536).

#### Sensorless flow calculation

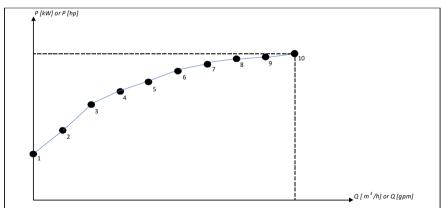
The flow calculation function provides a reasonably accurate (typically  $\pm 3...6\%$ ) calculation of the flow without the installation of a separate flow meter. The flow is calculated on the basis of parameter data such as pump inlet and outlet diameters, pressure at pump inlet and outlet, height difference of pressure sensors, and pump characteristics.

The user can either define a HQ (head/flow) or PQ (power/flow) performance curve that is used as the basis for the calculation. It is also possible to use differential pressure based flow feedback. Flow calculation method is selected in Primary settings or with parameter 80.13 Flow feedback function.

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



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



The flow calculated based on HQ or PQ curve is scaled according to the actual speed of the pump. Scaling reference speed is set in parameter 80.21 Flow pump nominal speed.

To increase the flow calculation accuracy, a correction factor can be entered to parameter 80.14 Flow feedback multiplier.

#### Sensorless head calculation

If these two pump curves are properly parameterized, they can be used to not only calculate the flow without a sensor, but to also calculate the head without a sensor. In simplified terms, the PQ curve can be used to calculate the flow and that calculated flow can then be used in the QH curve to determine the head.

The selection *PQ* and *QH* curves is available from Drive firmware version 2.18.2.1 onwards and is selected with parameter *80.13 Flow feedback function*.

#### Notes

- The flow calculation function cannot be used for invoicing purposes.
- The flow calculation function cannot be used outside the normal operating range of the pump.
- Head point H1 in HQ curve must be defined at zero flow.
- Head points in HQ curve are expected to be in descending order (H1 > H2 > H3 > H4 > H5, etc).
- Power point P1 in PQ curve must be defined at zero flow.
- Power points in PQ curve are expected to be in ascending order (P1 < P2 < P3 < P4 < P5, etc).</li>

Parameter group 80 Flow calculation (page 528) defines the HQ/PQ or differential pressure-based flow feedback and 81 Sensor settings (page 535) defines pump inlet and outlet selection for HQ calculation.

#### Settings

 Parameter group 80 Flow calculation (page 528) and 81 Sensor settings (page 535).

# Pump cleaning

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

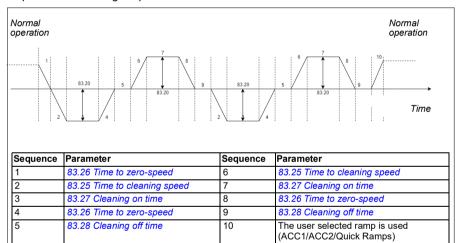
The Pump cleaning function prevents:

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

## Pump cleaning sequence

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

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



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

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

- The pump system meets the triggering conditions defined by parameter 83.10
   Pump cleaning action. At these conditions, normal operation stops and the drive uses the target time defined in parameter 83.26 Time to zero-speed to reach zero speed.
- 2. Acceleration for cleaning is defined by parameter 83.25 Time to cleaning speed.
- 3. The pump runs at cleaning speed for the time defined by parameter 83.27 Cleaning on time.
- 4. The pump decelerates to zero-speed. Target time is defined by parameter 83.26 Time to zero-speed.
- 5. The pump is stopped until parameter 83.28 Cleaning off time is elapsed.
- 6. The pump accelerates the pump speed to positive direction. See parameter 83.25 *Time to cleaning speed*.
- The pump runs at the positive cleaning speed. See parameter 83.27 Cleaning on time.
- 8. The pump decreases the pump speed back to zero defined by parameter 83.26 Time to zero-speed.
- 9. The drive waits until the parameter 83.28 Cleaning off time is elapsed. A new cleaning sequence starts or normal operation starts.
- 10. The pump starts following speed/frequency reference of the active control location. During acceleration to speed/frequency, the drive follows pump cleaning acceleration time 83.25 Time to cleaning speed.

**Note:** Quick ramps are not used in pump cleaning.

The cleaning sequence starts based on the selected triggering conditions. The cleaning sequence follows the diagram on page *123*. You can start the sequence in these conditions:

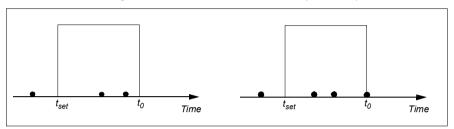
- on every start and stop
- based on the monitoring pump condition (for example, supervision 1...3; underload and overload curve, see group 37 User load curve on page 459)
- based on time interval (for example, at every 10 hours)
- manually (for example, DI4 to DI6, defined by parameter 83.12 Manually force cleaning)
- through fieldbus, using parameter 83.12 Manually force cleaning. Set the
  parameter to a value of 1 (a 2 s pulse) from the fieldbus to start a cleaning cycle
  from an overriding controller.

### Cleaning count monitoring

The cleaning count monitoring function calculates the number of cleaning cycles inside a user-defined monitoring window. Too frequent cleaning attempts may

indicate a pump problem (such as blockage) that the pump cleaning function cannot solve alone but it requires manual inspection and cleaning. The following figures describes the operation of cleaning count monitoring.

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



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

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

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

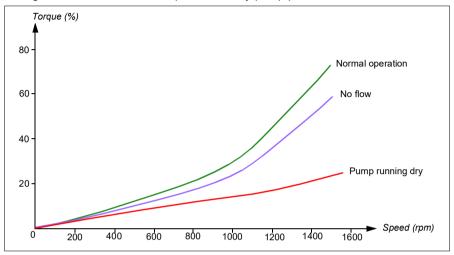
## Settings

- Menu Primary settings Pump cleaning
- Parameter group 83 Pump cleaning (page 542).

# Dry pump protection

The Dry pump protection function can be used to protect the pump from getting dry.

The figure below illustrates the operation of dry pump protection function.



The dry pump can be detected using the underload curve, low level mechanical switch and pressure sensor.

- Underload curve Detects the pump maybe getting dry and generates a warning
  or fault.
- Low/high level mechanical switch Indicates the water level in the pump system through a digital input and generates a warning or fault.
- Pressure sensor Connected to Supervision 1...3 through an analog input. The
  output of supervision indicates the pump inlet getting dry and generates a warning
  or fault.

#### Settings

- Menu -> Primary settings -> Pump features -> Dry pump protection
- Parameter group 82 Pump protections (page 536).

# Pump inlet and outlet protection

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

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

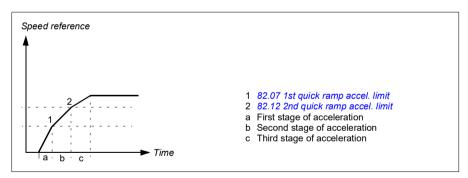
The outlet maximum pressure protection function can first generate a warning when the pump outlet pressure is above maximum pressure warning level for pressure check delay time. If the pressure continues to rise above the maximum pressure fault level, a fault is generated.

#### Settinas

- Menu -> Primary settings -> Pump features -> Pressure protection
- Parameter group 81 Sensor settings (page 535) and 82 Pump protections (page 536).

# Ramps - Quick ramps

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



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

For ramps in general, see section Ramps on page 136.

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

Quick ramps are enabled for acceleration with parameters 82.01 Quick ramp accel. mode. Quick ramps for deceleration are enabled with parameter 82.02 Quick ramp decel. mode. Both acceleration and deceleration can use either 1 quick ramp or 2

quick ramps. Parameter 82.02 Quick ramp decel. mode can also use the value Follow accel. limits, which will use the same configuration (mode and limits) for both deceleration and acceleration

Also if parameter *21.03 Stop mode* is selected to be *Coast*, then Quick ramp 1 decel. and Quick ramp 2 decel. are not used because the drive is stopped by coasting.

Starting with software version 2.12 (released in spring 2020), two quick ramp modes are available:

- Legacy mode is compatible with software before version 2.12.
- Updated functionality allows more control over the quick ramp feature.

#### Legacy mode

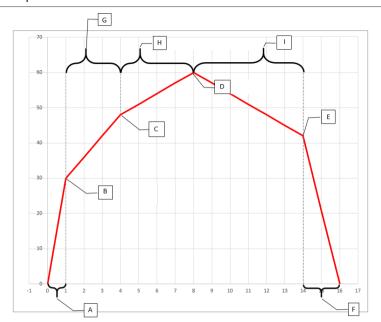
Legacy mode can be used by specifying legacy mode selections for parameter 82.01 Quick ramp accel. mode or parameter 82.02 Quick ramp decel. mode. The legacy mode selections use parameters 46.01 Speed scaling and 46.02 Frequency scaling for Quick ramp 1, Quick ramp 2, and Operational quick ramp definitions.

**Note:** If either acceleration or deceleration is using updated functionality quick ramp(s) instead of legacy mode, both will use the updated functionality quick ramp mode.

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

- The first stage of acceleration (a) is to lift the impeller so that the fluid protects the bearings and sealings. Otherwise, the pump can get damaged. For example, 0 to 25/30 Hz with ramp time of 1 second.
- The second stage of acceleration (b) is optional. The pump produces a valid flow in this region, so the reasonable acceleration rate is requested to overcome the static head and limit the turbidity. The effective inside region is 25/30 to 43/45 Hz and the ramp times typically are between 10 to 45 seconds.
  - **Note:** Acceleration time is proportional to full speed range. This means that if quick ramp 2 is configured from 20 to 40 Hz, set time is 30 seconds and the full speed is 60 Hz, the actual acceleration time from 20 to 40 Hz is 10 seconds. The full speed value is defined by parameter 46.01 Speed scaling or 46.02 Frequency scaling.
- The third stage of acceleration (c) is a normal ramp. The pump provides a reasonable flow rate. The drive uses normal ramp times, for example, 60 seconds.

#### Example:



A = 82.05 1st quick ramp accel. time

B = 82.07 1st quick ramp accel. limit

C = 82.12 2nd quick ramp accel. limit

D = 46.01 Speed scaling I 46.02 Frequency scaling

E = 82.08 Final quick ramp decel. limit

F = 82.06 Final quick ramp decel. time

G = 82.10 2nd quick ramp accel. time

H = 82.14 Oper. quick ramp accel. time (3rd)

I = 82.15 Oper. quick ramp decel. time (1st)

# Updated functionality

Updated functionality can be used by specifying other than legacy mode selections for parameter 82.01 Quick ramp accel. mode or parameter 82.02 Quick ramp decel. mode.

With updated functionality, ramps are handled by separate operational ramp acceleration/deceleration time parameters:

- 82.14 Oper. quick ramp accel. time (3rd)
- 82.15 Oper. quick ramp decel. time (1st).

If any quick ramp function (acceleration or deceleration) is selected, both acceleration and deceleration are based on the quick ramp parameters 82.14 and 82.15. Normal acceleration/deceleration values from the frequency/speed chain are ignored. The final ramp is calculated from the last active quick ramp limit.

The acceleration rate is defined as the time to accelerate from zero speed to the speed value defined by parameter 46.01 Speed scaling or 46.02 Frequency scaling. This acceleration rate is effective from zero to speed/frequency defined by parameter 82.07 Final quick ramp decel. limit.

#### Settings

- Menu > Primary settings > Ramps > Quick ramps
- Pump protections Quick ramps: Parameter group 82 Pump protections (page 536).

#### Automatic fault resets

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

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

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

### Settings

- Menu > Primary settings > Advanced functions > Autoreset faults
- Parameters 31.12...31.16 (page 414).

#### External events

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.

## Settings

- Menu > Primary settings > Advanced functions > External events
- Parameters 31.01...31.10 (page 412).

# Constant speeds/frequencies

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



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

#### **Settings**

- Menu > Primary settings > Start, stop, reference > Constant speeds
- Menu > Primary settings > Start, stop, reference > Constant frequencies
- Parameter groups 22 Speed reference selection (page 382) and 28 Frequency reference chain (page 397).

## 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.

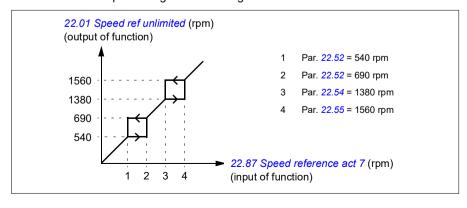
When the drive is limiting the allowed output speeds/frequencies, it limits to the absolutely lowest critical speed (critical speed low or critical frequency low) when accelerating from standstill, unless the speed reference is over the upper critical speed/ frequency limit.

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, the output by 28.97 Frequency ref unlimited.

# Example for critical speeds:

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

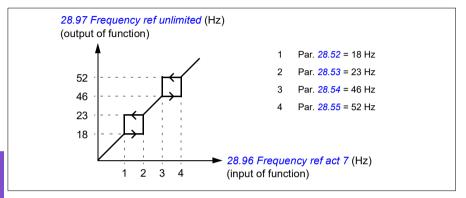
- enable the critical speeds function by turning on bit 0 of parameter 22.51 Critical speed function, and
- set the critical speed ranges as in the figure below.



### **Example for critical frequencies:**

A pump has vibrations in the range of 18...23 Hz and 46...52 Hz. To make the drive avoid these frequency ranges,

- enable the critical frequencies function by turning on bit 0 of parameter 28.51
   Critical frequency function, and
- set the critical frequency ranges as in the figure below.



#### Settings

- Menu > Primary settings > Start, stop, reference > Constant speeds
- Menu > Primary settings > Start, stop, reference > Constant frequencies
- Critical speeds: parameters 22.51...22.57 (page 387)
- Critical frequencies: parameters 28.51...28.57 (page 402).

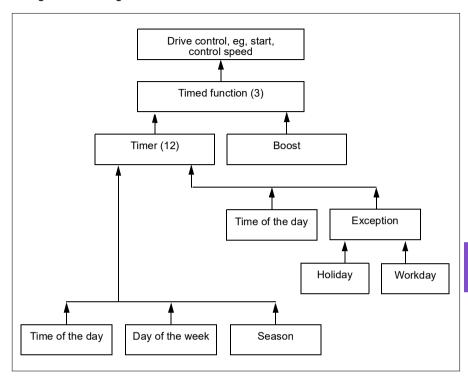
#### Timed functions

The base entity of the timed functions is called a timer. A timer can be active based on time of the day, day of the week and season of the year. In addition to these time related parameters, the timer activation can be influenced by so called days of exception (configurable as holiday or workday). For example, 25.12. (Dec 25th) can be defined as holiday in many countries. A timer can be set to be active or inactive during the days of exception.

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

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

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



#### Settings

- Menu > Primary settings > Advanced functions > Timed functions
- Parameter group 34 Timed functions (page 436).

#### Cavitation control

Pump cavitation detection helps to prevent cavitation within the pump that can not only destroy pump impellers but also cause other issues, such as leaking seals. The pump cavitation detection algorithm uses the calculated motor torque ripple to detect variations which are greater than normal. In many cases these variations are caused by either cavitation or other mechanical issues which require maintenance.

#### Cavitation autotune

The cavitation detection algorithm relies on a drive cavitation curve that is used as the benchmark of 'normal' operation. When the running torque ripple is compared to this benchmark, it is possible to detect if pump cavitation is occurring. The drive automatically identifies the benchmark curve by performing a process called cavitation autotune.

Select the initial autotune of the pump curve with parameter 86.20 Cavitation curve autotune.

Note: The drive must be in Hand mode in order to perform the initial autotune.

#### Reaction to cavitation

Detected cavitation can result in one of the following drive reactions:

- Warning only
- · Warning and control of the drive speed reference to resolve the issue
- Fault only

Select the drive reaction with parameter 86.11 Cavitation control.

When the control reaction is selected, the drive will begin to step the speed down in increments defined by parameter 86.13 Cavitation speed decrease or parameter 86.16 Cavitation frequency decrease, depending on whether the value of parameter 99.04 Motor control mode is Vector or Scalar.

At each step, the drive will again check for cavitation. If cavitation is still detected, the drive will continue to decrease the speed using the defined step, until it reaches the minimum value defined with parameter 86.12 Cavitation minimum speed or parameter 86.13 Cavitation minimum frequency. If cavitation is still detected at the minimum value, the drive will fault after the time defined by parameter 86.19 Cavitation empty well time.

If at any point in the cavitation control cavitation is no longer detected, the drive will begin to step the speed back up to the speed it was running prior to the initial cavitation detection. The speed up step is defined by parameter 86.14 Cavitation speed increase or parameter 86.17 Cavitation frequency increase, depending on motor control mode (parameter 99.04).

### Settings

- pump autoreset: parameters 82.51 and 82.52 (page 541)
- cavitation control: parameter group 86 Cavitation control (page 544).

# Pump restart delay

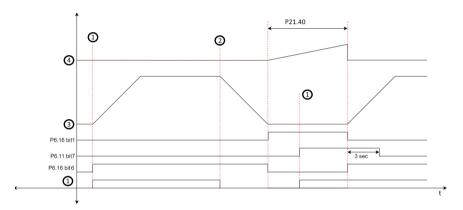
Pump restart delay is useful when a large vertical water column drains from the outlet side of the pump after it stops and the pump components could be damaged if the pump was started during this period. The user can configure this feature with parameter 21.40 Restart delay.

Parameter 21.42 Restart delay remaining shows the value of the timer in real time and allows the user to bypass the timer one time, if necessary.

## Restart delay

Pump restart delay prevents a frequent restart of the drive within the restart delay time, set with parameter 21.40 Restart delay. By default, this feature is disabled and the restart delay is zero seconds.

When the drive stops modulating, if the value of 21.40 Restart delay is greater than zero, the restart delay timer starts. During this time, the drive will not start until the restart delay has elapsed. When the delay has elapsed, the drive can again start. If the user gives the Start command before the restart delay has elapsed, the system displays warning D590 Restart delay with aux code 0002 Pump short cycle protection. The warning disappears when the delay time has elapsed.



- 1 = Start cmd
- 2 = Stop cmd
- 3 = Speed
- 4 = Restart delay counter

The drive will start automatically after the restart delay timer has elapsed. When level trigger and edge trigger are used, a raising edge of start command is required.

The restart delay functions over a power cycle. The restart delay timer continues to elapse when the drive has no power, as long as a time synchronization source (see parameter 96.20 Time sync primary source) is active both before and after the power cycle.

If there is no time synchronization source active when power is restored, the drive resumes the timer with the last value stored in parameter 21.42 Restart delay remaining.

If the restart delay value is changed while restart delay is active, the parameter value is calculated based the entered value and elapsed time:

- If the new parameter value is less than the elapsed time, the system terminates the timer immediately. The new parameter value will be effective for the next stop.
- if the new parameter value is greater than the elapsed time, the system initializes
  the restart delay timer preset value to a new preset value: new parameter value
  elapsed time.

To deactivate the pump restart delay functionality, set parameter 21.42 to zero.

## Remaining delay

Parameter 21.42 Restart delay remaining displays the value of the restart delay timer in real time. This can be helpful for troubleshooting, or displayed on the home screen.

You can also use parameter 21.42 to bypass the timer by setting the parameter to its default value of zero seconds.

## Settings

- Parameters: 21.40 Restart delay, 21.42 Restart delay remaining, and 96.20 Time sync primary source
- Warning: D590 Restart delay.

# Ramps

#### Overview

Ramps refer to acceleration and deceleration times. The ramps function adjusts the rate of how fast or slow a drive changes the motor speed with respect to the commanded speed. Ramps should be configured based on the specific application requirements.

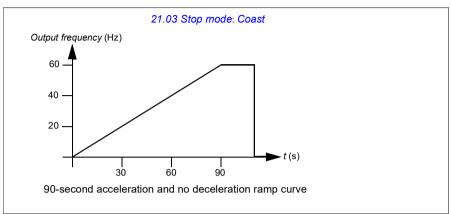
Additional quick ramps are provided for starting submersible pumps. See section *Ramps* – *Quick ramps* on page 127.

# Functionality

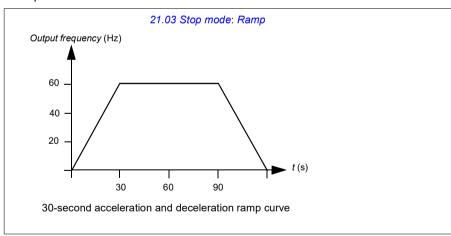
Acceleration ramps are recommended for all applications. The acceleration ramp is the amount of time required for the drive to ramp up the motor from 0 Hz to the ramp time target frequency setting. The Ramp time target frequency setting is located under **Menu > Primary Settings > Ramps**.

The deceleration ramp is the amount of time required for the drive to ramp down from the ramp time target frequency to 0 Hz. The most typical settings of ramp time target frequency are 50 Hz outside of North America and 60 Hz for North America. Note that the ramps function is always active during operation and not just used for starting and stopping modes.

If the stop mode is set to coast, it will cause the drive to ignore the deceleration ramp while stopping. In this scenario, the drive will no longer be controlling the speed of the motor once the run command is removed. The figure below shows a ramp curve for 90-second acceleration and no deceleration.



In pump applications, the stop mode is typically set to ramp and the deceleration ramp is used while stopping. Ramping a pump motor to a stop helps prevent issues such as water hammer and assist in closing the check valve. The figure below shows a ramp curve for 30-second acceleration and deceleration.



If the acceleration time is too short, the drive may trip out on overcurrent. If the deceleration ramp is set to stop too quickly, the drive may trip out on overvoltage. These scenarios are unlikely in most applications due to the internal current and voltage limiting features built into the drive. However, the desired ramps times will not be achieved in such circumstances.

Each application and motor is unique. As a general guideline for pumps, ramp times are often set between 30 and 90 seconds. Typically a larger drive/motor has a longer ramp time. However, certain applications or pump types require a much faster or slower ramp time.

# **Settings**

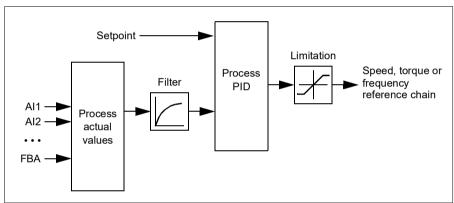
- Menu > Primary settings > Ramps
- Speed reference ramping: Parameters 23.12...23.13 and 46.01 (pages 391 and 488)
- Frequency reference ramping: Parameters 28.72...28.73 and 46.02 (pages 403 and 488)
- Motor potentiometer: Parameter 22.75 (page 389)
- Emergency stop ("Off3" mode): Parameter 23.23 Emergency stop time (page 391).

# Process PID control (PID/Loop controller)

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

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

The simplified block diagram below illustrates the process PID control. For more detailed block diagrams, see pages 283 and 285.



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

Note: Process PID control is only available in external control location EXT2; see section Local control vs. external control (page 87).

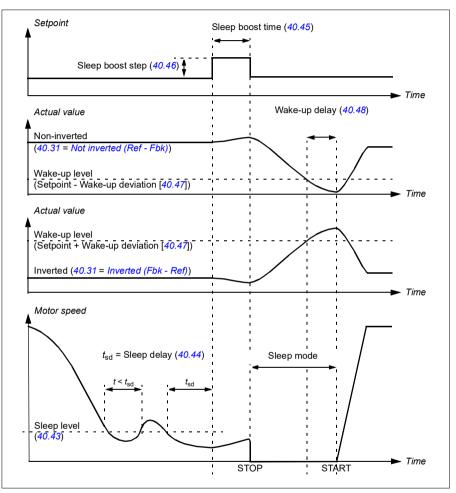
#### Sleep and boost functions for process PID control

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

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

resumes when the pressure falls under the predefined minimum level and the wakeup delay has passed.

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



# Tracking

In tracking mode, the PID block output is set directly to the value of parameter 40.50 (or 41.50) Set 1 tracking ref selection. The internal I term of the PID controller is set so that no transient is allowed to pass on to the output, so when the tracking mode is left, normal process control operation can be resumed without a significant bump.

## Settings

• Parameter groups 40 Process PID set 1 (page 462) and 41 Process PID set 2 (page 479).

# Limits

#### Limits overview

The drive has multiple limits that can be set to prevent the drive from causing damage to the motor or the pump system. Limits can be applied to the minimum and maximum frequency, speed, or torque and the maximum current. Frequency limits are used in scalar motor control mode, while speed limits are used in vector motor control mode.

Setting a minimum speed/frequency may be used to prevent a pump or motor from overheating. Running a certain pump or motor type at too slow a speed will decrease its ability to cool itself. Equipment that runs warmer, or lacks proper lubrication, will likely have a shorter lifespan. Consult the equipment manufacturer for minimum speed/frequency settings.

Setting a maximum speed/frequency may be used to prevent excessive mechanical stress. Mechanical stress at levels above the equipment's design will likely shorten the lifespan of the equipment. Consult the equipment manufacturer to determine the maximum safe speed/frequency.

The maximum current setting will prevent steady-state operation above a specific current operation. Note that this setting is unrelated to the motor overload protection, which is configured based on actual motor current information entered into the drive.

### Settings

- Menu > Primary Settings > Limits
- Parameter group 30 Limits.

## Interlocks

#### Overview

Interlocks provide a way to prevent the drive from running when an input is not satisfied. The interlock feature of the drive is often used to wire safeties back to the drive. ABB does not recommend wiring interlocks in series with each other, unless there are more than four interlocks. Wiring interlocks separately allows for faster system troubleshooting, as the drive provides quick identification on which individual interlock is no longer satisfied. Monitoring the status of each interlock is available over fieldbus communications.

Interlocks typically are wired to the drive's digital inputs (DI), DI1 through DI6. Certain fieldbus communications can also be used to control interlocks, although typically not recommended for most applications.

# Configuration

You can configure interlocks either in the **Primary settings** menu, or via parameter group 20 Start/stop/direction in the Parameters menu. ABB recommends configuration via the **Primary settings** menu (**Menu > Primary settings > Start**, stop, reference > Interlocks/permissives).

Interlocks are configurable for normally open or normally closed functionality.

For example, in the **Primary settings**, selecting an interlock for DI4 high indicates that digital input 4 must be closed, or logic 1, to allow the drive to run. A setting of DI4 low indicates the digital input must be open, or logic 0, to allow the drive to run. If the interlock is not in a logic state that will allow the drive to run, the interlock is unsatisfied. If the interlock is in a logic state that will allow the drive to run, the interlock is satisfied.

An unsatisfied interlock is indicated on the drive control panel display via a flashing green LED light, and a flashing warning on the display. You can set up the drive to indicate an unsatisfied interlock in one of two methods (Menu > Primary settings > Start, stop, reference > Interlocks/permissives > Interlock warning condition). This setting applies to all the interlocks.

- Indicate a warning, whenever an interlock is unsatisfied, regardless of a run command.
- Indicate a warning, whenever an interlock is unsatisfied and a run command is present.

You can configure the drive for either coast or ramp to a stop, when the interlock changes to an unsatisfied state (Menu > Primary settings > Start, stop, reference > Interlocks/permissives > Interlock stop mode).

# Wiring connections

Interlocks function in both Auto and Hand control modes. ABB recommends that the system interlocks are wired directly to the drive, and not to an external PLC/SCADA.

Failure to wire the interlock(s) directly to the drive can inadvertently allow Hand mode operation, when an interlock is not satisfied.

# Functionality

The drive allows predefined descriptive text and label text (free text) to be independently associated with each of the four different interlocks. The control panel display will display that specific text when the interlock becomes unsatisfied.

You configure (select) the predefined descriptive text in **Menu > Primary settings > Start, stop, reference > Interlocks/Permissives > Descriptive text**.

You configure (edit) the label text in Menu > Primary settings > Start, stop, reference > Interlocks/Permissives > Label text.

### Settings and diagnostics

- Menu > Primary settings > Start, stop, reference > Interlocks/Permissives
- Parameter 20.41 Start interlock 1 (page 371)
- Warnings AFEE Start interlock 1, AFEF Start interlock 2, AFF0 Start interlock 3, and AFF1 Start interlock 4.

# Run permissives

#### Overview

The run permissive function provides a way to prevent the drive from outputting to a motor when an input is not satisfied. This function is used to support applications that require the drive to first trigger an external event before the drive starts to ramp the motor. Run permissive is often used in conjunction with an end-switch wired back to the drive. Monitoring the status of the run permissive is available over fieldbus communications.

Run permissive is different from start interlock:

- A run permissive makes the drive enter a run state but does not provide an output to the motor.
- An unsatisfied run permissive input will only indicate a warning on the control panel display if a start command is also provided. No warning will be provided if the start command is not present. Start interlock is configurable to acknowledge, or ignore, the start command status when determining if a warning must be indicated.

The run permissive is typically wired to one of the drive's digital inputs (DI), DI1 through DI6. DI2 is most commonly used. Certain fieldbus communications can also be used to control run permissive, although typically not recommended for most applications.

# Configuration

You can configure run permissive either in the **Primary settings** menu, or via parameter group 20 Start/stop/direction in the Parameters menu. ABB recommends configuration via the Primary settings menu (Menu > Primary settings > Start, stop, reference > Interlocks/permissives). Run permissive is configurable for normally open or normally closed functionality.

# Wiring connections

The run permissive functions in both Auto and Hand control modes. ABB recommends that any system permissive is wired directly to the drive and not to an external PLC/SCADA.

Failure to wire the permissive directly to the drive can inadvertently allow Hand mode operation when a permissive is not satisfied.

# Functionality

The drive allows predefined Descriptive text, and Label text (free text), to be associated with the Run permissive. The control panel will display that specific text when the permissive becomes unsatisfied.

- You configure (select) the predefined descriptive text in Menu > Primary settings
   Start, stop, reference > Interlocks/Permissives > Descriptive text.
- You configure (edit) the label text in Menu > Primary settings > Start, stop, reference > Interlocks/Permissives > Label text.

Run permissive features include the following:

- With no run command issued and run permissive not satisfied, no warning is displayed.
- With a start command issued and run permissive not satisfied, the drive displays
  a warning that the run permissive is missing, the status LED will flash green, and
  the control panel's direction arrow is dashed and rotating. The drive remains in
  running mode, but does not output to the motor until run permissive is satisfied.
- During normal operation of the motor, if run permissive changes state, the drive will coast to stop and display a warning that run permissive is keeping the drive from outputting to the motor.
- Relay settings that are not affected by run permissive input not being satisfied include: Ready run, Enabled, Started and Running. Relay settings that are affected by run permissive include: Warning and Fault/Warning.

### Settings and diagnostics

- Menu > Primary settings > Start, stop, reference > Interlocks/permissives
- Parameter 20.40 Run permissive (page 370)
- Warning AFED Run permissive.

# Application example 1: Valve opening

The Run permissive function is used in valve control to prevent the pump from running until the valve is opened. Sequence of operation:

- 1. Drive receives start command, either via Hand or Auto source.
- 2. Drive verifies safeties are satisfied and valve position has not yet been satisfied.
- Drive activates a relay output that was programmed to Valve opening (could have also been programmed to Started or Running). This relay allows power to the actuator.
- Once the valve is opened, run permissive is satisfied and the drive outputs to the motor.

# Motor control

### Frequency control mode

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

Frequency control uses frequency reference chain. Select frequency reference with parameters in group 28 Frequency reference chain on page 397.

### Scalar motor control

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

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

- If the exact nominal motor values are not available or the drive needs to run different motor after the commissioning phase
- If a short commissioning time is needed or no ID run is wanted
- In multimotor systems: 1) if the load is not equally shared between the motors, 2) if the motors are of different sizes, or 3) if the motors are going to be changed after motor identification (ID run)
- If the nominal current of the motor is less than 1/6 of the nominal output current of the drive
- If the drive is used without a motor connected (for example, for test purposes)
- If the drive is equipped with a sine filter.

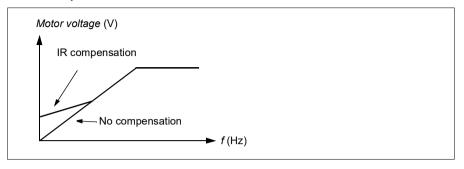
In scalar control, some standard features are not available.

See also section Operating modes of the drive (page 90).

### IR compensation for scalar motor control

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

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



### Settings

- Menu > Primary settings > Motor > IR compensation
- Parameters 97.13 IR compensation (page 568), 97.94 IR comp max frequency (page 569) and 99.04 Motor control mode (page 572)
- Parameter group 28 Frequency reference chain (page 397).

# Speed control mode

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

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

Speed control uses speed reference chain. Select speed reference with parameters in group 22 Speed reference selection on page 382.

### Vector motor control

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

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

Stator flux is calculated by integrating the motor voltage in vector space. Rotor flux can be calculated from stator flux and the motor model. Motor torque is produced by controlling current 90 degrees from the rotor flux. By utilizing the identified motor

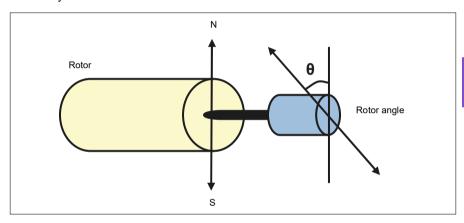
model, the rotor flux estimate is improved. Actual motor shaft speed is not needed for the motor control

### **Settings**

- Menu > Primary settings > Motor > Control mode
- Parameters 99.04 Motor control mode (page 572) and 99.13 ID run requested (page 574)

# Autophasing

Autophasing is an automatic measurement routine to determine the angular position of the magnetic flux of a permanent magnet synchronous motor. The motor control requires the absolute position of the rotor flux in order to control motor torque accurately.



The autophasing routine is performed with permanent magnet synchronous motors to determine the rotor angle at every start.

Note: The motor always turns when it is started as the shaft is turned towards the remanence flux.

Two autophasing modes are available, see parameter 21.13 Autophasing mode (page 377).

If the autophasing routine fails, the drive trips an autophasing fault (3385) Autophasing, page 212).

### Settings and diagnostics

- Parameters: 21.13 Autophasing mode (page 377), 99.13 ID run requested (page 574)
- Fault 3385 Autophasing on page 212.

# Motor types

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

### Motor identification

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

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

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

# Settings

- Menu > Primary settings > Motor > Control mode > Vector control
- Parameter 99.13 ID run requested (page 574).

### 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

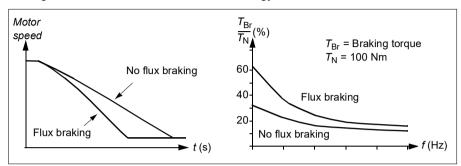
In squared mode (default), the ratio of the voltage to frequency increases as the square of the frequency below the field weakening point. This is typically used in centrifugal pump applications. For these applications, the torque required follows the square relationship with frequency. Therefore, if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

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.

- Menu > Primary settings > Motor > U/f ratio
- Parameter 97.20 U/F ratio (page 569).

# 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.

- Menu > Primary settings > Motor > Flux braking
- Parameter 97.05 Flux braking (page 566).

# Start methods - DC magnetization

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

# Pre-heating (Motor heating)

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

When pre-heating is activated and the stop command is given, pre-heating starts immediately if the drive is running below the zero speed limit (see bit 0 in parameter 06.19 Speed control status word). If the drive is running above the zero speed limit, pre-heating is delayed by the time defined by parameter 21.15 Pre-heating time delay to prevent excessive current.

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

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

#### Notes:

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

#### Settings

- Menu > Primary settings > Motor > Pre-heating
- Parameters 21.14 Pre-heating input source, 21.15 Pre-heating time delay and 21.16 Pre-heating current (page 378).

# Pre-magnetization

Pre-magnetization refers to DC magnetization of the motor before start. Depending on the selected start mode (21.01 Start mode or 21.19 Scalar start mode), premagnetization can be applied to guarantee the highest possible breakaway torque,

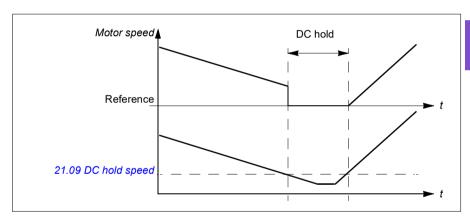
up to 200% of the nominal torque of the motor. By adjusting the pre-magnetization time (21.02 Magnetization time), it is possible to synchronize the motor start and, for example, the release of a mechanical brake.

### Settings

• Parameters 21.01 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



### Settinas

Parameters 21.08 DC current control and 21.09 DC hold speed.

#### DC brake

This function enables DC injection braking after modulation has stopped for a certain period (21.11 Post magnetization time). DC injection braking can be used to quickly stop the motor without using a mechanical brake. DC brake is activated by parameter 21.08 DC current control. The DC braking current is set by parameter 21.10 DC current reference.

# 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 21.03 Stop mode (page 374), 21.08 DC current control and 21.11 Post magnetization time.

# 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, for example, with EMC C1 filters (see the *Hardware manual* of the drive), set both the reference and the minimum switching frequency to this value and the drive will retain this switching frequency.

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

#### Settings

- Menu > Primary settings > Motor > Switching frequency
- Parameters 97.01 Switching frequency reference and 97.02 Minimum switching frequency (page 549).

# 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 drive.

#### Insulation

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

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

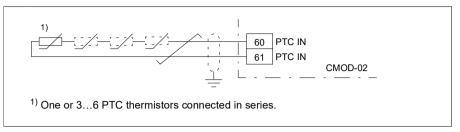
- Separate the thermistor from live parts of the motor with double reinforced insulation.
- Protect all circuits connected to the drive's digital and analog inputs. Protect against contact, and insulate from other low voltage circuits with basic insulation (rated for the same voltage level as the drive's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

When CMOD-02 or CPTC-02 modules are used, they provide sufficient insulation.

### Temperature monitoring using PTC sensors

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

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

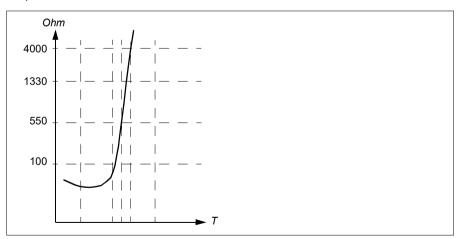


The resistance of the PTC sensor increases when its temperature rises. The increasing resistance of the sensor decreases the voltage at the input, and eventually its state switches from 1 to 0, indicating overtemperature.

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

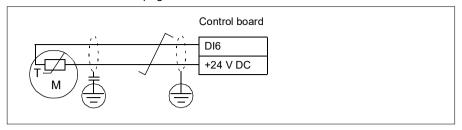
For wiring of the sensor, see the Hardware Manual of the drive.

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



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

See section *Insulation* on page 155.



For wiring of the sensor, see the *Hardware manual* of the drive.

# Temperature monitoring using Pt100 sensors

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

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

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

See section *Insulation* on page 155.

For the wiring of the sensor, see Al1 and Al2 as Pt100, Pt1000, Ni1000, KTY83 and KTY84 sensor inputs (X1) on page 160.

# Temperature monitoring using Pt1000 sensors

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

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

See section Insulation on page 155.

For the wiring of the sensor, see Al1 and Al2 as Pt100, Pt1000, Ni1000, KTY83 and KTY84 sensor inputs (X1) on page 160.

# 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. Resistance at 100 degrees Celsius is 1618 ohm, and the rate of change is 6180 ppm / degrees Celsius. The temperature measurement function reads the voltage through the analog input and converts it into degrees Celsius.

See section *Insulation* on page 155.

For the wiring of the sensor, see section Al1 and Al2 as Pt100, Pt1000, Ni1000, KTY83 and KTY84 sensor inputs (X1) on page 160.

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

See section Insulation on page 155.

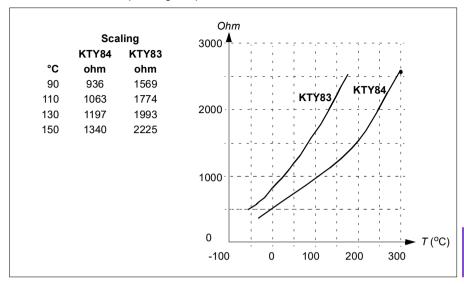
For the wiring of the sensor, see section Al1 and Al2 as Pt100, Pt1000, Ni1000, KTY83 and KTY84 sensor inputs (X1) on page 160.

### Temperature monitoring using KTY83 sensors

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

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

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



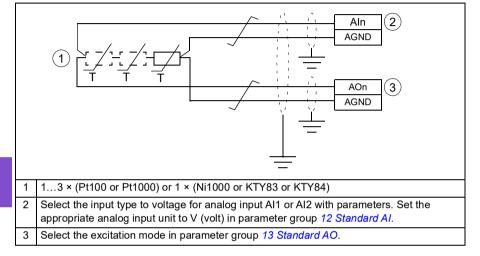
It is possible to adjust the motor temperature supervision limits and select how the drive reacts when overtemperature is detected.

See section Insulation on page 155.

For the wiring of the sensor, see section Al1 and Al2 as Pt100, Pt1000, Ni1000, KTY83 and KTY84 sensor inputs (X1) on page 160.

# Al1 and Al2 as Pt100, Pt1000, Ni1000, KTY83 and KTY84 sensor inputs (X1)

One, two or three Pt100 sensors; one, two or three Pt1000 sensors; or one Ni1000, KTY83 or KTY84 sensor for motor temperature measurement can be connected between an analog input and output as shown below. Do not connect both ends of the cable shields directly to ground. If a capacitor cannot be used at one end, leave that end of the shield unconnected.

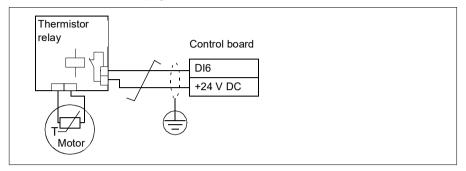


WARNING! As the inputs pictured above are not insulated according to IEC 60664, the connection of the motor temperature sensor requires double or reinforced insulation between motor live parts and the sensor. If the assembly does not fulfill the requirement, the I/O board terminals must be protected against contact and must not be connected to other equipment or the temperature sensor must be isolated from the I/O terminals.

# Temperature monitoring using thermistor relavs

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

See section *Insulation* on page 155.



### Settings

- Menu > Primary settings > Motor > Thermal protection estimated
- Menu > Primary settings > Motor > Thermal protection measured
- Parameter group 35 Motor thermal protection (page 444).

# Motor overload protection

This section describes motor overload protection without using motor thermal protection model, either with estimated or measured temperature. For protection with the motor thermal protection model, see section *Motor thermal protection* on page 154.

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

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

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

The motor overload class (class of operation), parameter 35.57 Motor overload class, is given as the time required for the overload relay to trip when operating at 7.2 times the tripping level in the case of IEC 60947-4-1 and 6 times the tripping level in the case of NEMA ICS 2. The standards also specify the time to trip for current levels

between the tripping level and the 6 times tripping level. The drive satisfies the IEC standard and NEMA standard trip times.

Using class 20 satisfies the UL 508C requirements.

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

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

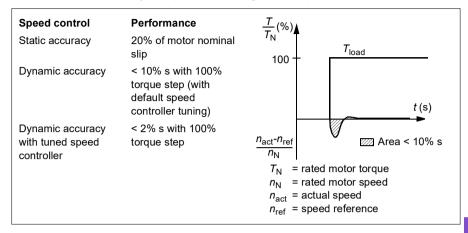
Parameters 35.51 Motor load curve, 35.52 Zero speed load and 35.53 Break point serve a dual purpose. They determine the load curve for temperature estimate when using motor thermal protection model as well as specify the overload tripping level.

Motor overload protection fulfills standard IEC/EN 61800-5-1 ed. 2.1 requirements for thermal memory retention and speed sensitivity. The motor overload state is retained over power down. Speed dependency is set by parameters 35.51 Motor load curve, 35.52 Zero speed load and 35.53 Break point.

- Parameters common to motor thermal protection and motor overload protection: 35.51 Motor load curve (page 453), 35.52 Zero speed load (page 453) and 35.53 Break point (page 454).
- Parameters specific to motor overload protection: 35.05 Motor overload level (page 445), 35.56 Motor overload action (page 455) and 35.57 Motor overload class (page 455).

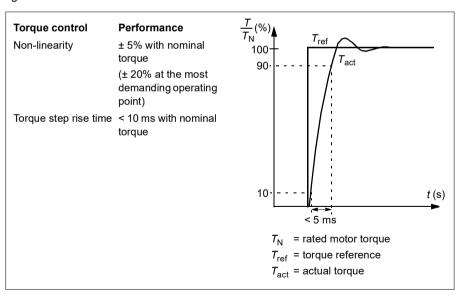
# Speed control performance figures

The table below shows typical performance figures for speed control.



# Torque control performance figures

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



# Motor potentiometer

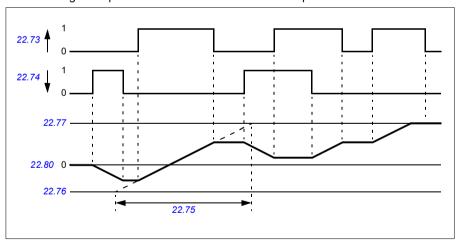
The Motor potentiometer is, in effect, a counter whose value can be adjusted up and down using two digital signals selected by parameters 22.73 Motor potentiometer up source and 22.74 Motor potentiometer down source. When the Motor potentiometer is enabled by 22.71 Motor potentiometer function, the counter assumes the value set by 22.72 Motor potentiometer initial value. Depending on the mode selected in 22.71, the counter 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 counter value does not change.

The output of the Motor potentiometer 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.

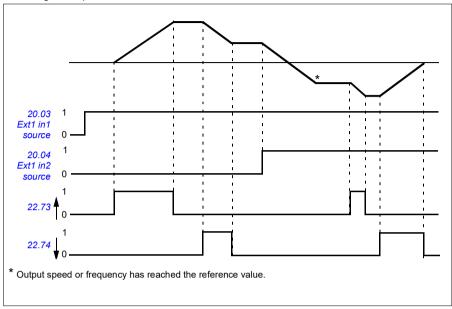
**Note**: Parameter 22.70 Motor potentiometer reference enable should be set appropriately (see the parameter description) to ensure that parameter 22.80 Motor potentiometer ref act is increased/decreased by 22.73 Motor potentiometer up source or 22.74 Motor potentiometer down source.

The following example shows the behavior of the Motor potentiometer counter value.



Parameters 22.73 Motor potentiometer up source and 22.74 Motor potentiometer down source control speed or frequency from zero to maximum speed or frequency.

The running direction can be changed with parameter 20.04 Ext1 in 2 source. See the following example.



# Settings

- Parameters 22.71 Motor potentiometer function...22.80
- 22.80 Motor potentiometer ref act (page 388).

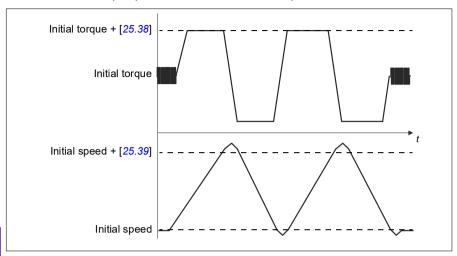
### Speed controller autotune

You can adjust the speed controller of the drive automatically with the autotune function. Autotuning is based on an estimation of the mechanical time constant (inertia) of the motor and machine.

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

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

The diagram below shows the behavior of speed and torque during the autotune routine. In this example, parameter *25.40 Auto tune repeat times* is set to 2.



#### Notes

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

### Before activating the autotune routine

**Note**: Speed controller autotuning works only when the speed stays within a specific window during the sequence:

- Speed is max 90% of the motor nominal speed or max speed (parameter group 30 Limits), whichever is smaller.
- Speed is min 10% of the motor nominal speed or minimum speed (parameter group 30 Limits), whichever is bigger.

The prerequisites for performing the autotune routine are the following:

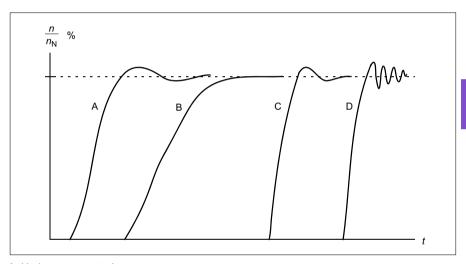
- The motor identification run (ID run) has been successfully completed
- Speed and torque limits (parameter group 30 Limits) have been set
- The speed feedback has been monitored for noise, vibrations and other disturbances caused by the mechanics of the system, and speed error filtering (24 Speed reference conditioning) and zero speed (parameters 21.06 and 21.07) have been set to eliminate these disturbances.

The drive has been started and is running in speed control mode.

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

#### Autotune modes

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



- A: Undercompensated
- B: Normally tuned (autotuning)
- C: Normally tuned (manually). Better dynamic performance than with B
- D: Overcompensated speed controller

#### Autotune results

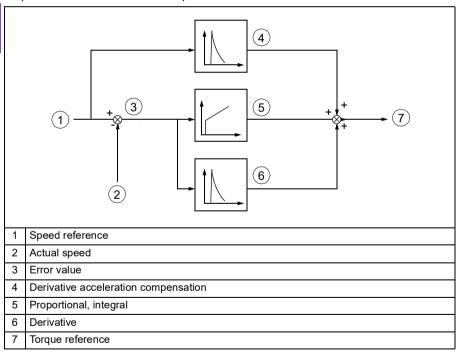
For the parameters, see FW Part 2.

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

- 25.02 Speed proportional gain 25.02 Speed proportional gain (proportional gain of the speed controller)
- 25.03 Speed integration time25.03 Speed integration time (integration time of the speed controller)
- 25.37 Mechanical time constant25.37 Mechanical time constant (mechanical time constant of the motor and machine).

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

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



# Warning indications

A warning message, *AF90 Speed controller autotuning*, will be generated if the autotune routine does not complete successfully. See chapter *Fault tracing* on page 191 for further information.

- Parameters 25.33 Speed controller auto tune...25.40 Auto tune repeat times25.33 Speed controller autotune...25.40 Auto tune repeat times (FW Part 2)
- Event: AF90 Speed controller autotuningAF90 Speed controller autotuning.

# DC voltage control

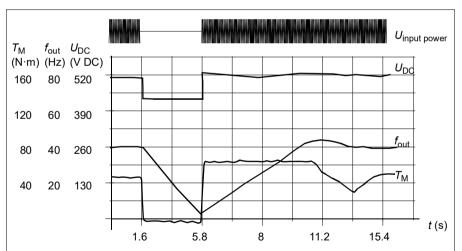
# Overvoltage control

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 (for example, UPS) to keep the contactor control circuit closed during a short supply break.



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

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

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

Implement the undervoltage control function as follows:

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

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



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

#### Automatic restart

It is possible to restart the drive automatically after a short (max. 10 seconds) power supply failure by using the Automatic restart function, provided that the drive is allowed to run for 10 seconds without the cooling fans operating.

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

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

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

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

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

# Voltage control and trip limits

The control and trip limits of the intermediate DC voltage regulator are relative to the supply voltage as well as drive/inverter type. The DC voltage  $(U_{DC})$  is approximately

1.41 times the line-to-line supply voltage, and is displayed by parameter *01.11 DC voltage*.

The system calculates the necessary drive DC limits from parameters 95.01 Supply voltage and 95.02 Adaptive voltage limits.

# DC voltage levels for drive types -01 and -04

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

Adaptive voltage limit enabled by parameter 95.02 Adaptive voltage limits

	95.01 Supply voltage							
DC voltage level [V] See 95.01 Supply voltage.	AC supply voltage range [V] 208240	AC supply voltage range [V] 380415	AC supply voltage range [V] 440480	AC supply voltage range [V] 525600	Automatic / Not selected			
Overvoltage fault limit	421	842	842	1053	842			
Overvoltage control limit	389	779	779	974	779			
Internal brake chopper start limit	389	779	779	974	779			
Internal brake chopper stop limit	379	759	759	949	759			
Overvoltage warning limit	372	745	745	931	745			
Undervoltage warning limit	0.85 x 1.41 x par 95.03 value	0.85 × 1.41 × par 95.03 value	0.85 × 1.41 × par 95.03 value	0.85 × 1.41 × par 95.03 value	0.85 × 1.41 × par 95.03 value			
Undervoltage control limit	0.78 x 1.41 x par 95.03 value	0.78 × 1.41 × par 95.03 value	0.78 × 1.41 × par 95.03 value	0.78 × 1.41 × par 95.03 value	0.78 × 1.41 × par 95.03 value			
Charging relay closing limit / charging deactivation	0.78 x 1.41 x par 95.03 value	0.78 × 1.41 × par 95.03 value	0.78 × 1.41 × par 95.03 value	0.78 × 1.41 × par 95.03 value	0.78 × 1.41 × par 95.03 value			
Charging relay opening limit / charging activation	0.73 x 1.41 x par 95.03 value	0.73 × 1.41 × par 95.03 value	0.73 × 1.41 × par 95.03 value	0.73 × 1.41 × par 95.03 value	0.73 × 1.41 × par 95.03 value			
DC voltage at upper bound of supply voltage range (U <sub>DCmax</sub> )	324	560	648	810	(variable)			
DC voltage at lower bound of supply voltage range $(U_{\rm DCmin})$	281	513	594	709	(variable)			
Standby limit <sup>3)</sup>	0.73 x 1.41 x par 95.03 value	0.73 × 1.41 × par 95.03 value	0.73 × 1.41 × par 95.03 value	0.73 × 1.41 × par 95.03 value	0.73 × 1.41 × par 95.03 value			
Charging relay opening limit / charging activation	0.73 x 1.41 x par 95.03 value	0.73 × 1.41 × par 95.03 value	0.73 × 1.41 × par 95.03 value	0.73 × 1.41 × par 95.03 value	0.73 × 1.41 × par 95.03 value			

**Note**: Parameter 95.03 Estimated AC supply voltage is the estimated AC supply voltage while powering up the drive and it will not be continuously updated during run time.

# Adaptive voltage limit disabled by parameter 95.02 Adaptive voltage limits

DC voltage level [V] See 95.01 Supply voltage.	95.01 Supply Voltage							
	AC supply voltage range	AC supply	AC supply voltage	AC supply voltage	Automatic / Not selected			
	[V] 208240	voltage range [V] 380415	range [V] 440480	range [V] 525600	if 95.03 < 456 V AC	if 95.03 > 456 V AC		
Overvoltage fault limit	421	842	842	1053	842	842		
Overvoltage control limit	389	779	779	974	779	779		
Internal brake chopper start limit	389	779	779	974	779	779		
Internal brake chopper stop limit	379	759	759	949	759	759		
Overvoltage warning limit	372	745	745	931	745	745		
Undervoltage warning limit	0.85 x 1.35 x 208 = 239	0.85 × 1.35 × 380 = 436	0.85 × 1.35 × 440 = 504	0.85 x 1.35 x 525 = 602	0.85 × 1.35 × 380 = 436	0.85 × 1.35 × 440 = 505		
Undervoltage control limit	0.78 x 1.35 x 208 = 219	0.78 × 1.35 × 380 = 400	0.78 × 1.35 × 440 = 463	0.78 x 1.35 x 525 = 553	0.78 × 1.35 × 380 = 400	0.78 × 1.35 × 440 = 463		
Charging relay closing limit / charging deactivation	0.78 x 1.35 x 208 = 219	0.78 × 1.35 × 380 = 400	0.78 × 1.35 × 440 = 463	0.78 x 1.35 x 525 = 553	0.78 × 1.35 × 380 = 400	0.78 × 1.35 × 440 = 463		
Charging relay opening limit / charging activation	0.73 x 1.35 x 208 = 205	0.73 × 1.35 x 380 = 374	0.73 × 1.35 x 440 = 433	0.73 x 1.35 x 525 = 517	0.73 × 1.35 x 380 = 374	0.73 × 1.35 x 440 = 433		
DC voltage at upper bound of supply voltage range ( <i>U</i> <sub>DCmax</sub> )	324	560	648	810	(variable)	(variable)		
DC voltage at lower bound of supply voltage range (U <sub>DCmin</sub> )	281	513	594	709	(variable)	(variable)		
Standby limit	0.73 x 1.35 x 208 = 205	0.73 × 1.35 × 380 = 374	0.73 × 1.35 × 440 = 433	0.73 x 1.35 x 525 = 517	0.73 × 1.35 × 380 = 374	0.73 × 1.35 × 440 = 433		
Undervoltage fault limit <sup>1)</sup>	0.73 x 1.35 x 208 = 205	0.73 × 1.35 × 380 = 374	0.73×1.35×4 40 = 433	0.73 x 1.35 x 525 = 517	0.73 × 1.35 × 380 = 374	0.73 × 1.35 × 440 = 433		

<sup>1)</sup> See section *Triggering the undervoltage fault* on page 175.

# DC voltage levels for drive types -31 and -34

All levels are relative to the supply voltage range selected in parameter 95.01 Supply voltage. The following table shows the values of selected DC voltage levels in volts and in percent of  $U_{\rm DCmax}$  (the DC voltage at the upper bound of the supply voltage range).

Level IV DC /0/ of //	Supply voltage range [V AC] (see 95.01 Supply voltage)						
Level [V DC (% of U <sub>DCmax</sub> )]	208240	380415	440480	500	525600	660690	
Overvoltage fault limit	489/440*	800	878	880	1113	1218	
Overvoltage control limit	405 (125)	700 (125)	810 (125)	810 (120)	1013 (125)	1167 (125)	
Internal brake chopper at 100% pulse width	403 (124)	697 (124)	806 (124)	806 (119)	1008 (124)	1159 (124)	
Internal brake chopper at 0% pulse width	375 (116)	648 (116)	749 (116)	780 (116)	936 (116)	1077 (116)	
Overvoltage warning limit	373 (115)	644 (115)	745 (115)	776 (115)	932 (115)	1071 (115)	
U <sub>DCmax</sub> = DC voltage at upper bound of supply voltage range	324 (100)	560 (100)	648 (100)	675 (100)	810 (100)	932 (100)	
DC voltage at lower bound of supply voltage range	281	513	594	675	709	891	
Undervoltage control and warning limit	239 (85)	436 (85)	505 (85)	574 (85)	602 (85)	757 (85)	
Charging activation/standby limit	225 (80)	410 (80)	475 (80)	540 (80)	567 (80)	713 (80)	
Undervoltage fault limit	168 (60)	308 (60)	356 (60)	405 (60)	425 (60)	535 (60)	

<sup>\*489</sup> V with frames R1...R3, 440 V with frames R4...R8.

### Triggering the undervoltage warning

The undervoltage warning A3A2 is triggered if one of below conditions is active:

- If the DC link voltage goes below the undervoltage warning limit when the drive is not modulating.
- If the DC link voltage goes below the standby limit when the drive is modulating, and auto restart is enabled (that is, parameter 21.18 Auto restart time > 0.0 s). The warning will continue to appear if the actual DC link voltage is continuously below the standby limit and until the auto restart time has elapsed. The drive control board must be externally powered by 24 VDC to have this functionality, otherwise the control board may be switched off if the voltage goes below the hardware limit.

# Triggering the undervoltage fault

The undervoltage fault 3220 is triggered if the drive is modulating and one of the below conditions is active:

- If the DC link voltage goes below the undervoltage trip limit and auto restart is not enabled (that is, parameter 21.18 Auto restart time = 0.0 s).
- If the DC link voltage goes below the undervoltage trip limit and auto restart is enabled (that is, parameter 21.18 Auto restart time > 0.0 s), then undervoltage trip will occur if only the DC link voltage is continuously below the undervoltage trip limit and after auto restart time has elapsed. Control board of the drive must be externally powered by 24 VDC source to have this functionality. Otherwise the control board may be switched off, just showing an undervoltage warning.

### Settings

- Parameters 01.11 DC voltage (page 293), 30.30 Overvoltage control (page 408), 30.31 Undervoltage control (page 408), 95.01 Supply voltage (page 549) and 95.02 Adaptive voltage limits (page 549).
- Warning A3A2 DC link undervoltage (page 195) and fault 3220 DC link undervoltage (page 212).

# 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 R1...R3) start conducting when the DC link voltage reaches approximately 1.15  $\times$   $U_{\rm DCmax}$ . 100% maximum pulse width is reached at approximately 1.2 ×  $U_{DCmax}$ : ( $U_{DCmax}$  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.

- Parameter 01.11 DC voltage (page 293)
- Parameter group 43 Brake chopper (page 482).

# Supervisory

# 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**

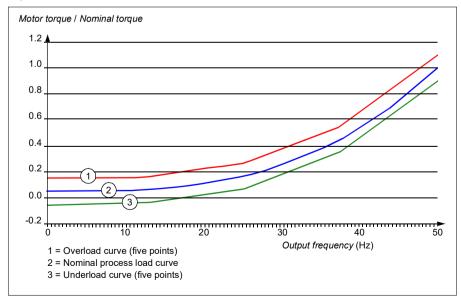
Parameter group 32 Supervision (page 423).

# User load curve (Condition monitoring)

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

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

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



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

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

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

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

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

# Settings

• Parameter group 37 User load curve (page 459).

# **Energy efficiency**

# 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. Energy optimization is enabled by default.

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

### Settings

- Menu > Energy efficiency
- Parameter 45.11 Energy optimizer (page 485).

# 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 CO<sub>2</sub> emissions, and
- A load analyzer showing the load profile of the drive (see separate section on page 179).

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

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

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

- Menu > Energy efficiency
- Parameter group 45 Energy efficiency (page 483)
- Parameters 01.50 Current hour kWh, 01.51 Previous hour kWh, 01.52 Current day kWh and 01.53 Previous day kWh (on page 294)
- Parameters 01.55 Inverter GWh counter (resettable), 01.56 Inverter MWh counter (resettable), 01.57 Inverter kWh counter (resettable) and 01.58 Cumulative inverter energy (resettable) (on page 295).

# Load analyzer

### Peak value logger

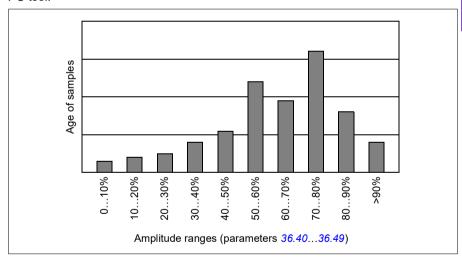
The user can select a signal to be monitored by a peak value logger. The logger records the peak value of the signal along with the time the peak occurred, as well as motor current. DC voltage and motor speed at the time of the peak. The peak value is sampled at 2 ms intervals.

### **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 control 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  $(I_{\text{max}})$ , which is listed in the *Hardware manual* of the drive. The measured current is logged continuously. The distribution of samples is shown by parameters 36.20...36.29.

- Menu > Diagnostics > Load profile
- Parameter group 36 Load analyzer (page 456).

# 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 possible to use digital inputs to switch between user parameter sets.

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

- forced I/O values such as parameters 10.03 DI force selection and 10.04 DI forced data
- I/O extension module settings (group 15)
- data storage parameters (group 47)
- fieldbus communication enable parameter (50.01 FBA A enable)
- other fieldbus communication settings (groups 51...53 and 58)
- some hardware settings in group 95 HW configuration (for example parameter 95.01 Supply voltage)
- user set selection parameters 96.11...96.13.

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.

If no parameter sets have been saved, attempting to load a set will create all sets from the currently active parameter settings.

Switching between sets is only possible with the drive stopped.

- Menu > Primary settings > Advanced functions > User sets
- Parameters 96.10...96.13 (page 557).

### System 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 170.

#### DC undervoltage

See section *Undervoltage control* (power loss ride-through) on page 170.

#### **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.

### Programmable protection functions

#### Motor phase loss detection (parameter 31.19)

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

#### 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...31.31)

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

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

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

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

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

#### Emergency stop

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

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

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

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

#### Notes:

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

### Settings

• Parameters 21.04 Emergency stop mode (page 374), 21.05 Emergency stop source (page 374), 23.23 Emergency stop time (page 391), 31.32 Emergency ramp supervision (page 420) and 31.33 Emergency ramp supervision delay (page *421*).

### **Diagnostics**

#### Diagnostics menu

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



- Drive actual values
- Active faults: Use this view to see currently active faults and how to fix and reset them.
- Active warnings: Use this view to see currently active warnings and how to fix them.
- Active inhibits: Use this view to see the active inhibits and how to fix them. In
  addition, in the Clock, region, display menu you can disable (enabled by default)
  pop-up views showing information on inhibits when you try to start the drive but it
  is prevented.
- Fault and event log: Shows lists faults and other events.
- 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.
- Communication status: Use this view to find out status information and sent and received data from fieldbus.
- Motor summary: Use this view to find out motor nominal values, control mode and whether ID run has been completed.

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

#### Backup

#### Manual backup

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

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

#### Automatic backup

The assistant control panel has a dedicated space for one automatic backup. An automatic backup is created two hours after the last parameter change. After completing the backup, the control 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.

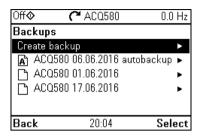
Parameter changes from fieldbus interfaces are ignored unless you have forced parameter saving with parameter 96.07 Parameter save manually.

#### Restore

The backups are shown on the control panel. Automatic backups are marked with icon (A) and manual backups with (1). To restore a backup, select it and press (1). In the following display you can view backup contents and restore all parameters or select a subset to be restored.

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

**Note:** There is a risk of removing the **QR code** menu entry permanently if a backup from a drive with an old firmware or old control panel firmware is restored to a drive with a new firmware from October 2014 or later





#### Settings

- Menu > Backups
- Parameter 96.07 Parameter save manually (page 555).

#### 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 491).

#### Parameter checksum calculation

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

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

The parameters included in the checksum A calculation are user editable parameters in parameter groups 10...13, 15, 19...25, 28, 30...32, 34...37, 40...41, 43, 45...46, 70...74, 76, 80, 94...99.

The set of parameters for checksum B does not include

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

The parameters included in the checksum B calculation are user editable parameters in parameter groups 10...13, 15, 19...25, 28, 30...32, 34, 35...37, 40...41, 43, 46, 70...74. 76. 80. 94...97.

#### Settings

• Parameters 96.54...96.69, 96.71...96.72 (page 560).

#### User lock

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



WARNING! ABB will not be liable for damages or losses caused by the failure to activate the user lock using a new pass code. See Cybersecurity disclaimer (page 20).

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



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

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

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

#### Settings

Parameters 96.02 (page 555) and 96.100...96.102 (page 563).

#### Sine filter support

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

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

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

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

#### Settings

Parameter 95.15 Special HW settings (page 549).

#### Al dead band

Al dead band value is set in parameter 12.110 (Al dead band) as a percentage of 10V in case of voltage, 20mA in case of current and applicable to both Al1 and Al2. In addition to this, 10% of the dead band value is added as a dead band hysteresis positive and negative.

- In case of voltage: Al dead band value = 10 \* Al dead band (parameter 12.110) \* 0.01
- In case of current: Al dead band value = 20\* Al dead band (parameter 12.110) \* 0.01

After this, the AI dead band value is multiplied with the Hysteresis value (fixed to 10%):

Al Hysteresis value = Al dead band value \* 0.1

#### Example

Parameter 12.110 (Al dead band) value is set to 50%.

In case of voltage:

- · Al unit selection = V
- Al max in range of 0V to 10V
- Al dead band value = 10 \* 50 \* 0.01 = 5V
- Al Hysteresis value = 5 \* 0.1 = 0.5V
- Hysteresis positive value = 5 + 0.5 = 5.5V
- Hysteresis negative value = 5 0.5 = 4.5V

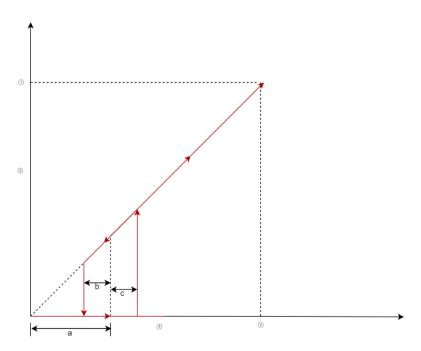
Now, when AI input voltage is increasing up to 5.5V, AI actual shows 0. As soon as AI input voltage reaches 5.5V, AI actual shows 5.5V and continues to detect the AI input voltage up to AI max which is in range of 0V to 10V. When AI input voltage is

decreasing, AI actual shows the actual AI applied up to 4.5V. As soon as AI input goes below 4.5V, Al actual shows 0 till input voltage reaches 0V.

#### In case of current:

- Al unit selection = mA
- Al max in range of 0ma to 20mA
- Al dead band value = 20 \* 50 \* 0.01 = 10mA
- Al Hysteresis value = 10 \* 0.1 = 1.0mA
- Hysteresis positive value = 10 + 1.0 = 11.0mA
- Hysteresis negative value = 10 1.0 = 9.0mA

Now, when AI input current is increasing up to 11mA, AI actual shows 0mA. As soon as AI input current reaches 11.0mA, AI actual shows 11.0mA and continues to detect the AI input current up to AI max which is in range of 0ma to 20mA. When AI input current is decreasing, AI actual shows the actual AI applied up to 9.0mA. As soon as Al input goes below 9.0mA, Al actual shows 0 till input current reaches 0mA.



- 1 = AI max actual
- 2 = Al actual
- 3 = Al given
- 4 = AI max

In the above diagram, a is the deadband value. Values b and c are -10% and +10% hysteresis value respectively. Hysteresis values are internally set in firmware and cannot be edited by the user.



# Fault tracing

### What this chapter contains

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

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

### Safety

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

### Indications

### Warnings and faults

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

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

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

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

#### Pure events

In addition to warnings and faults, there are pure events that are only recorded in the event log of the drive. The codes of these events are included in the *Warning messages* table on page 194.

#### 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

The drive has two event logs. One log contains faults and fault resets, the other contains warnings, pure events, and clearing entries. Each log contains 32 the most recent events. All indications are stored in the event log with a time stamp and other information. See section *Viewing warning/fault information* on page 192.

To clear the fault and event logger, select **Menu > Primary settings > Reset to defaults > Reset fault and event logs**, or set parameter 96.51 Clear fault and event logger to value Clear.

#### **Auxiliary codes**

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

### Viewing warning/fault information

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

For each stored fault, the control panel shows the fault code, time and values of nine parameters (actual signals and status words) stored at the time of the fault. The values of the parameters for the latest fault are in parameters 05.80...05.89.

For active faults and warnings, see

- Menu > Diagnostics > Active faults
- Menu > Diagnostics > Active warnings
- parameters in group 04 Warnings and faults (page 298).

For previously occurred faults and warnings, see

- Menu > Diagnostics > Fault & event log
- parameters in group 04 Warnings and faults (page 298).

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

### QR code generation for mobile service application

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

To generate the QR code, select **Menu > System info > QR code**.

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

Note: There is a risk of removing the QR code menu permanently if a backup from a drive with an old firmware or old panel firmware is restored to a drive with a new firmware from October 2014 or later.

## Warning messages

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

Code (hex)	Warning / Aux. code	Cause	What to do
A2B1	Overcurrent	Output current has exceeded internal fault limit. In addition to an actual overcurrent situation, this warning may also be caused by an earth fault or supply phase loss.	Check motor load. Check acceleration times in parameter group 23 Speed reference ramp (speed control) or 28 Frequency reference chain (frequency control). Also check parameters 46.01 Speed scaling, 46.02 Frequency scaling and 46.03 Torque scaling. Check motor and motor cable (including phasing and delta/star connection). Check for an earth fault in motor or motor cables by measuring the insulation resistances of motor and motor cable. See chapter Electrical installation, section Checking the insulation of the assembly in the Hardware manual of the drive. Check there are no contactors opening and closing in motor cable. Check that the start-up data in parameter group 99 Motor data corresponds to the motor rating plate. Check that there are no power factor correction capacitors or surge absorbers in motor cable.
A2B3	Earth leakage	Drive has detected load unbalance typically due to earth fault in motor or motor cable.	Check there are no power factor correction capacitors or surge absorbers in motor cable.  Check for an earth fault in motor or motor cables by measuring the insulation resistances of motor and motor cable. See chapter Electrical installation, section Checking the insulation of the assembly in the Hardware manual of the drive. If an earth fault is found, fix or change the motor cable and/or motor. If no earth fault can be detected, contact your local ABB representative.
A2B4	Short circuit	Short-circuit in motor cable(s) or motor.	Check motor and motor cable for cabling errors. Check motor and motor cable (including phasing and delta/star connection). Check for an earth fault in motor or motor cables by measuring the insulation resistances of motor and motor cable. See chapter Electrical installation, section Checking the insulation of the assembly in the Hardware manual of the drive. Check there are no power factor correction capacitors or surge absorbers in motor cable.

Code (hex)	Warning / Aux. code	Cause	What to do
	0001	Short circuit in the upper transistor of the U-phase. For frames R6 to R11.	
	0002	Short circuit in the lower transistor of the U-phase. For frames R6 to R11.	
	0004	Short circuit in the upper transistor of the V-phase. For frames R6 to R11.	
	8000	Short circuit in the lower transistor of the V-phase. For frames R6 to R11.	
	0010	Short circuit in the upper transistor of the W-phase. For frames R6 to R11.	
	0020	Short circuit in the lower transistor of the W-phase. For frames R6 to R11.	
	0040	DC capacitor short circuit. For frames R6 to R11.	
	0080	State feedback from output phases does not match control signals. For frames R6 and R7.	
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.
A490	Incorrect temperature sensor setup	Temperature cannot be supervised due to incorrect adapter setup.	Check the settings of temperature source parameters 35.11 and 35.21.
A491	External temperature 1 (Editable message text)	Measured temperature 1 has exceeded warning limit.	Check the value of parameter 35.02  Measured temperature 1.  Check the cooling of the motor (or other equipment whose temperature is being measured).  Check the value of 35.13 Temperature 1 warning limit.

Code (hex)	Warning / Aux. code	Cause	What to do
A492	External temperature 2 (Editable message text)	Measured temperature 2 has exceeded warning limit.	Check the value of parameter 35.03  Measured temperature 2. Check the cooling of the motor (or other equipment whose temperature is being measured). Check the value of 35.23 Temperature 2 warning limit.
A4A0	Control board temperature	Control board temperature is too high.	Check the auxiliary code. See actions for each code below.
	(none)	Temperature above warning limit	Check ambient conditions. Check air flow and fan operation. Check heatsink fins for dust pick-up.
	0001	Thermistor broken	Contact an ABB service representative for control board replacement.
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 (IP21 frames R4R9) or if it exceeds 50 °C /122 °F (IP21 frames R1R9), ensure that load current does not exceed derated load capacity of the drive. For all P55 frames, check the derating temperatures. See chapter <i>Technical data</i> , section <i>Derating</i> in the <i>Hardware manual</i> of the drive. Check drive module cooling air flow and fan operation.  Check inside of cabinet and heatsink of drive module for dust pick-up. Clean whenever necessary.
A4B0	Excess temperature	Power unit module temperature is excessive.	Check ambient conditions. Check air flow and fan operation. Check heatsink fins for dust pick-up. Check motor power against drive power. Check the auxiliary code.
	FA	Ambient temperature	
A4B1	Excess temperature difference	High temperature difference between the IGBTs of different phases.	Check the motor cabling. Check cooling of drive module(s).
A4F6	IGBT temperature	Drive IGBT temperature is excessive.	Check ambient conditions. Check air flow and fan operation. Check heatsink fins for dust pick-up. Check motor power against drive power.
A581	Fan	Cooling fan feedback missing.	Check the auxiliary code to identify the fan. Code <b>0</b> denotes main fan 1. Other codes (format XYZ): "X" specifies state code ( <b>1</b> : ID run, <b>2</b> : normal). "Y" = 0, "Z" specifies the index of the fan ( <b>1</b> : Main fan 1, <b>2</b> : Main fan 2, <b>3</b> : Main fan 3). Check fan operation and connection. Replace fan if faulty.

Code (hex)	Warning / Aux. code	Cause	What to do
A582	Auxiliary fan missing	An auxiliary cooling fan (IP55 internal fan) is stuck or disconnected.	Check the auxiliary code. Check the auxiliary fan and connection. Replace faulty fan. Make sure the front cover of the drive is in place and tightened. If the commissioning of the drive requires that the cover is off, set parameter 31.36 Aux fan fault function temporarily to value No action within two minutes from power-up.
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.  Check the value of parameter 95.04 Control board supply.
A5EA	Measurement circuit temperature	Problem with internal temperature measurement of the drive.	Check the auxiliary code. They depend on the control unit type.
		Frames R1R5	Contact your local ABB representative.
	0000 0000	IGBT temperature	
	0000 0003	Board temperature	
	0000 0006	Power supply temperature	
		Frames R6R11 and ACx580-31 frame R3	Contact your local ABB representative.
	0000 0001	U-phase IGBT	
	0000 0002	V-phase IGBT	
	0000 0003	W-phase IGBT	
	0000 0004	Board temperature	
	0000 0005	Brake chopper	
	0000 0006	Air inlet (TEMP3)	
	0000 0007	Power supply temperature	
	8000 0008	du/dt (TEMP2)	
	0000 0009	TEMP1	
	FAh =1111 1010	Ambient temperature	
A5EB	PU board powerfail	Power unit power supply failure.	Contact your local ABB representative.
A5ED	Measurement circuit ADC	Measurement circuit fault.	Contact your local ABB representative.
A5EE	Measurement circuit DFF	Measurement circuit fault.	Contact your local ABB representative.
A5EF	PU state feedback	State feedback from output phases does not match control signals.	Contact your local ABB representative.
A5F0	Charging feedback	Charging feedback signal missing.	Check the feedback signal coming from the charging system.

Code (hex)	Warning / Aux. code	Cause	What to do
A682	Flash erase speed exceeded	The flash memory (in the memory unit) has been erased too frequently, compromising the lifetime of the memory.	Avoid forcing unnecessary parameter saves by parameter 96.07 or cyclic parameter writes (such as user logger triggering through parameters). Check the auxiliary code (format XYYY YZZZ). "X" specifies the source of warning (1: generic flash erase supervision). "ZZZ" specifies the flash subsector number that generated the warning.
A686	Checksum mismatch Programmable warning: 96.54 Checksum action	The calculated parameter checksum does not match any enabled reference checksum.	Check that all necessary approved (reference) checksums (96.7196.72) are enabled in 96.55 Checksum control word.  Check the parameter configuration.  Using 96.55 Checksum control word, enable a checksum parameter and copy the actual checksum into that parameter.
A687	Checksum configuration	An action has been defined for a parameter checksum mismatch but the feature has not been configured.	Contact your local ABB representative for configuring the feature, or disable the feature in 96.54 Checksum action.
A6A4	Motor nominal value	The motor parameters are set incorrectly.	Check the auxiliary code. See actions for each code below.
		The drive is not dimensioned correctly.	
	0001	Slip frequency is too small.	Check the settings of the motor
	0002	Synchronous and nominal speeds differ too much.	configuration parameters in groups 98 and 99.  Check that the drive is sized correctly for
	0003	Nominal speed is higher than synchronous speed with 1 pole pair.	the motor.
	0004	Nominal current is outside limits	
	0005	Nominal voltage is outside limits.	
	0006	Nominal power is higher than apparent power.	
	0007	Nominal power not consistent with nominal speed and torque.	
	8000	Motor nominal power factor is not within limits for Asynchronous motors [0.50.97].	
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
A6A7	System time not set	System time is not set. Timed functions cannot be used and fault log dates are not correct.	Set the system time manually or connect the control panel to the drive to synchronize the clock. If basic control panel is used, synchronize the clock through the EFB or a fieldbus module. Set parameter 34.10 Timed functions enable to Disabled to disable the timed functions if they are not used.
A6B0	User lock is open	The user lock is open, ie, user lock configuration parameters 96.10096.102 are visible.	Close the user lock by entering an invalid pass code in parameter 96.02 Pass code. See section Parameter checksum calculation (page 186).
A6B1	User pass code not confirmed	A new user pass code has been entered in parameter 96.100 but not confirmed in 96.101.	Confirm the new pass code by entering the same code in 96.101. To cancel, close the user lock without confirming the new code. See section Parameter checksum calculation (page 186).
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 group 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.
A6E6	ULC configuration	User load curve configuration error.	Check the auxiliary code. See actions for each code below.
	0000	Speed points inconsistent.	Check that each speed point (parameters 37.1137.15) has a higher value than the previous point.
	0001	Frequency points inconsistent.	Check that each frequency point (37.2037.16) has a higher value than the previous point.
	0002	Underload point above overload point.	Check that each overload point (37.3137.35) has a higher value than
	0003	Overload point below underload point.	the corresponding underload point (37.2137.25).
A6E7	IPC configuration warning	IPC configuration error.	Check the auxiliary code. See actions for each code below.

Code (hex)	Warning / Aux. code	Cause	What to do
	0001	IPC incorrectly configured for EFB.	Check that if parameter 76.21 Multipump configuration is set to IPC, Level control-Emptying or Level control-Filling, parameter 58.01 Protocol enable is set to None / IPC communication.
			Check that if 58.01 Protocol enable is set to None / IPC communication, 76.21 Multipump configuration is set to IPC, Level control - Emptying or Level control - Filling, and 76.24 IPC communication port is set to EFB.
	0002	IPC incorrectly configured for FBA.	Check that if parameter 76.21 Multipump configuration is set to none of IPC, Level control - Emptying or Level control - Filling, parameter 50.01 FBA A enable is set to Disable.
A6E8	IPC version mismatch	The master and follower(s) do not have the same IPC version and will not run in IPC mode.	Check 07.05 Firmware version of all drives on the IPC network and load the drive(s) as needed with the desired firmware version.
A780	Motor stall Programmable warning: 31.24 Stall function	Motor is operating in stall region because of, for example, excessive load or insufficient motor power.	Check motor load and drive ratings. Check fault function parameters.
A783	Motor overload	Motor current is too high.	Check for overloaded motor. Adjust the parameters used for the motor overload function (35.5135.53) and 35.5535.56.
A784	Motor disconnect	All three output phases are disconnected from motor.	Check that switches between drive and motor are closed. Check that all cables between drive and motor are connected and secured. If no issue was detected and drive output was actually connected to motor, contact ABB.
A792	Brake resistor wiring	Brake resistor short circuit or brake chopper control fault. For drive frames R6 or larger.	Check brake chopper and brake resistor connection. Ensure brake resistor is not damaged.
A793	BR excess temperature	Brake resistor temperature has exceeded warning limit defined by parameter 43.12 Brake resistor warning limit.	Stop drive. Let resistor cool down. Check resistor overload protection function settings (parameter group 43 Brake chopper). Check warning limit setting, parameter 43.12 Brake resistor warning limit. Check that the resistor has been dimensioned correctly. Check that braking cycle meets allowed limits.
A794	BR data	Brake resistor data has not been given.	One or more of the resistor data settings (parameters 43.0843.10) is incorrect. The parameter is specified by the auxiliary code.
	0000 0001	Resistance value too low.	Check value of 43.10 Brake resistance.

Code (hex)	Warning / Aux. code	Cause	What to do
	0000 0002	Thermal time constant not given.	Check value of 43.08 Brake resistor thermal tc.
	0000 0003	Maximum continuous power not given.	Check value of 43.09 Brake resistor Pmax cont.
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 extension module is not the same as configured.	Check that the installed extension module (shown by parameter 15.02 Detected extension module) is the same as selected by parameter 15.01 Extension module type.
A7C1	FBA A communication Programmable warning: 50.02 FBA A comm loss func	Cyclical communication between drive and fieldbus adapter module A or between PLC and fieldbus adapter module A is lost.	Check status of fieldbus communication. See user documentation of fieldbus interface. Check settings of parameter groups 50 Fieldbus adapter (FBA), 51 FBA A settings, 52 FBA A data in and 53 FBA A data out. Check cable connections. Check if communication master is able to communicate.
A7CE	EFB comm loss Programmable warning: 58.14 Communication loss action	Communication break in embedded fieldbus (EFB) communication.	Check the status of the fieldbus master (online/offline/error etc.). Check cable connections to the EIA-485/X5 terminals 29, 30 and 31 on the control unit.
A7EE	Panel loss Programmable warning: 49.05 Communication loss action	Control panel or PC tool selected as active control location for drive has ceased communicating.	Check PC tool or control panel connection. Check control panel connector. Check mounting platform if being used. Disconnect and reconnect the control panel.
A88F	Cooling fan	Maintenance timer limit exceeded.	Consider changing the cooling fan. Parameter 05.04 Fan on-time counter shows the running time of the cooling fan.

Code (hex)	Warning / Aux. code	Cause	What to do
A8A0	Al supervision Programmable warning: 12.03 Al supervision function	An analog signal is outside the limits specified for the analog input.	Check signal level at the analog input. Check the wiring connected to the input. Check the minimum and maximum limits of the input in parameter group 12 Standard AI.
A8A1	RO life warning	The relay has changed states more than the recommended number of times.	Change the control board or stop using the relay output. Check the auxiliary code, which identifies 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, for example, 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.  Check the auxiliary code, which identifies the relay output source parameter.
	0001	Relay output 1	Select a different signal with parameter 10.24 RO1 source.
	0002	Relay output 2	Select a different signal with parameter 10.27 RO2 source.
	0003	Relay output 3	Select a different signal with parameter 10.30 RO3 source.
A8B0	ABB Signal supervision 1 (Editable message text) Programmable warning: 32.06 Supervision 1 action	Warning generated by the signal supervision function 1.	Check the source of the warning (parameter 32.07 Supervision 1 signal).
A8B1	ABB Signal supervision 2 (Editable message text) Programmable warning: 32.16 Supervision 2 action	Warning generated by the signal supervision function 2.	Check the source of the warning (parameter 32.17 Supervision 2 signal).
A8B2	ABB Signal supervision 3 (Editable message text) Programmable warning: 32.26 Supervision 3 action	Warning generated by the signal supervision function 3.	Check the source of the warning (parameter 32.27 Supervision 3 signal).
A8B3	ABB Signal supervision 4 (Editable message text) Programmable warning: 32.36 Supervision 4 action	Warning generated by the signal supervision function 4.	Check the source of the warning (parameter 32.37 Supervision 4 signal).
A8B4	ABB Signal supervision 5 (Editable message text) Programmable warning: 32.46 Supervision 5 action	Warning generated by the signal supervision function 5.	Check the source of the warning (parameter 32.47 Supervision 5 signal).

Code (hex)	Warning / Aux. code	Cause	What to do
A8B5	ABB Signal supervision 6 (Editable message text) Programmable warning: 32.56 Supervision 6 action	Warning generated by the signal supervision function 6.	Check the source of the warning (parameter 32.57 Supervision 6 signal).
A8BE	ULC overload warning Programmable fault: 37.03 ULC overload actions	Selected signal has exceeded the user overload curve.	Check for any operating conditions increasing the monitored signal (for example, the loading of the motor if the torque or current is being monitored). Check the definition of the load curve (parameter group 37 User load curve).
A8BF	ULC underload warning Programmable fault: 37.04 ULC underload actions	Selected signal has fallen below the user underload curve.	Check for any operating conditions decreasing the monitored signal (for example, loss of load if the torque or current is being monitored).  Check the definition of the load curve (parameter group 37 User load curve).
A981	External warning 1 (Editable message text) Programmable warning: 31.01 External event 1 source 31.02 External event 1 type	Fault in external device 1.	Check the external device. Check setting of parameter 31.01 External event 1 source.
A982	External warning 2 (Editable message text) Programmable warning: 31.03 External event 2 source 31.04 External event 2 type	Fault in external device 2.	Check the external device. Check setting of parameter 31.03 External event 2 source.
A983	External warning 3 (Editable message text) Programmable warning: 31.05 External event 3 source 31.06 External event 3 type	Fault in external device 3.	Check the external device. Check setting of parameter 31.05 External event 3 source.
A984	External warning 4 (Editable message text) Programmable warning: 31.07 External event 4 source 31.08 External event 4 type	Fault in external device 4.	Check the external device. Check setting of parameter 31.07 External event 4 source.
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.

<b>.</b> .	Т		
Code (hex)	Warning / Aux. code	Cause	What to do
AF80	INU-LSU comm loss Programmable warning: 60.79 INU-LSU comm loss function	DDCS (fiber optic) communication between converters (for example, the inverter unit and the supply unit) is lost. Note that the inverter unit will continue operating based on the status information that was last received from the other converter.	Only for ACQ580-31 and ACQ580-34. Check status of other converter (parameters 06.36 and 06.39). Check settings of parameter group 60 DDCS communication. Check the corresponding settings in the control program of the other converter. Check cable connections. If necessary, replace cables.
AF85	Line side unit warning	The supply unit (or other converter) has generated a warning.	Only for ACQ580-31 and ACQ580-34. The auxiliary code specifies the original warning code in the supply unit control program. You can find the most common auxiliary codes in section Auxiliary codes for the LSU supply unit warnings on page 225.  For full information, chapter Fault tracing in ACS880 IGBT supply control program firmware manual (3AUA0000131562 [English]).
AF88	Season configuration warning	You have configured a season which starts before the previous season.	Configure the seasons with increasing start dates, see parameters 34.60 Season 1 start date34.63 Season 4 start date.
AF90	Speed controller autotuning	The speed controller autotune routine did not complete successfully.	Check the auxiliary code. See actions for each code below.
	0000	Drive was stopped before the autotune was complete.	Start the drive and repeat autotune until successful.
	0001	The drive was started and it was not ready to follow the autotune command.	Make sure the prerequisites of the autotune run are fulfilled. See section Before activating the autotune routine (page 166).
	0002	Required torque reference could not be reached before the drive reached maximum speed.	Decrease the torque step (parameter 25.38) or increase the speed step (parameter 25.39).
	0003	Motor could not accelerate/ to maximum speed.	Increase the torque step (parameter 25.38) or decrease the speed step (parameter 25.39).
	0004	Motor could not decelerate to minimum speed.	Increase the torque step (parameter 25.38) or decrease the speed step (parameter 25.39).
	0005	Motor could not decelerate with full autotune torque.	Decrease the torque step (parameter 25.38) or the speed step (parameter 25.39).
	0006	Autotune could not write a parameter.	Run the drive one more time.
	0007	Drive was ramping down when the autotune was activated.	Run the drive to the set point and start the autotune one more time.
	0008	Drive was ramping up when the autotune was activated.	Wait until the drive reaches the set point and start autotune.

Code (hex)	Warning / Aux. code	Cause	What to do
	0009	Drive was running outside of autotune speed limits during the autotune activation.	Check the limits, set the correct setpoint and repeat the autotune.
AFAA	Autoreset	A fault is about to be autoreset.	Informative warning. See the settings in parameter group 31 Fault functions.
AFE1	Emergency stop (off2)	Drive has received an emergency stop (mode selection off2) command.	Check that it is safe to continue operation. Then return emergency stop push button to normal position. Restart
AFE2	Emergency stop (off1 or off3)	Drive has received an emergency stop (mode selection off1 or off3) command.	drive.  If the emergency stop was unintentional, check the source selected by parameter 21.05 Emergency stop source.
AFE9	Start delay	The start delay is active and the drive will start the motor after a predefined delay.	Informative warning. See parameter 21.22 Start delay.
AFED	Run permissive	Run permissive is keeping the drive from running the motor.	Check the setting of (and source selected by) parameter 20.40 Run permissive.
AFEE	Start interlock 1	Start interlock 1 is keeping the drive from starting.	Check the signal source selected for parameter 20.41 Start interlock 1.
AFEF	Start interlock 2	Start interlock 2 is keeping the drive from starting.	Check the signal source selected for parameter 20.42 Start interlock 2.
AFF0	Start interlock 3	Start interlock 3 is keeping the drive from starting.	Check the signal source selected for parameter 20.43 Start interlock 3.
AFF1	Start interlock 4	Start interlock 4 is keeping the drive from starting.	Check the signal source selected for parameter 20.44 Start interlock 4.
AFF6	Identification run	Motor ID run will occur at next start.	Informative warning.
AFF8	Motor heating active	Pre-heating is being performed	Informative warning.  Motor pre-heating is active. Current specified by parameter 21.16 Pre-heating current is being passed through the motor.
B5A0	STO event Programmable event: 31.22 STO indication run/stop	Safe torque off function is active, ie, safety circuit signal(s) connected to connector STO is lost.	Informative warning. Check safety circuit connections. For more information, see chapter <i>The Safe torque off function</i> in the <i>Hardware manual</i> of the drive and description of parameter 31.22 STO indication run/stop (page 416).
B5A2	Power applied	The drive was powered up or the control board was rebooted successfully.	Informative event.
B681	Hand mode selected	The drive was placed in Hand mode.	Informative event. Check the control panel to ensure that the current control location is correct.
B682	Off mode selected	The drive was placed in Off mode.	Informative event. Check the control panel to ensure that the current control location is correct.
B683	Auto mode selected	The drive was placed in Auto mode.	Informative event. Check the control panel to ensure that the current control location is correct.

Code (hex)	Warning / Aux. code	Cause	What to do
B686	Checksum mismatch Programmable event: 96.54 Checksum action	The calculated parameter checksum does not match any enabled reference checksum.	See A686 Checksum mismatch (page 198).
B687	Auto start command	The drive received a start command while in Auto mode.	Informative event.
B688	Auto stop command	The drive received a stop command while in Auto mode.	Informative event.
B689	Modulating started	The drive started modulating.	Informative event.
B68A	Modulating stopped	The drive stopped modulating.	Informative event.
D501	No more available PFC motors	No more PFC motors can be started because they can be interlocked or in the Hand mode.	Check that there are no interlocked PFC motors, see parameters: 76.8176.84. If all motors are in use, the PFC system is not adequately dimensioned to handle the demand.
D502	All motors interlocked	All the motors in the PFC system are interlocked.	Check that there are no interlocked PFC motors, see parameters 76.8176.84.
D503	VSD controlled PFC motor interlocked	The motor connected to the drive is interlocked (unavailable).	Motor connected to the drive is interlocked and thus cannot be started. Remove the corresponding interlock to start the drive controlled PFC motor. See parameters 76.8176.84.
D505	Max cleaning warning Programmable warning: 83.35 Cleaning count fault	Maximum number of cleanings are reached in defined time. The Pump cleaning is unable to clean the pump and hence, manual cleaning is required.	Check the pump for blockages. Clean the pump manually if needed. Check parameters 83.35 Cleaning count fault to 83.37 Maximum cleaning count.
D506	Pump cleaning not possible	Pump cleaning cannot be started. The drive needs to be in remote control and start signal is activated.	Change control location to Auto.
D507	Pump cleaning needed	Dirt detection indicates that the pump needs cleaning but automatic pump cleaning is not allowed.	Perform pump cleaning manually. Start pump cleaning by changing parameter 83.12 Manually force cleaning to Start cleaning now.
D508	High level Programmable warning: 76.93 LC high level action	Water level is reached the high level limit. Level control is unable to control the level for the following reasons:  • running out of pumping capacity.  • analog feedback sensor failure.	Check analog level sensor. Check that all the pumps are operating normally. Check parameters 76.91 LC high level switch and 76.93 LC high level action.
D509	Low level Programmable warning: 76.92 LC low level action	Water level is reached the low level limit. Level control is unable to control the level for the following reasons:  • running out of pumping capacity.  • analog feedback sensor failure.	Check analog level sensor. Check that all the pumps are operating normally. Check parameters 76.90 LC low level switch and 76.92 LC low level action.

Code (hex)	Warning / Aux. code	Cause	What to do
D50A	Running dry Programmable warning: 82.20 Dry run protection	Dry run protection is activated.	Check the pump inlet for sufficient water level. Check dry run protection settings in parameters 82.20 Dry run protection and 82.21 Dry run source.
D50B	Pipe fill-timeout Programmable warning: 82.25 Soft pipe fill supervision	Soft pipe fill is reached the timeout limit. The PID output is not reached the setpoint after reference ramping is ended and timeout limit is elapsed.	Check the pipe for possible leakage. See parameter 82.25 Soft pipe fill supervision and 82.26 Time-out limit.
D50C	Maximum flow protection Programmable warning: 80.17 Maximum flow protection	Actual flow is exceeded the defined warning level.	Check the system for leakages. Check flow protection settings in parameters 80.15 Maximum flow, 80.17 Maximum flow protection and 80.19 Flow check delay.
D50D	Minimum flow protection Programmable warning: 80.18 Minimum flow protection	Actual flow is below the defined warning level.	Check that the inlet and outlet valves are open. Check flow protection settings in parameters 80.16 Minimum flow, 80.18 Minimum flow protection and 80.19 Flow check delay.
D50E	Outlet minimum pressure Programmable warning: 82.30 Outlet minimum pressure protection	Measured outlet pressure is below the defined warning limit.	Check the pump outlet for leakages. Check the configuration of outlet pressure protection. See parameters 82.30 Outlet minimum pressure protection and 82.31 Outlet minimum pressure warning level.
D50F	Outlet maximum pressure Programmable warning: 82.35 Outlet maximum pressure protection	Measured outlet pressure is above the defined warning limit.	Check the pump outlet for blockages or closed valve. Check the configuration of outlet pressure protection. See parameters 82.35 Outlet maximum pressure protection and 82.37 Outlet maximum pressure warning level
D510	Inlet minimum pressure Programmable warning: 82.40 Inlet minimum pressure protection	Measured inlet pressure is below the defined warning level.	Check the pump inlet for blockages or closed valve. Check the configuration of inlet pressure protection. See parameters 82.40 Inlet minimum pressure protection and 82.41 Inlet minimum pressure warning level.
D590	Restart delay	The restart delay is active.	Check parameter 21.40 Restart delay. The drive cannot be started until the restart delay has elapsed. The restart delay can be bypassed by setting parameter 21.42 Restart delay remaining to 0.
	0000	-	Contact your local ABB representative.
	0001	-	
	0002	Pump short cycle protection.	
D511	Cavitation control	Cavitation control warning. See section <i>Parameter group 34 Timed functions (page 436)</i> . on page 133.	Check the auxiliary code. See actions for each code below.

Code (hex)	Warning / Aux. code	Cause	What to do
	0001	Cavitation detected warning. The pump is not getting enough liquid. Check the system.	Confirm that cavitation is occurring. Check the fluid level in the system. Adjust the parameters used for the cavitation detection function (86.12 – 86.30) if needed.
	0002	Cavitation tune required.Perform a cavitation auto tune or enter the data manually.  Cavitation control has been selected (86.11); however, there is missing data in 86.21 – 86.25.	Perform a cavitation curve autotune (86.20).  Manually enter the data used for the cavitation detection function (86.21 – 86.25) if autotune is not an option.  Disable cavitation control (86.11 if the above cannot be accomplished.
	0003	Cavitation curve autotune has been selected and will be performed on next start (in Hand).Check 86.20 if tune is not desired.	Press Hand to run the autotune.     De-select the cavitation curve autotune (86.20).
D5B2	No flow	The flow switch feedback is missing.	Check the signal to the digital input set in parameter 82.23.
	0000	Flow switch feedback signal not received.	<ul> <li>Check the system for the proper flow.</li> <li>Check the operation of the flow switch.</li> <li>Check the voltage at the flow switch.</li> <li>Check the voltage at the Digital Input.</li> <li>Use a different Digital Input.</li> <li>Replace the control board.</li> </ul>
D602	Cavitation tune completed	Cavitation auto tune has finished and stopped the drive.	Information only.

# Fault messages

Code (hex)	Fault / Aux. code	Cause	What to do
1080	Backup/Restore timeout	Control 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 <i>ID run requested</i> ). If the fault persists, contact your local ABB representative.  Auxiliary codes are shown below.
	0001	Too high offset error in U- phase current.	
	0002	Too high offset error in V-phase current.	
	0003	Too high offset error in W-phase current.	
	0004	Too high gain difference detected between phase current measurements.	

Code (hex)	Fault / Aux. code	Cause	What to do
2310	Overcurrent	Output current has exceeded internal fault limit. In addition to an actual overcurrent situation, this fault may also be caused by an earth fault or supply phase loss.	Check the received auxiliary code (format XXXYYYZZ). The ZZ part indicates the overcurrent type and the phase that triggered the fault:  • bit0 = Phase U,  • bit1 = Phase V,  • bit2 = Phase W  If bit7 is 1, this indicates SW overcurrent. For example aux code 0x83 indicates SW overcurrent of phase U and V. If there is no aux code, HW overcurrent has been triggered.  Check the motor load.  Check acceleration times in parameter group 23 Speed reference ramp (speed control) or 28 Frequency reference chain (frequency control). Also check parameters 46.01 Speed scaling, 46.02 Frequency scaling and 46.03 Torque scaling.  Check the 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 Motor data 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	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.
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. Auxiliary codes are shown below.

Code (hex)	Fault / Aux. code	Cause	What to do
	0001	Short circuit in the upper transistor of the U-phase. For frames R6 to R11.	
	0002	Short circuit in the lower transistor of the U-phase. For frames R6 to R11.	
	0004	Short circuit in the upper transistor of the V-phase. For frames R6 to R11.	
	0008	Short circuit in the lower transistor of the V-phase. For frames R6 to R11.	
	0010	Short circuit in the upper transistor of the W-phase. For frames R6 to R11.	
	0020	Short circuit in the lower transistor of the W-phase. For frames R6 to R11.	
	0040	DC capacitor short circuit. For frames R6 to R11.	
	0080	State feedback from output phases does not match control signals. For frames R6 and R7.	
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.

Code (hex)	Fault / Aux. code	Cause	What to do
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.
3385	Autophasing	Autophasing routine (see section <i>Autophasing</i> on page 149) has failed.	Try other autophasing modes (see parameter 21.13 Autophasing mode) if possible. Check that the motor ID run has been successfully completed. Check that the motor is not already turning when the autophasing routine starts. Check the setting of parameter 99.03 Motor type is Permanent magnet motor.
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.
4290	Cooling	Drive module temperature is excessive.	Check ambient temperature. If it exceeds 40 °C/104 °F (IP21 frames R4R9) or if it exceeds 50 °C /122 °F (IP21 frames R1R9), ensure that load current does not exceed derated load capacity of drive. For all P55 frames, check the derating temperatures. See chapter <i>Technical data</i> , section <i>Derating</i> in the <i>Hardware manual</i> of the drive. Check drive module cooling air flow and fan operation.  Check inside of cabinet and heatsink of drive module for dust pick-up. Clean whenever necessary.

Code (hex)	Fault / Aux. code	Cause	What to do
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. Check the auxiliary code.
	FA	Ambient temperature	
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	Measured temperature 1 has exceeded fault limit.	Check the value of parameter 35.02  Measured temperature 1.  Check the cooling of the motor (or other equipment whose temperature is being measured).
4982	External temperature 2	Measured temperature 2 has exceeded fault limit.	Check the value of parameter 35.03  Measured temperature 2.  Check the cooling of the motor (or other equipment whose temperature is being measured).
4990	CPTC-02 not found	CPTC-02 extension module is not detected in option slot 2.	Power down the drive and check that the module is properly inserted in option slot 2. See also CPTC-02 ATEX-certified thermistor protection module, Ex II (2) GD (+L537+Q971) user's manual (3AXD50000030058 [English]).
4991	Safe motor temperature	The CPTC-02 module indicates overtemperature:  • motor temperature is too high, or  • the thermistor is in short-circuit or disconnected	Check the cooling of the motor. Check the motor load and drive ratings. Check the wiring of the temperature sensor. Repair wiring if faulty. Measure the resistance of the sensor. Replace the sensor if faulty.
5080	Fan	Cooling fan feedback missing.	See <i>A581 Fan</i> (page <i>196</i> ).
5081	Auxiliary fan broken	An auxiliary cooling fan (connected to the fan connectors on the control unit) is stuck or disconnected.	Check the auxiliary code, which identifies the broken fan. Check auxiliary fan(s) and connection(s). Replace fan if faulty. Make sure the front cover of the drive is in place and tightened. If the commissioning of the drive requires that the cover is off, set parameter 31.36 Aux fan fault function temporarily to value No action within two minutes from powerup. Reboot the control unit (using parameter 96.08 Control board boot) or by cycling power.
	0001	,	
	0002	Auxiliary fan 2 broken.	

Code (hex)	Fault / Aux. code	Cause	What to do
5089	SMT circuit malfunction	Fault 4991 Safe motor temperature is generated but drive STO is not activated.  Note: If only one STO channel is opened, fault FA81 Safe torque off 1 or FA82 Safe torque off 2 is generated.	Check connection between the relay output of the CPTC-02 module and the STO terminal. Check CPTC-02 module. Replace if faulty. See also CPTC-02 ATEX-certified thermistor protection module, Ex II (2) GD (+L537+Q971) user's manual (3AXD50000030058 [English]).
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 416).  Check the value of parameter 95.04 Control board supply.
5092	PU logic error	Power unit memory has cleared.	Contact your local ABB representative.
5093	Rating ID mismatch	The hardware of the drive does not match the information stored in the memory. This may occur, for example, 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.
5098	I/O communication loss	Internal standard I/O communication failure.	Try resetting the fault or reboot the drive.
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.
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.
5697	Charging feedback	Charging feedback signal missing.	Check the feedback signal coming from the charging system.
5698	Unknown PU fault	The power unit logic has generated a fault which is not known by the software.	Check the logic and software compatibility.

Code (hex)	Fault / Aux. code	Cause	What to do
5E1A	Charging circuit failure	Charging circuit is non- operational.	Only for ACQ580-31. Contact your local ABB representative.
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
6200	Checksum mismatch Programmable fault: 96.54 Checksum action	The calculated parameter checksum does not match any enabled reference checksum.	See A686 Checksum mismatch (page 198).
6306	FBA A mapping file	Fieldbus adapter A mapping file read error.	Contact your local ABB representative.
6481	Task overload	Internal fault.	Reboot the control unit (using parameter 96.08 Control board boot) or by cycling power. If the problem persists, contact your local ABB representative
6487	Stack overflow	Internal fault.	Reboot the control unit (using parameter 96.08 Control board boot) or by cycling power. If the problem persists, contact your local ABB representative
64A1	Internal file load	File read error.	Reboot the control unit (using parameter 96.08 Control board boot) or by cycling power. If the problem persists, contact your local ABB representative
64A4	Rating ID fault	Rating ID load error.	Contact your local ABB representative.
64A6	Adaptive program	Error running the adaptive program.	Check the auxiliary code (format XXYY ZZZZ).  "XX" specifies the number of the state (00=base program) and "YY" specifies the number of the function block (0000=generic error).  "ZZZZ" indicates the problem.
	000A	Program corrupted or block non-existent	Restore the template program or download the program to the drive.
	000C	Required block input missing	Check the inputs of the block.
	000E	Program corrupted or block non-existent	Restore the template program or download the program to the drive.
	0011	Program too large.	Remove blocks until the error stops.
	0012	Program is empty.	Correct the program and download it to the drive.
	001C	A non-existing parameter or block is used in the program.	Edit the program to correct the parameter reference, or to use an existing block.
	001D	Parameter type invalid for selected pin.	Edit the program to correct the parameter reference.
	001E	Output to parameter failed because the parameter was write-protected.	Check the parameter reference in the program. Check for other sources affecting the target parameter.
	0023 0024	Program file incompatible with current firmware version.	Adapt the program to current block library and firmware version.
	0024		

Code (hex)	Fault / Aux. code	Cause	What to do
	Other	-	Contact your local ABB representative, quoting the auxiliary code.
64B1	Internal SSW fault	Internal fault.	Reboot the control unit (using parameter 96.08 Control board boot) or by cycling power. If the problem persists, contact your local ABB representative.
64B2	User set fault	Loading of user parameter set failed because  requested set does not exist  set is not compatible with control program  drive was switched off during loading.	Ensure that a valid user parameter set exists. Reload if uncertain.
64B3	Macro parameterization error	Loading of macro parameter set failed.	Reboot the control unit (using parameter 96.08 Control board boot) or by cycling power. If the problem persists, contact your local ABB representative.
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.
64FF	Fault reset	A fault has been reset from the control panel, Drive composer PC tool, fieldbus or I/O.	Event. Informative only.
6581	Parameter system	Parameter load or save failed.	Try forcing a save using parameter 96.07 Parameter save manually. Retry.
6591	Backup/Restore timeout	During backup creating or restoring operation a control panel or PC tool has failed to communicate with the drive as part this operation.	Check control panel or PC tool communication and if it is still in backup or restore state.
65A1	FBA A parameter conflict	The drive does not have a functionality requested by PLC, or requested functionality has not been activated.	Check PLC programming. Check settings of parameter groups 50 Fieldbus adapter (FBA) and 51 FBA A settings.
6681	EFB comm loss Programmable fault: 58.14 Communication loss action	Communication break in embedded fieldbus (EFB) communication.	Check the status of the fieldbus master (online/offline/error etc.). Check cable connections to the EIA-485/X5 terminals 29, 30 and 31 on the control unit.
6682	EFB config file	Embedded fieldbus (EFB) configuration file could not be read.	Contact your local ABB representative.
6683	EFB invalid parameterization	Embedded fieldbus (EFB) parameter settings inconsistent or not compatible with selected protocol.	Check the settings in parameter group 58 Embedded fieldbus.
6684	EFB load fault	Embedded fieldbus (EFB) protocol firmware could not be loaded. Version mismatch between EFB protocol firmware and drive firmware.	Contact your local ABB representative.

Code (hex)	Fault / Aux. code	Cause	What to do
6685	EFB fault 2	Fault reserved for the EFB protocol application.	Check the documentation of the protocol.
6686	EFB fault 3	Fault reserved for the EFB protocol application.	Check the documentation of the protocol.
6882	Text 32-bit table overflow	Internal fault.	Reset the fault. Contact your local ABB representative if the fault persists.
6885	Text file overflow	Internal fault.	Reset the fault. Contact your local ABB representative if the fault persists.
7081	Control panel loss Programmable fault: 49.05 Communication loss action	Control panel or PC tool selected as active control location for drive has ceased communicating.	Check PC tool or control panel connection. Check control panel connector. Disconnect and reconnect the control panel.
7085	Incompatible option module	Fieldbus option module not supported.	Replace the module with a supported type.
7086	Al Overvoltage	An overvoltage has been detected on an analog input. The analog input has temporarily been changed to voltage mode and will be changed back to current mode when the Al signal level is back within acceptable limits.	Check AI signal levels.
7100	Excitation current	Excitation current feedback low or missing	
7121	Motor stall Programmable fault: 31.24 Stall function	Motor is operating in stall region because of, for example, excessive load or insufficient motor power.	Check motor load and drive ratings. Check fault function parameters.
7122	Motor overload	Motor current is too high.	Check for overloaded motor. Adjust the parameters used for the motor overload function (35.5135.53) and 35.5535.56.
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.

0-4			T
Code (hex)	Fault / Aux. code	Cause	What to do
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 (23.1223.13 for mode Off1, 23.23 for mode Off3).
73F0	Overfrequency	Maximum allowed output frequency exceeded.	Check the auxiliary code.
	00FA	Motor is turning faster than the highest allowed frequency due to incorrectly set minimum/maximum frequency or the motor rushes because of too high supply voltage or incorrect supply voltage selection in parameter 95.01 Supply voltage.	Check minimum/maximum frequency settings, parameters 30.13 Minimum frequency and 30.14 Maximum frequency.  Check used supply voltage and voltage selection parameter 95.01 Supply voltage.
	Other	-	Contact your local ABB representative, quoting the auxiliary code.

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.
7580	INU-LSU comm loss Programmable fault: 60.79 INU-LSU comm loss function	DDCS communication between the inverter unit and the supply unit is lost.	Check status of the supply unit (parameter group 06 Control and status words). Check settings of parameter group 60 DDCS communication. Check the corresponding settings in the control program of the supply unit. Check cable connections. If necessary, replace cables.
7583	Line side unit faulted	The supply unit connected to the inverter unit has generated a fault.	The auxiliary code specifies the original fault code in the supply unit control program. You can find the most common auxiliary codes in section Auxiliary codes for the LSU supply unit warnings on page 225.  For full information, see chapter Fault tracing in ACS880 IGBT supply control program firmware manual (3AUA0000131562 [English]).
7584	LSU charge failed	The supply unit was not ready (ie. the main contactor/breaker could not be closed) within expected time.	Check settings of parameter 94.10 LSU max charging time. Check that the supply unit is enabled, allowed to start, and can be controlled by the inverter unit (eg. not in local control mode).
8001	ULC underload fault	User load curve: Signal has been too long under the underload curve.	See parameter 37.04 ULC underload actions.
8002	ULC overload fault	User load curve: Signal has been too long over the overload curve.	See parameter 37.03 ULC overload actions.
80A0	Al supervision Programmable fault: 12.03 Al supervision function	An analog signal is outside the limits specified for the analog input.	Check signal level at the analog input. Check the auxiliary code. Check the wiring connected to the input. Check the minimum and maximum limits of the input in parameter group 12 Standard AI.
	0001	Al1LessMIN	
	0002	AI1GreaterMAX	
	0003	Al2LessMIN.	
	0004	Al2GreaterMAX	

Code (hex)	Fault / Aux. code	Cause	What to do
80B0	Signal supervision 1 (Editable message text) Programmable fault: 32.06 Supervision 1 action	Fault generated by the signal supervision function 1.	Check the source of the fault (parameter 32.07 Supervision 1 signal).
80B1	Signal supervision 2 (Editable message text) Programmable fault: 32.16 Supervision 2 action	Fault generated by the signal supervision function 2.	Check the source of the fault (parameter 32.17 Supervision 2 signal).
80B2	Signal supervision 3 (Editable message text) Programmable fault: 32.26 Supervision 3 action	Fault generated by the signal supervision function 3.	Check the source of the fault (parameter 32.27 Supervision 3 signal).
80B3	Signal supervision 4 (Editable message text) Programmable fault: 32.36 Supervision 4 action	Fault generated by the signal supervision function 4.	Check the source of the fault (parameter 32.37 Supervision 4 signal).
80B4	Signal supervision 5 (Editable message text) Programmable fault: 32.46 Supervision 5 action	Fault generated by the signal supervision function 5.	Check the source of the fault (parameter 32.47 Supervision 5 signal).
80B5	Signal supervision 6 (Editable message text) Programmable fault:, 32.56 Supervision 6 action	Fault generated by the signal supervision function 6.	Check the source of the fault (parameter 32.57 Supervision 6 signal).
9081	External fault 1 (Editable message text) Programmable fault: 31.01 External event 1 source, 31.02 External event 1 type	Fault in external device 1.	Check the external device. Check setting of parameter 31.01 External event 1 source.
9082	External fault 2 (Editable message text) Programmable fault: 31.03 External event 2 source, 31.04 External event 2 type	Fault in external device 2.	Check the external device. Check setting of parameter 31.03 External event 2 source.
9083	External fault 3 (Editable message text) Programmable fault: 31.05 External event 3 source, 31.06 External event 3 type	Fault in external device 3.	Check the external device. Check setting of parameter 31.05 External event 3 source.
9084	External fault 4 (Editable message text) Programmable fault: 31.07 External event 4 source, 31.08 External event 4 type	Fault in external device 4.	Check the external device. Check setting of parameter 31.07 External event 4 source.
9085	External fault 5 (Editable message text) Programmable fault: 31.09 External event 5 source, 31.10 External event 5 type	Fault in external device 5.	Check the external device. Check setting of parameter 31.09 External event 5 source.

Code (hex)	Fault / Aux. code	Cause	What to do
D401	Max cleaning fault Programmable fault: 83.35 Cleaning count fault	The maximum number of cleanings are reached in the defined time. The pump cleaning is unable to clean the pump and hence, manual cleaning is required.	Check the pump for blockages. Clean the pump manually if needed. Check parameters 83.35 Cleaning count fault to 83.37 Maximum cleaning count.
D402	High level Programmable fault: 76.93 LC high level action	Water level is reached the high level limit. Level control is unable to control the level for the following reasons:  running out of pumping capacity or  analog feedback sensor failure.	Check the analog level sensor. Check that all pumps are operating normally. Check parameters 76.91 LC high level switch and 76.93 LC high level action.
D403	Low level Programmable fault: 76.92 LC low level action	Water level is reached the low level limit. Level control is unable to control the level for the following reasons:  running out of pumping capacity or  analog feedback sensor failure.	Check the analog level sensor. Check that all pumps are operating normally. Check parameters 76.90 LC low level switch and 76.92 LC low level action.
D404	Running dry Programmable fault: 82.20 Dry run protection	Dry run protection is activated.	Check the pump inlet for sufficient water level. Check dry run protection settings in parameters 82.20 Dry run protection and 82.21 Dry run source.
D405	Pipe fill-timeout Programmable fault: 82.25 Soft pipe fill supervision	Soft pipe fill has reached timeout limit. The PID output is not reached the setpoint after reference ramping is ended and the timeout limit is elapsed.	Check the pipe for possible leakage. See parameter 82.25 Soft pipe fill supervision and 82.26 Time-out limit.
D406	Maximum flow protection Programmable fault: 80.17 Maximum flow protection	Actual flow is exceeded the defined fault level.	Check the system for leakages. Check flow protection settings in parameters 80.15 Maximum flow, 80.17 Maximum flow protection and 80.19 Flow check delay.
D407	Minimum flow protection Programmable fault: 80.18 Minimum flow protection	Actual flow is below the defined fault level.	Check that the inlet and outlet valves are open. Check flow protection settings in parameters 80.16 Minimum flow, 80.18 Minimum flow protection and 80.19 Flow check delay.
D408	Outlet minimum pressure Programmable fault: 82.30 Outlet minimum pressure protection	The measured outlet pressure is below the defined fault limit.	Check the pump outlet for leakages. Check the configuration of outlet pressure protection. See parameters 82.30 Outlet minimum pressure protection and 82.32 Outlet minimum pressure fault level.

Code	Fault / Aux. code	Cause	What to do
(hex)	Fault / Aux. code	Cause	what to do
D409	Outlet maximum pressure Programmable fault: 82.35 Outlet maximum pressure protection	The measured outlet pressure is above the defined fault limit.	Check the pump outlet for blockages or closed valve. Check the configuration of outlet pressure protection. See parameters 82.35 Outlet maximum pressure protection and 82.38 Outlet maximum pressure fault level.
D40A	Inlet minimum pressure Programmable fault: 82.40 Inlet minimum pressure protection	The measured inlet pressure is below the defined fault level.	Check the pump inlet for blockages or closed valve. Check the configuration of inlet pressure protection. See parameters 82.40 Inlet minimum pressure protection and 82.42 Inlet minimum pressure fault level.
D40C	Multipump run permissive timeout	The run permissive setting configured with parameter 20.40 Run permissive was not satisfied within the time set in parameter 20.40 Run permissive 76.64 Run permissive timeout from when the drive was commanded to start.	Check the signal source selected for parameter 20.40 Run permissive.
D40C	Cavitation detected	The pump is not getting enough liquid.	Check the fluid level in the system. Restart the pump and confirm if cavitation is still occurring. Adjust the parameters used for the cavitation detection function (86.12 – 86.30) if needed.
D4B2	No flow	The flow switch feedback is missing.	Check the signal to the digital input set in parameter 82.23.
	0000	Flow switch feedback signal not received.	<ul> <li>Check the system for proper flow.</li> <li>Check the operation of the flow switch.</li> <li>Check the voltage at the flow switch.</li> <li>Check the voltage at the Digital Input.</li> <li>Use a different Digital Input.</li> <li>Replace the control board.</li> </ul>
FA81	Safe torque off 1	Safe torque off function is active, that is, 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, that is, STO circuit 2 is broken.	manual of the drive and description of parameter 31.22 STO indication run/sto (page 416).  Check the value of parameter 95.04 Control board supply.

Code (hex)	Fault / Aux. code	Cause	What to do
FF61	ID run	Motor ID run was not completed successfully.	Check the nominal motor values in parameter group 99 Motor data. Check that no external control system is connected to the drive. Cycle the power to the drive (and its control unit, if powered separately). Check that no operation limits prevent the completion of the ID run. Restore parameters to default settings and try again. Check that the motor shaft is not locked. Check the auxiliary code. See actions for each code below.
	0001	Maximum current limit too low.	Check settings of parameters 99.06 Motor nominal current and 30.17 Maximum current. Make sure that 30.17 > 99.06. Check that the drive is dimensioned correctly according to the motor.
	0002	Maximum speed limit or calculated field weakening point too low.	Check settings of parameters  • 30.11 Minimum speed  • 30.12 Maximum speed  • 99.07 Motor nominal voltage  • 99.08 Motor nominal frequency  • 99.09 Motor nominal speed.  Make sure that  • 30.12 > (0.55 × 99.09) > (0.50 × synchronous speed)  • 30.11 ≤ 0, and  • supply voltage ≥ (0.66 × 99.07.
	0003	Maximum torque limit too low.	Check settings of parameter 99.12 Motor nominal torque, and the torque limits in group 30 Limits.  Make sure that the maximum torque limit in force is greater than 100%.
	0004	Current measurement calibration did not finish within reasonable time	Contact your local ABB representative.
	00050008	Internal error.	Contact your local ABB representative.
	0009	(Asynchronous motors only) Acceleration did not finish within reasonable time.	Contact your local ABB representative.
	000A	(Asynchronous motors only) Deceleration did not finish within reasonable time.	Contact your local ABB representative.
	000B	(Asynchronous motors only) Speed dropped to zero during ID run.	Contact your local ABB representative.
	000C	(Permanent magnet motors only) First acceleration did not finish within reasonable time.	Contact your local ABB representative.

Code (hex)	Fault / Aux. code	Cause	What to do
	000D	(Permanent magnet motors only) Second acceleration did not finish within reasonable time.	Contact your local ABB representative.
	000E0010	Internal error.	Contact your local ABB representative.
	0011	(Synchronous reluctance motors only) Pulse test error.	Contact your local ABB representative.
	0012	Motor too large for advanced standstill ID run.	Check that the motor and drive sizes are compatible. Contact your local ABB representative.
	0013	(Asynchronous motors only) Motor data error.	Check that the motor nominal value settings in the drive are the same as in the motor nameplate.  Contact your local ABB representative.
FF63	STO diagnostics failure.	SW internal malfunction.	Reboot the control unit (using parameter 96.08 Control board boot) or by cycling power.
FF81	FB A force trip	A fault trip command has been received through fieldbus adapter A.	Check the fault information provided by the PLC.
FF8E	EFB force trip	A fault trip command has been received through the embedded fieldbus interface.	Check the fault information provided by the PLC.

# Auxiliary codes for the LSU supply unit warnings

For ACQ580-31 and ACQ580-34 only.

The table below lists the auxiliary codes of AF85 Line side unit warning. For advanced troubleshooting, see chapter Fault tracing in ACS880 IGBT supply control program firmware manual (3AUA0000131562 [English]).

Code (hex)	Warning / Aux. code	Cause	What to do
AE01	Overcurrent	Line side current has exceeded internal fault limit.	Check supply voltage. Check that there are no power factor correction capacitors or surge absorbers in supply cable. Check motor load and acceleration times. Check power semiconductors (IGBTs) and current transducers.
AE02	Earth leakage Programmable warning: 31.120 LSU earth fault	IGBT supply has detected load unbalance.	Check AC fuses. Check for earth leakages. Check supply cabling. Check power modules. Check there are no power factor correction capacitors or surge absorbers in supply cable. If no earth fault can be detected, contact your local ABB representative.
AE09	DC link overvoltage	Excessive intermediate circuit DC voltage.  Note: This warning can be shown only when the IGBT supply unit is not modulating.	Check that parameter 95.01 Supply voltage is set according to the supply voltage in use.
AE0A	DC link undervoltage	Intermediate circuit DC voltage is not sufficient due to missing phase in supply voltage, blown fuse or rectifier bridge internal fault.  Note: This warning can be shown only when the IGBT supply unit is not modulating.	Check supply cabling, fuses and switchgear. Check that parameter 95.01 Supply voltage is set according to the supply voltage in use.
AE0B	DC not charged	The voltage of the intermediate DC circuit has not yet risen to operating level.	Check the input voltage setting in parameter 95.01 Supply voltage. Check the input voltage. If the problem persists, contact your local ABB representative.
AE14	Excess temperature	Power unit temperature is excessive.	Check ambient conditions. Check air flow and fan operation. Check heatsink fins for dust pick-up.
AE16	IGBT temperature	IGBT temperature is excessive.	Check ambient conditions. Check air flow and fan operation. Check heatsink fins for dust pick-up.
AE19	Measurement circuit temperature	Problem with internal temperature measurement of the drive.	Contact your local ABB representative.

Code (hex)	Warning / Aux. code	Cause	What to do
AE24	Voltage category unselected	The supply voltage range has not been defined.	Define the supply voltage range (parameter 95.01 Supply voltage).
AE56	INU-LSU comm loss	The communication to the inverter unit is lost.	Check the settings of parameter group 60 DDCS communication.
AE58	Emergency stop (off2)	IGBT supply unit has received an emergency stop (mode selection off2) command.	Check that it is safe to continue operation. Return emergency stop push button to normal position. Restart the IGBT supply unit.
AE78	Fan	Cooling fan is stuck or disconnected.	Check the auxiliary code in the line-side converter program to identify the fan. Check fan operation and connection. If the problem persists, contact your local ABB representative.
AE80	Auxiliary fan missing	Auxiliary fan is not connected or it is broken.	Contact your local ABB representative.
BE02	MCB maintenance notice	Main circuit breaker should be maintained.	Maintain the main circuit breaker.

# Auxiliary codes for the LSU supply unit faults

For ACQ580-31 and ACQ580-34 only.

The table below lists the auxiliary codes of fault 7583 Line side unit faulted. For advanced troubleshooting, see chapter Fault tracing in ACS880 IGBT supply control program firmware manual (3AUA0000131562 [English]).

Code (hex)	Fault / Aux. code	Cause	What to do
2E00	Overcurrent	Line side current has exceeded internal fault limit.	Check supply voltage. Check that there are no power factor correction capacitors or surge absorbers in supply cable. Check motor load and acceleration times. Check power semiconductors (IGBTs) and current transducers.
2E01	Earth leakage Programmable warning: 31.120 LSU earth fault	IGBT supply unit has detected an earth fault.	Check AC fuses. Check for earth leakages. Check supply cabling. Check power modules. Check there are no power factor correction capacitors or surge absorbers in supply cable. If no earth fault can be detected, contact your local ABB representative.
2E02	Short circuit	IGBT supply unit has detected short circuit.	Check supply cable. Check there are no power factor correction capacitors or surge absorbers in supply cable. After correcting the cause of the fault, reboot the control unit (using parameter 96.108 LSU control board boot) or by cycling power.
3E00	Input phase loss Programmable warning: 31.121 LSU supply phase loss	Input phase loss detected by the IGBT bridge.	Check the AC fuses. Check for input power supply imbalance.
3E04	DC link overvoltage	Excessive intermediate circuit DC voltage.	Check that parameter 95.01 Supply voltage is set according to the supply voltage in use. Check that parameter 30.30 Overvoltage control is enabled.
3E05	DC link undervoltage	Intermediate circuit DC voltage is not sufficient because of a missing supply phase or blown fuse.	Check supply cabling, fuses and switchgear. Check that parameter 95.01 Supply voltage is set according to the supply voltage in use.
4E02	IGBT temperature	IGBT temperature is excessive.	Check ambient conditions. Check air flow and fan operation. Check heatsink fins for dust pick-up.
5E01	Aux fan missing	Broken fan detected.	Replace the fan.

Code (hex)	Fault / Aux. code	Cause	What to do
5E05	Rating ID mismatch	The hardware of the supply unit does not match the information stored in the memory unit. This may occur eg, after a firmware update or memory unit replacement.	Cycle the power to the supply unit. If the control unit is externally powered, reboot the control unit (using parameter 96.108 LSU control board boot) or by cycling its power.  If the problem persists, contact your local ABB representative.
5E06	Main contactor fault	Control program does not receive main contactor on acknowledgement. Main contactor / main breaker is not functioning properly, or there is a loose / bad connection.	Check main contactor / main breaker control circuit wiring. Contact your local ABB representative.
5E08	Power unit lost	Connection between the control unit and power unit is lost.	Contact your local ABB representative.
5E09	PU board powerfail	Power unit power supply failure.	Contact your local ABB representative.
5E10	Charging feedback	Charging feedback signal missing.	Check charge contactor control circuit wiring. Contact your local ABB representative.
5E14	Measurement circuit temperature	Problem with internal temperature measurement of the drive.	Contact your local ABB representative.
7E11	DDCS controller comm loss	DDCS communication between supply unit and inverter unit has been lost.	Check the settings of parameter group 60 DDCS communication.

# Fieldbus control through the embedded fieldbus interface (EFB)

# What this chapter contains

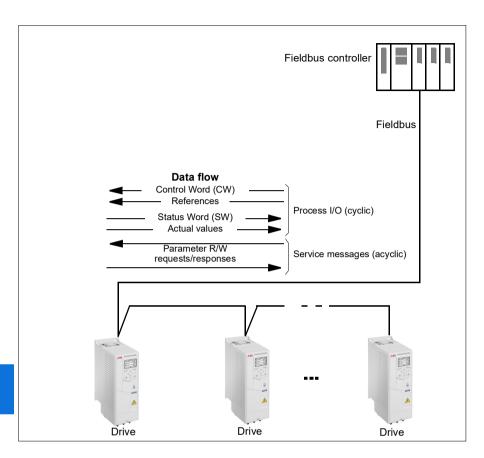
The chapter describes how the drive can be controlled by external devices over a communication network (fieldbus) using the embedded fieldbus interface.

# 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 drive to the fieldbus

See the Hardware manual of the drive.

# Setting up the embedded fieldbus interface

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

Parameter		Setting for fieldbus control	Function/Information				
COMMUNICATION INITIALIZATION							
58.01	Protocol enable	Modbus RTU	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	No action (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	30.0 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 234).				
58.26 58.27	EFB ref1 type EFB ref2 type	Speed or frequency (default for 58.26), Transparent, General, Transpar ent (default for 58.27) Speed, Frequency	Defines the types of fieldbus references 1 and 2. The scaling for each reference type is defined by parameters 46.0146.03. With the Speed or frequency setting, the type is selected automatically according to the currently active drive control mode.				
58.28 58.29	EFB act1 type EFB act2 type	Speed or frequency (default for 58.28), Transparent (default for 58.29), General, Speed, Frequency	Defines the types of actual values 1 and 2. The scaling for each actual value type is defined by parameters 46.0146.03. With the Speed or frequency setting, the type is selected automatically according to the currently active drive control mode.				

Parame	eter	Setting for fieldbus control	Function/Information		
58.31 58.32	EFB act1 transparent source EFB act2 transparent source	Not selected	Defines the source of actual values 1 and 2 when the 58.26 EFB ref1 type (58.27 EFB ref2 type) is set to Transparent.		
58.33	Addressing mode	Mode 0 (default)	Defines the mapping between parameters and holding registers in the 400001465536 (10065535) Modbus register range.		
58.34	Word order	LO-HI (default)	Defines the order of the data words in the Modbus message frame.		
	Data I/O 1  Data I/O 14	For example, the default settings (I/Os 16 contain the control word, the status word, two references and two actual values)	Defines the address of the drive parameter which the Modbus master accesses when it reads from or writes to the register address corresponding to Modbus In/Out parameters. Select the parameters that you want to read or write through the Modbus I/O words.		
		RO/DIO control word, AO1 data storage, AO2 data storage, Feedback data storage, Setpoint data storage	These settings write the incoming data into storage parameters 10.99 RO/DIO control word, 13.91 AO1 data storage, 13.92 AO2 data storage, 40.91 Feedback data storage or 40.92 Setpoint data storage.		
58.06	Communication control	Refresh settings	Validates the settings of the configuration parameters.		

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

# Setting the drive control parameters

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

Parameter Setting for fieldbus control		Function/Information	
CONTROL COMMAND SOURCE SELECTION			
20.01 Ext1 commands	Embedded fieldbus	Selects fieldbus as the source for the start and stop commands when EXT1 is selected as the active control location.	

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

#### OTHER SELECTIONS

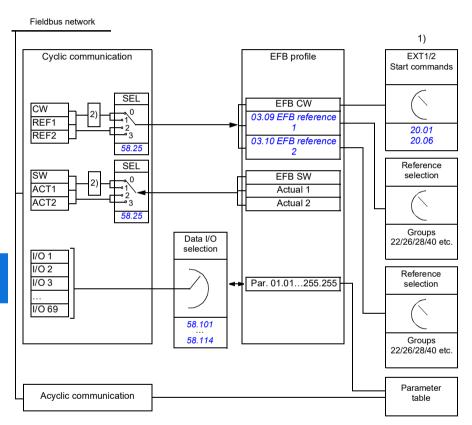
EFB references can be selected as the source at virtually any signal selector parameter by selecting *Other*, then either 03.09 EFB reference 1 or 03.10 EFB reference 2.

SYSTEM CONTROL INPUTS		
96.07 Parameter save manually	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 237).

#### 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 EXT1 and EXT2, 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 237).

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 237).

#### References

EFB references 1 and 2 are 16-bit or 32-bit signed integers. The contents of each reference word can be used as the source of virtually any signal, such as the speed, frequency or process reference. In embedded fieldbus communication, references 1 and 2 are displayed by 03.09 EFB reference 1 and 03.10 EFB reference 2 respectively. Whether the references are scaled or not depends on the settings of 58.26 EFB ref1 type and 58.27 EFB ref2 type. See section About the control profiles (page 237).

#### 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 237).

# Data input/outputs

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

# Register addressing

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

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

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

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

See parameter 58.33 Addressing mode.

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

# About the control profiles

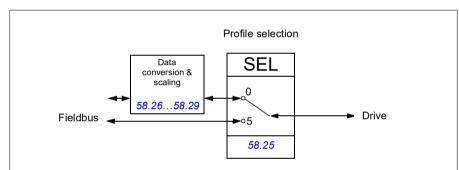
A control profile defines the rules for data transfer between the drive and the fieldbus master, for example:

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

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

- ABB Drives
- DCU Profile.

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



Control profile selection with parameter 58.25 Control profile is:

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

### **Control Word**

# **Control Word for the ABB Drives profile**

The table below shows the contents of the fieldbus Control Word for the ABB Drives control profile. The embedded fieldbus interface converts this word to the form in which it is used in the drive. The upper case boldface text refers to the states shown in State transition diagram for the ABB Drives profile on page 245.

Bit	Name	Value	STATE/Description
0	OFF1_	1	Proceed to READY TO OPERATE.
	CONTROL		Stop along currently active deceleration ramp. Proceed to OFF1 ACTIVE; proceed to READY TO SWITCH ON unless other interlocks (OFF2, OFF3) are active.
1	OFF2_	1	Continue operation (OFF2 inactive).
	CONTROL	0	Emergency OFF, coast to stop. Proceed to OFF2 ACTIVE, proceed to SWITCH-ON INHIBITED.
2	OFF3_	1	Continue operation (OFF3 inactive).
	CONTROL	0	Emergency stop, stop within time defined by drive parameter. Proceed to OFF3 ACTIVE; proceed to SWITCH-ON INHIBITED.
			<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 permissive signal must be active; see the drive documentation. If the drive is set to receive the Run permissive 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	Reserved			
9	Reserved			
10	REMOTE_	1	Fieldbus control d.	
	CMD	0	Control Word <> 0 or Reference <> 0: Retain last Control Word and Reference.	
			Control Word = 0 and Reference = 0: Fieldbus control d. Reference and deceleration/acceleration ramp are locked.	
11	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)
2	REVERSE	1	Reverse direction of motor rotation.
		0	Direction of motor rotation depends on the sign of reference:
			Positive reference: Forward
			Negative reference: Reverse.
3	Reserved		
4	RESET	0=>1	Fault reset if an active fault exists.
		0	(no op)
5	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.

Bit	Name	Value	State/Description
6	RUN_DISABLE		Run disable. If the drive is set to receive the run enable signal from the fieldbus, this bit deactivates the signal.
		0	Run enable. If the drive is set to receive the run enable signal from the fieldbus, this bit activates the signal.
7	STOPMODE_RA	1	Normal ramp stop mode
	MP	0	(no op) Default to parameter stop mode if bits 79 are all 0.
8	STOPMODE_EM	1	Emergency ramp stop mode.
	ERGENCY_RAM P	0	(no op) Default to parameter stop mode if bits 79 are all 0.
9	STOPMODE_CO	1	Coast stop mode.
	AST	0	(no op) Default to parameter stop mode if bits 79 are all 0.
10	RAMP_PAIR _2	1	(no op)
		0	Select ramp set 1 (Acceleration time 1 / Deceleration time 1).
11	RAMP_OUT_ZER O	1	Force Ramp Function Generator output to zero. Drive ramps to stop (current and DC voltage limits in force).
		0	Normal operation.
12	RAMP_HOLD	1	Halt ramping (Ramp Function Generator output held).
		0	Normal operation.
13	RAMP_IN_ZERO	1	Force Ramp Function Generator input to zero.
		0	Normal operation.
14	REQ_LOCAL_LO CK	1	Drive does not switch to local control mode (see parameter 19.18 HAND/OFF disable source).
		0	Drive can switch between local and external control modes.
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		

u	•	,
7	•	М
L	u	У

Bit	Name	Value	State/Description
22	USER_0		Writable control bits that can be combined with drive logic
23	USER_1		for application-specific functionality.
24	USER_2		
25	USER_3		
26 31	Reserved		

### **Status Word**

# Status Word for the ABB Drives profile

The table below shows the fieldbus Status Word for the ABB Drives control profile. The embedded fieldbus interface converts the drive Status Word into this form for the fieldbus. The upper case boldface text refers to the states shown in State transition diagram for the ABB Drives profile on page 245.

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	OFF_3_STATUS	1	OFF3 inactive.
		0	OFF3 ACTIVE.
6 SWC_ON_ INHIB	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, for example, 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.  Set by drive parameters 46.31 Above speed limit and 46.32 Above frequency limit. These parameters are indicated by bit 10 of 06.11 Main status word.
		0	Actual frequency or speed within supervision limit.

Bit	Name	Value	STATE/Description
11	USER_0		Status bits that can be combined with drive logic for application-specific functionality.
12	USER_1		
13	USER_2		
14	USER_3		
15	Reserved		

#### Status Word for the DCU Profile

The embedded fieldbus interface writes the drive Status Word bits 0 to 15 to the fieldbus Status Word as is.

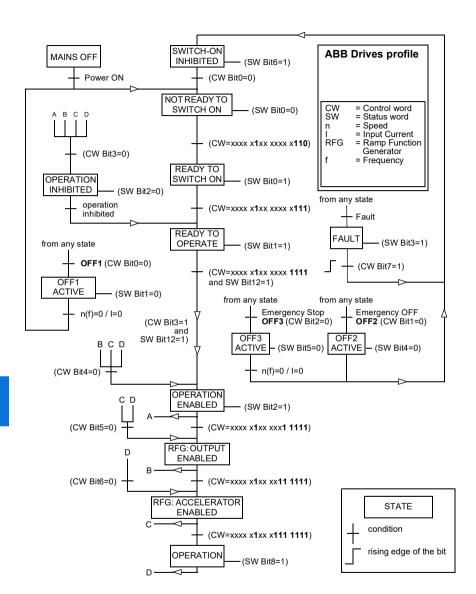
Bit	Name	Value	State/Description
0	READY	1	Drive is ready to receive the start command.
		0	Drive is not ready.
1	ENABLED	1	Run permissive and all start interlocks are active.
		0	Run permissive and all start interlocks are not active.
2	STARTED	1	Drive has received start command.
		0	Drive has not received start command.
3	RUNNING	1	Drive is modulating.
		0	Drive is not modulating.
4	ZERO_SPEED	1	Drive is at zero speed.
		0	Drive is not at zero speed.
5	ACCELERATING	1	Drive speed is increasing.
		0	Drive speed is not increasing.
6	DECELERATING	1	Drive speed is decreasing.
		0	Drive speed is not decreasing.
7	AT_SETPOINT	1	Drive is at setpoint.
		0	Drive is not at setpoint.
8	LIMIT	1	Drive operation is limited.
		0	Drive operation is not limited.
9	SUPERVISION	1	Actual value (speed, frequency or torque) is above a limit. Limit is set with parameters 46.31 Above speed limit and 46.32 Above frequency limit.
		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

Bit	Name	Value	State/Description
12	PANEL_LOCAL	1	Control panel/keypad (or PC tool) is in local control mode.
		0	Control panel/keypad (or PC tool) is not in local control mode.
13	FIELDBUS_LOC	1	Fieldbus is in local control mode.
	AL	0	Fieldbus is not in local control mode.
14	EXT2_ACT	1	External control location EXT2 is active.
		0	External control location EXT1 is active.
15	FAULT	1	Drive is faulted.
		0	Drive is not faulted.
16	ALARM	1	Warning/Alarm is active.
		0	No warning/alarm.
17	Reserved		
18	DIRLOCK	1	Direction lock is ON. (Direction change is locked out.)
		0	Direction lock is OFF.
19	LOCALLOCK	1	Local mode lock is ON. (Local mode is locked out.)
		0	Local mode lock is OFF.
20	CTL_MODE	1	Vector motor control mode is active.
		0	Scalar motor control mode is active.
21	Reserved		
22	USER_0		Status bits that can be combined with drive logic for
23	USER_1		application-specific functionality.
24	USER_2		
25	USER_3		
26	REQ_CTL	1	Control has been granted to this channel.
		0	Control has not been granted to this channel.
27	REQ_REF1	1	Reference 1 has been requested in this channel.
		0	Reference 1 has not been requested in this channel.
28	REQ_REF2	1	Reference 2 has been requested in this channel.
		0	Reference 2 has not been requested in this channel.
29 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 238 and Status Word for the ABB Drives profile on page 242.



The start and stop sequences are given below.

#### Control word:

#### Start:

- 1142 (476h) -> NOT READY TO SWITCH ON
- If MSW bit 0 = 1 then
  - 1150 (47Eh) -> READY TO SWITCH ON (Stopped)
  - 1151 (47Fh) -> OPERATION (Running)

#### Stop:

- 1143 (477h) = Stop according to 21.03 Stop mode (Preferred)
- 1150 (47Eh) = OFF1 ramp stop (Note: uninterruptable ramp stop)
- 1149 (47Dh) = OFF2 emergency coast to stop
- 1147 (47Bh) = OFF3 emergency ramp stop

#### Fault reset:

Rising edge of MCW bit 7

#### Start after STO:

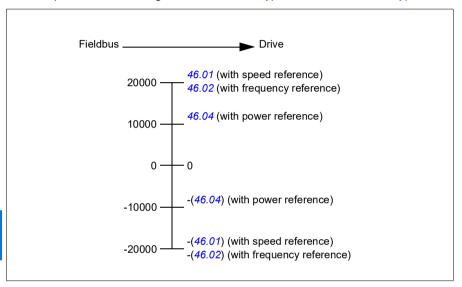
 If 31.22 STO indication run/stop is not Fault/ Fault, check that 06.18 Start inhibit status word, bit 7 STO = 0 before giving a start command.

#### References

#### References for the ABB Drives profile and DCU Profile

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

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



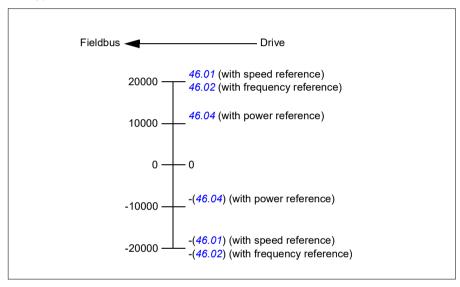
The scaled references are shown by parameters 03.09 EFB reference 1 and 03.10 EFB reference 2.

#### **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.



# 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 238) and Control Word for the DCU Profile (page 239).  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 58.103 Data I/O 3.	
400004	Default: Status Word (SW 16bit). See sections Status Word for the ABB Drives profile (page 242) and Status Word for the DCU Profile (page 243).	
	The selection can be changed using parameter 58.104 Data I/O 4.	
400005	Default: Actual value 1 (Act1 16bit).	
	The selection can be changed using parameter 58.105 Data I/O 5.	
400006	Actual value 2 (Act2 16bit).	
	The selection can be changed using parameter 58.106 Data I/O 6.	
400007400014	Data in/out 714.	
	Selected by parameters 58.107 Data I/O 758.114 Data I/O 14.	
400015400089	Unused	
400090400100	Error code access. See section <i>Error code registers</i> (holding registers 400090400100) (page 257).	
400101465536	Parameter read/write.	
	Parameters are mapped to register addresses according to parameter 58.33 Addressing mode.	

# **Modbus function codes**

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

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

Code	Function name	Description
17h	Read/Write Multiple Registers	Writes the contents of a contiguous block of 4X registers, then reads the contents of another group of registers (the same or different than those written) in a server device.
2Bh / 0Eh	Encapsulated Interface Transport	Supported subcodes:  OEh Read Device Identification: Allows reading the identification and other information.  Supported ID codes (access type):  Oh: Request to get the basic device identification (stream access)  O4h: Request to get one specific identification object (individual access)  Supported Object IDs:
		<ul> <li>O0h: Vendor Name ("ABB")</li> <li>O1h: Product Code (for example, "AQAKx")</li> <li>O2h: Major Minor Revision (combination of contents of parameters 07.05 Firmware version and 58.02 Protocol ID).</li> <li>O3h: Vendor URL ("www.abb.com")</li> <li>O4h: Product name: ("ACQ580").</li> </ul>

# **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 257.

### 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	Not for ACQ580	STOPMODE_EMERGENCY_RAMP
000010	Not for ACQ580	STOPMODE_COAST
000011	REMOTE_CMD	Reserved
000012	EXT_CTRL_LOC	RAMP_OUT_ZERO
000013	USER_0	RAMP_HOLD
000014	USER_1	RAMP_IN_ZERO
000015	USER_2	Reserved
000016	USER_3	Reserved
000017	Reserved	FB_LOCAL_CTL
000018	Reserved	FB_LOCAL_REF
000019	Reserved	Reserved
000020	Reserved	Reserved
000021	Reserved	Reserved
000022	Reserved	Reserved
000023	Reserved	USER_0
000024	Reserved	USER_1
000025	Reserved	USER_2
000026	Reserved	USER_3
000027	Reserved	Reserved
000028	Reserved	Reserved
000029	Reserved	Reserved
000030	Reserved	Reserved
000031	Reserved	Reserved
000032	Reserved	Reserved

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

### **Discrete inputs (1xxxx reference set)**

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

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

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

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

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

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



# Fieldbus control through a fieldbus adapter

### What this chapter contains

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

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

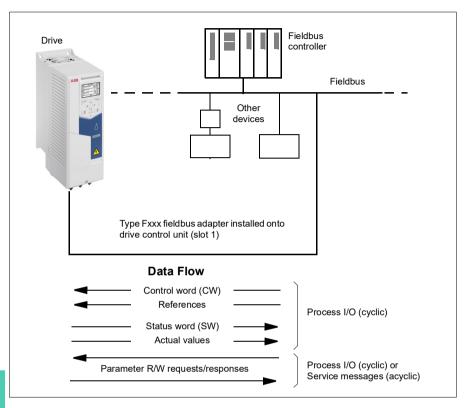
### System overview

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

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

- CANopen (FCAN-01 adapter)
- DeviceNet<sup>TM</sup> (FDNA-01 adapter)
- EtherNet/IP<sup>TM</sup> (FEIP-21 adapter, FENA-21 adapter)
- Modbus/RTU (FSCA-01 adapter)
- ModbusTCP (FBMT-21 adapter, FENA-21 adapter)
- PROFINET IO (FPNO-21 adapter, FENA-21 adapter)
- PROFIBUS DP (FPBA-01 adapter).

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



### Basics of the fieldbus control interface

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

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

#### Control word and Status word

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

For the ABB Drives communication profile, the contents of the Control word and the Status word are detailed on pages 264 and 265, respectively. The drive states are presented in the state diagram (page 266). For other fieldbus-specific communication profiles, see the *User's manual* of the fieldbus adapter.

### Debugging the network words

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

#### References

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

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

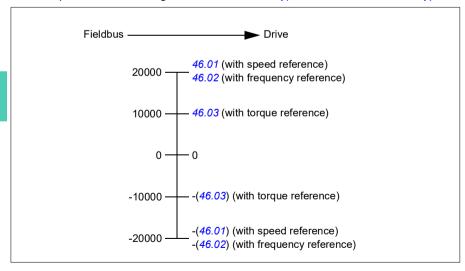
### Debugging the network words

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

#### Scaling of references

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

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



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

#### Actual values

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

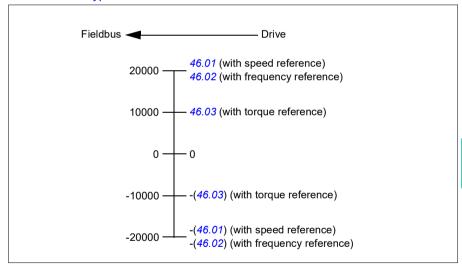
Actual values are 16-bit words containing information on the operation of the drive. The types of the monitored signals are selected by parameters 50.07 FBA A actual 1 type and 50.08 FBA A actual 2 type.

#### Debugging the network words

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

### Scaling of actual values

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



### Contents of the fieldbus Control word (ABB Drives profile)

The upper case boldface text refers to the states shown in the state diagram (page 266).

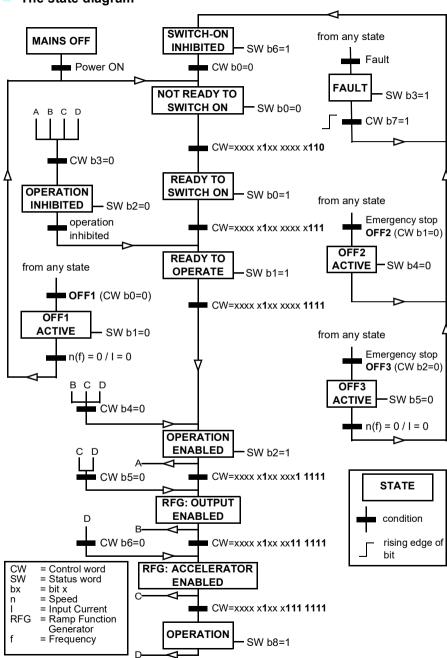
Bit	Name	Value	STATE/Description
0	Off1 control	1	Proceed to READY TO OPERATE.
		0	Stop along currently active deceleration ramp. Proceed to <b>OFF1 ACTIVE</b> ; proceed to <b>READY TO SWITCH ON</b> unless other interlocks (OFF2, OFF3) are active.
1	Off2 control	1	Continue operation (OFF2 inactive).
		0	Emergency OFF, coast to a stop. Proceed to OFF2 ACTIVE, proceed to SWITCH-ON INHIBITED.
2	Off3 control	1	Continue operation (OFF3 inactive).
		0	Emergency stop, stop within time defined by drive parameter. Proceed to OFF3 ACTIVE; proceed to SWITCH-ON INHIBITED.  WARNING: Ensure motor and driven machine can be stopped using this stop mode.
3	Run	1	Proceed to OPERATION ENABLED.
			<b>Note:</b> Run permissive signal must be active; see the drive documentation. If the drive is set to receive the Run permissive signal from the fieldbus, this bit activates the signal.  See also parameter 06.18 Start inhibit status word.
		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.
89	Reserved	· ·	
10	Remote cmd	1	Fieldbus control enabled.
		0	Control word and reference not getting through to the drive, except for bits 02.
11	Ext ctrl loc	1	Select External Control Location EXT2. Effective if control location is parameterized to be selected from fieldbus.
		0	Select External Control Location EXT1. Effective if control location is parameterized to be selected from fieldbus.
12	User bit 0	0	User configurable
13	User bit 1	0	
14	User bit 2	1	
15	User bit 3	1 0	
	I.	1-	

### Contents of the fieldbus Status word (ABB Drives profile)

The upper case boldface text refers to the states shown in the state diagram (page **266**).

Bit	Name	Value	STATE/Description		
0	Ready to switch	1	READY TO SWITCH ON.		
	ON	0	NOT READY TO SWITCH ON.		
1	Ready run	1	READY TO OPERATE.		
		0	OFF1 ACTIVE.		
2	Ready ref	1	OPERATION ENABLED.		
		0	OPERATION INHIBITED.		
			See also parameter 06.18 Start inhibit status word.		
3	Tripped	1	FAULT.		
		0	No fault.		
4	Off 2 inactive	1	OFF2 inactive.		
		0	OFF2 ACTIVE.		
5	Off 3 inactive	1	OFF3 inactive.		
		0	OFF3 ACTIVE.		
6	Switch-on inhibited	1	SWITCH-ON INHIBITED.		
		0	-		
7	Warning	1	Warning active.		
		0	No warning active.		
8	At setpoint	1	OPERATING. Actual value equals reference = is within tolerance		
			limits (see parameters 46.2146.22).		
		0	Actual value differs from reference = is outside tolerance limits.		
9	Remote	1	Drive control location: REMOTE (EXT1 or EXT2).		
		0	Drive control location: LOCAL.		
10	Above limit	-	See parameter 06.29 MSW bit 10 selection.		
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.

Drive parameter

### Parameter setting example: FPBA (PROFIBUS DP) with ABB Drives profile

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

The reference values sent over the fieldbus have to be scaled within the drive so they have the desired effect. The reference value ±20000 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 20000 sent over fieldbus will request 480 rpm.

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

Setting for ACQ580 Description

The table below gives the recommended drive parameter settings.

drives

		II
50.01 FBA A enable	1 = [slot number]	Enables/disables communication between the drive and the fieldbus adapter module.
50.04 FBA A ref1 type	4 = Speed	Selects the fieldbus A reference 1 type and scaling.
50.07 FBA A actual 1 type	<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.
51.01 FBA A type	<b>1</b> = FPBA <sup>1)</sup>	Displays the type of the fieldbus adapter module.
51.02 Node address	3 <sup>2)</sup>	Defines the PROFIBUS node address of the fieldbus adapter module.
51.03 Baud rate	12000 <sup>1)</sup>	Displays the current baud rate on the PROFIBUS network in kbit/s.
51.04 MSG type	<b>1</b> = PPO2 <sup>1)</sup>	Displays the telegram type selected by the PLC configuration tool.
51.05 Profile	1 = ABB Drives	Selects the Control word according to the ABB Drives profile (speed control mode).
51.07 RPBA mode	0 = Disabled	Disables the RPBA emulation mode.
52.01 FBA A data in1	<b>4</b> = SW 16bit <sup>1)</sup>	Status word
52.02 FBA data in2	<b>5</b> = Act1 16bit	Actual value 1
52.03 FBA data in3	01.07 <sup>2)</sup>	Motor current
52.05 FBA data in5	01.11 <sup>2)</sup>	DC voltage
53.01 FBA data out1	<b>1</b> = CW 16bit <sup>1)</sup>	Control word

Drive parameter	Setting for ACQ580 drives	Description
53.02 FBA data out2	2 = Ref1 16bit	Reference 1 (speed)
53.03 FBA data out3	23.12 <sup>2)</sup>	Acceleration time 1
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.
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

<sup>&</sup>lt;sup>2)</sup> Example

Drive parameter

# Parameter setting example: FPBA (PROFIBUS DP) with PROFIdrive profile

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

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

Direction	PZD1	PZD2	PZD3	PZD4	PZD5	PZD6
Out	Control word	Speed reference	Acc time	1	Dec time	<del>:</del> 1
In	Status word	Speed actual value	ue Motor current DC volta		ge	

Setting for ACQ580 Description

The table below gives the recommended drive parameter settings.

drives

50.01 FBA A enable	1 = [slot number]	Enables/disables communication between the drive and the fieldbus adapter module.
50.04 FBA A ref1 type	4 = Speed	Selects the fieldbus A reference 1 type and scaling.
50.07 FBA A actual 1 type	<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.
51.01 FBA A type	<b>1</b> = FPBA <sup>1)</sup>	Displays the type of the fieldbus adapter module.
51.02 Node address	3 <sup>2)</sup>	Defines the PROFIBUS node address of the fieldbus adapter module.
51.03 Baud rate	12000 <sup>1)</sup>	Displays the current baud rate on the PROFIBUS network in kbit/s.
51.04 MSG type	<b>1</b> = PPO2 <sup>1)</sup>	Displays the telegram type selected by the PLC configuration tool.
51.05 Profile	0 = PROFIdrive	Selects the Control word according to the PROFIdrive profile (speed control mode).
51.07 RPBA mode	0 = Disabled	Disables the RPBA emulation mode.
52.01 FBA A data in1	4 = SW 16bit <sup>1)</sup>	Status word
52.02 FBA data in2	<b>5</b> = Act1 16bit	Actual value 1
52.03 FBA data in3	01.07 <sup>2)</sup>	Motor current
52.05 FBA data in5	01.11 <sup>2)</sup>	DC voltage
53.01 FBA data out1	<b>1</b> = CW 16bit <sup>1)</sup>	Control word

Drive parameter	Setting for ACQ580 drives	Description	
53.02 FBA data out2	2 = Ref1 16bit	Reference 1 (speed)	
53.03 FBA data out3	23.12 <sup>2)</sup>	Acceleration time 1	
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.	
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	

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

The start and stop sequences for the parameter examples above are given below.

#### Control word:

#### Start:

- 1142 (476h) -> NOT READY TO SWITCH ON
- If MSW bit 0 = 1 then
  - 1150 (47Eh) -> READY TO SWITCH ON (Stopped)
  - 1151 (47Fh) -> OPERATION (Running)

#### Stop:

- 1143 (477h) = Stop according to 21.03 Stop mode (Preferred)
- 1150 (47Eh) = OFF1 ramp stop (Note: uninterruptable ramp stop)
- 1149 (47Dh) = OFF2 emergency coast to stop
- 1147 (47Bh) = OFF3 emergency ramp stop

#### Fault reset:

Rising edge of MCW bit 7

#### Start after STO:

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

<sup>2)</sup> Example

### Automatic drive configuration for fieldbus control

The parameters set on module detection are shown in the table below. See also parameters 07.35 Drive configuration and 07.36 Drive configuration 2

Option	50.01 FBA A enable	50.02 FBA A comm loss func	51.02 FBA A Par2	51.04 FBA A Par4	51.05 FBA A Par5	51.06 FBA A Par6
FENA-21	1 (Enable)	0 (No action)	11	0	-	-
FPBA-01	1 (Enable)	0 (No action)	-	-	1	-
FCAN-01	1 (Enable)	0 (No action)	-	-	0	-
FSCA-01	1 (Enable)	0 (No action)	-	-	-	10
FEIP-21	1 (Enable)	0 (No action)	100	0	-	-
FMBT-21	1 (Enable)	0 (No action)	0	0	-	-
FPNO-21	1 (Enable)	0 (No action)	11	0	-	-
FDNA-01	1 (Enable)	0 (No action)	-	-	-	-

Option	51.07 FBA A Par7	51.21 FBA A Par21	51.23 FBA A Par23	51.24 FBA A Par24	52.01 FBA data in1	52.02 FBA data in2
FENA-21	-	-	-	-	4	5
FPBA-01	-	-	-	-	4	5
FCAN-01	-	-	-	-	-	-
FSCA-01	1	-	-	-	-	
FEIP-21	-	-	128	128	-	-
FMBT-21	-	1	-	-	-	-
FPNO-21	-	-	-	-	4	5
FDNA-01	-	-	-	-	-	-

Option	53.01 FBA data out1	53.02 FBA data out2
FENA-21	1	2
FPBA-01	1	2
FCAN-01	-	-
FSCA-01		
FEIP-21	-	-
FMBT-21	-	-
FPNO-21	1	2
FDNA-01	-	-

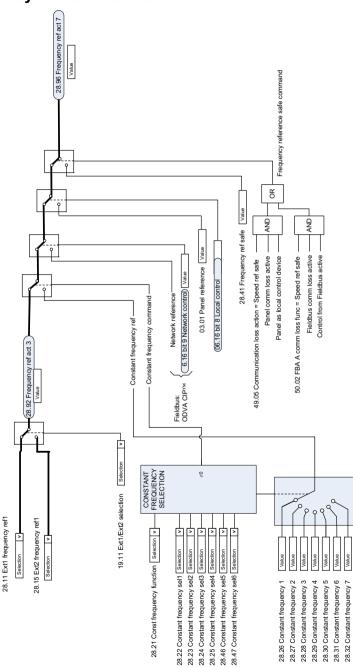
# **Control chain diagrams**

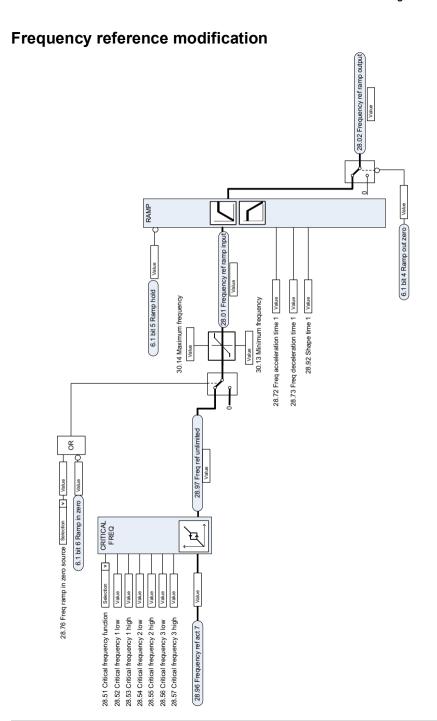
### Contents of this chapter

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.

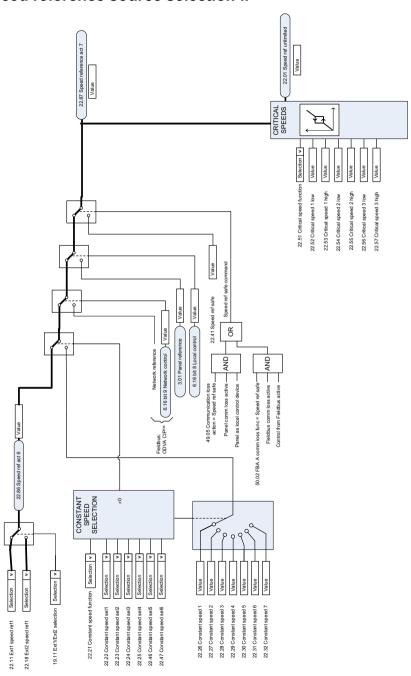
For a more general diagram, see section Operating modes of the drive (page 90).

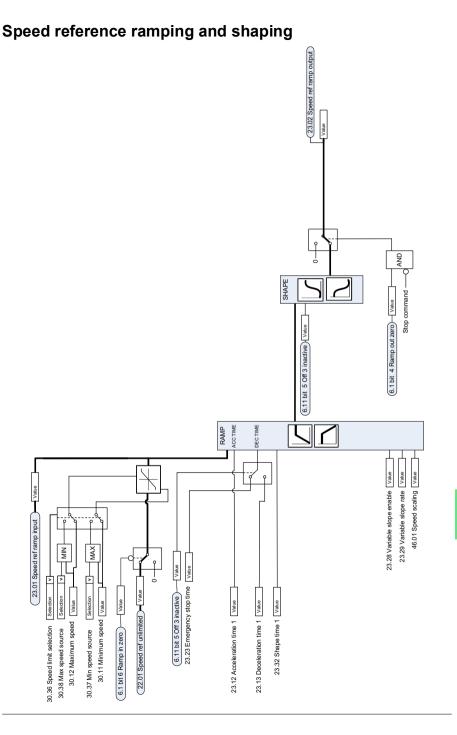
## Frequency reference selection



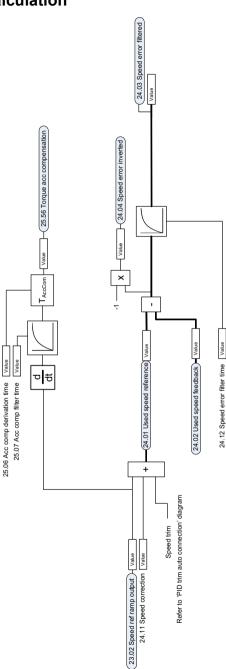


### Speed reference source selection II

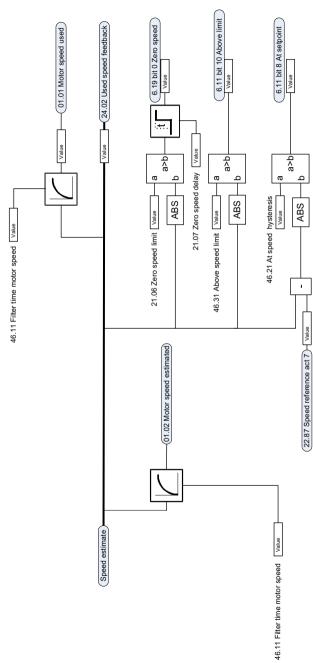




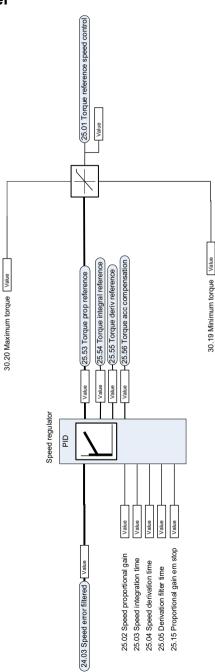
## **Speed error calculation**



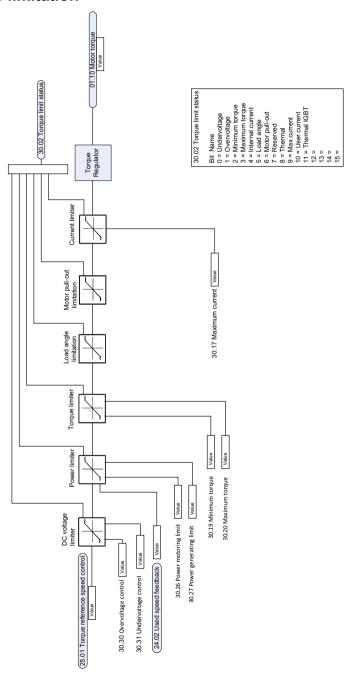
## Speed feedback



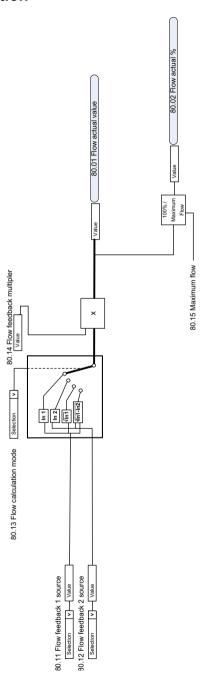
## Speed controller



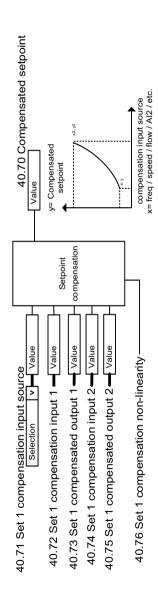
## **Torque limitation**



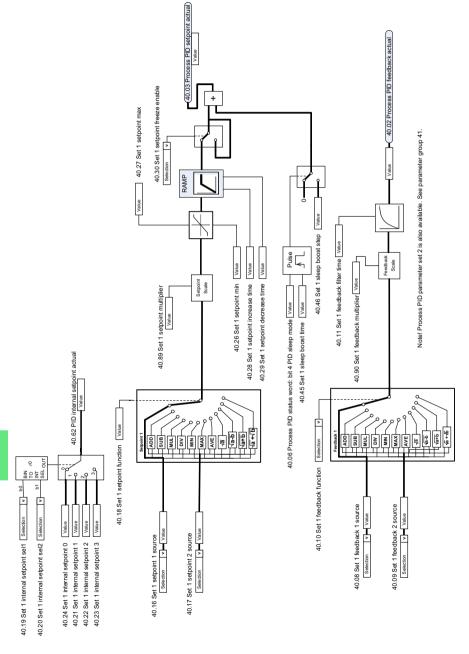
### PID flow calculation



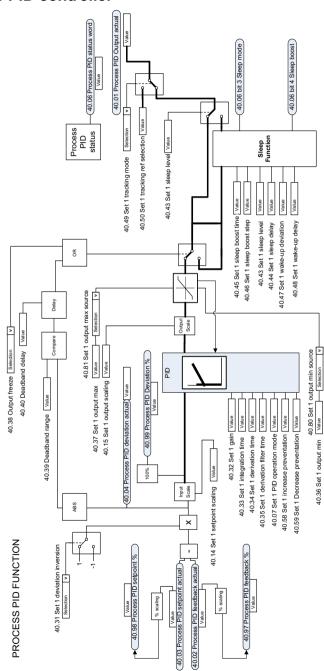
### PID setpoint compensation



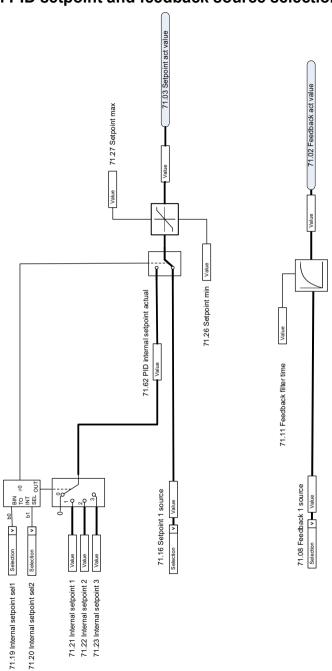
### Process PID setpoint and feedback source selection



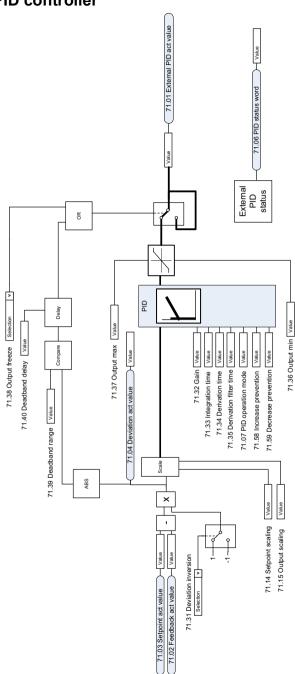
### **Process PID controller**



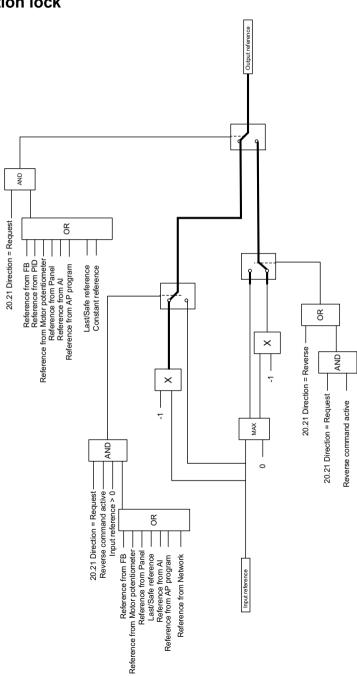
## External PID setpoint and feedback source selection



### **External PID controller**



### **Direction lock**





# **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 577, 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 read-only, 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 default configuration. For information on other macro-specific parameter values, see chapter  Default I/O configuration.
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 control 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 685).  Note: Any scaled value that exceeds 32767 will be clamped at 32767 when reading with a 16 bit system.
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 signal</i> .
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.	293
03 Input references	Values of references received from various sources.	297
04 Warnings and faults	Information on warnings and faults that occurred last.	298
05 Diagnostics	Various run-time-type counters and measurements related to drive maintenance.	300
06 Control and status words	Drive control and status words.	303
07 System info	Drive hardware and firmware information.	312
10 Standard DI, RO	Configuration of digital inputs and relay outputs.	314
11 Standard DIO, FI, FO	Configuration of the frequency input.	324
12 Standard AI	Configuration of standard analog inputs.	325
13 Standard AO	Configuration of standard analog outputs.	331
15 I/O extension module	Configuration of the I/O extension module installed in slot 2.	337
19 Operation mode	Selection of local and external control location sources and operating modes.	361
20 Start/stop/direction	Start/stop/direction and run/start enable signal source selection; positive/negative reference enable signal source selection.	362
21 Start/stop mode	Start and stop modes; emergency stop mode and signal source selection; DC magnetization settings.	373
22 Speed reference selection	Speed reference selection; Motor potentiometer settings.	382
23 Speed reference ramp	Speed reference ramp settings (programming of the acceleration and deceleration rates for the drive).	390
24 Speed reference conditioning	Speed error calculation; speed error window control configuration; speed error step.	392
25 Speed control	Speed controller settings.	392
28 Frequency reference chain	Settings for the frequency reference chain.	397
30 Limits	Drive operation limits.	404
31 Fault functions	Configuration of external events; selection of behavior of the drive upon fault situations.	412
32 Supervision	Configuration of signal supervision functions 16.	423
34 Timed functions	Configuration of the timed functions.	436
35 Motor thermal protection	Motor thermal protection settings such as temperature measurement configuration, load curve definition and motor fan control configuration; motor overload protection.	444
36 Load analyzer	Peak value and amplitude logger settings.	456
37 User load curve	Settings for user load curve.	459
40 Process PID set 1	Parameter values for process PID control.	462
41 Process PID set 2	A second set of parameter values for process PID control.	479
43 Brake chopper	Settings for the internal brake chopper.	482
45 Energy efficiency	Settings for the energy saving calculators as well as peak and energy loggers.	483
46 Monitoring/scaling settings	Speed supervision settings; actual signal filtering; general scaling settings.	488
47 Data storage	Data storage parameters that can be written to and read from using other parameters' source and target settings.	491

### **Parameter listing**

No.	Name/Value	Description	Def/FbEq16
01 Act	ual values	Basic signals for monitoring the drive. All parameters in this group are read-only unless otherwise noted.  Note: Values of these actual signals are filtered with the filter time defined in group 46 Monitoring/scaling settings. The selection lists for parameters in other groups mean the raw value of the actual signal instead. For example, if a selection is "Output frequency" it does not point to the value of parameter 01.06 Output frequency but to the raw value.	
01.01	Motor speed used	Estimated motor speed. A filter time constant for this signal can be defined by parameter 46.11 Filter time motor speed.	-
	-30000.00 30000.00 rpm	Estimated motor speed.	See par. 46.01
01.02	Motor speed estimated	Estimated motor speed in rpm. A filter time constant for this signal can be defined by parameter 46.11 Filter time motor speed.	-
	-30000.00 30000.00 rpm	Estimated motor speed.	See par. 46.01
01.03	Motor speed %	Motor speed in percent of the synchronous motor speed.	-
	-1000.00 1000.00%	Motor speed.	10 = 1%
01.06	Output frequency	Estimated drive output frequency in Hz. A filter time constant for this signal can be defined by parameter 46.12 Filter time output frequency.	-
	-500.00500.00 Hz	Estimated output frequency.	See par. 46.02
01.07	Motor current	Measured (absolute) motor current in A.	-
	0.0030000.00 A	Motor current.	See par. 46.05
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
01.51	Previous hour kWh	Previous hour energy consumption. The value 01.50 Current hour kWh is stored here when its values has been cumulated for 60 minutes.  If the power is cycled, after the drive is again up and running,	-
		the parameter value is set to the value it had before the power cycle.	
	0.001000000.00 kWh	Energy.	-
01.52	Current day kWh	Current day energy consumption. This is the energy of the last 24 hours (not necessarily continuous) the drive has been running, not the energy of a calendar day.  If the power is cycled, after the drive is again up and running, the parameter value is set to the value it had before the power	-
		cycle.	
	0.00 1000000.00 kWh	Energy.	-
01.53	Previous day kWh	Previous day energy consumption. The value 01.52 Current day kWh is stored here when its value has been cumulated for 24 hours.  If the power is cycled, after the drive is again up and running,	-
		the parameter value is set to the value it had before the power cycle.	
	0.00 1000000.00 kWh	Energy.	-
01.54	Cumulative inverter energy	Amount of energy that has passed through the drive (in either direction) in full kilowatt-hours. The minimum value is zero.	-
	-200000000.0 2000000000.0 kWh	Energy in kWh.	10 = 1 kWh
01.55	Inverter GWh counter (resettable)	Amount of energy that has passed through the drive (in either direction) in full gigawatt-hours. The minimum value is zero. You can reset the value by setting it to zero or by pressing the Reset softkey for 3 seconds. Resetting any of parameters 01.5501.58 resets all of them.	-
	065535 GWh	Energy in GWh.	1 = 1 GWh
01.56	Inverter MWh counter (resettable)	Amount of energy that has passed through the drive (in either direction) in full megawatt-hours. Whenever the counter rolls over, 01.55 Inverter GWh counter (resettable) is incremented. The minimum value is zero.  You can reset the value by setting it to zero or by pressing the Reset softkey for 3 seconds. Resetting any of parameters 01.5501.58 resets all of them.	-
	01000 MWh	Energy in MWh.	1 = 1 MWh
01.57	Inverter kWh counter (resettable)	Amount of energy that has passed through the drive (in either direction) in full kilowatt-hours. Whenever the counter rolls over, 01.56 Inverter MWh counter (resettable) is incremented. The minimum value is zero.	-
		You can reset the value by setting it to zero or by pressing the Reset softkey for 3 seconds. Resetting any of parameters 01.5501.58 resets all of them.	
	01000 kWh	Energy in kWh.	10 = 1 kWh

ЧЧ

No.	Name/Value	Description	Def/FbEq16
01.104	Active current	(Only visible for ACQ580-31 and ACQ580-34). Estimated active current flowing through the supply unit.	-
	-30000.00 30000.00 A	Estimated active current.	See par. 46.05
01.106	Reactive current	(Only visible for ACQ580-31 and ACQ580-34). Estimated reactive current flowing through the supply unit.	-
	-30000.00 30000.00 A	Estimated reactive current.	See par. 46.05
01.108	Grid frequency	(Only visible for ACQ580-31 and ACQ580-34). Estimated frequency of the power supply network.	-
	0.00 100.00 Hz	Estimated supply frequency.	See par. 46.02
01.109	Grid voltage	(Only visible for ACQ580-31 and ACQ580-34). Estimated voltage of the power supply network.	-
	0.00 2000.00 V	Estimated supply voltage.	10 = 1 V
01.110	Grid apparent power	(Only visible for ACQ580-31 and ACQ580-34). Estimated apparent power being transferred through the supply unit.	-
	-30000.00 30000.00 kVA	Estimated apparent power.	See par. 46.04
01.112	Grid power	(Only visible for ACQ580-31 and ACQ580-34). Estimated power being transferred through the supply unit.	-
	-30000.00 30000.00 kW	Estimated supply power.	See par. 46.04
01.114	Grid reactive power	(Only visible for ACQ580-31 and ACQ580-34). Estimated reactive power being transferred through the supply unit.	-
	-30000.00 30000.00 kvar	Estimated reactive power.	10 = 1 kvar
01.116	LSU cos Phi	(Only visible for ACQ580-31 and ACQ580-34). Power factor of the supply unit.	-
	-1.00 1.00	Power factor.	100 = 1
01.164	LSU nominal power	(Only visible for ACQ580-31 and ACQ580-34). Nominal power of the supply unit.	-
	030000 kW	Nominal power.	1 = 1 kW

03	Input references	Values of references received from various sources.  All parameters in this group are read-only unless otherwise noted.	
03.	01 Panel reference	Reference 1 given from the control panel or PC tool.	-
	-100000.00 100000.00	Control panel or PC tool reference.	1 = 10
03.	02 Panel reference remote	Reference 2 given from the control panel or PC tool.	-
	-100000.00 100000.00	Control panel or PC tool reference.	1 = 10

No.	Name/Value	Description	Def/FbEq16
04.18	3rd latest warning	Code of the 3rd stored (non-active) warning.	-
	0000hFFFFh	3rd stored warning.	1 = 1
04.40	Event word 1	User-defined event word. This word collects the status of the events (warnings or faults) selected by parameters 04.4104.71.  This parameter is read-only.	-

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

	0000hFFFFh	User-defined event word.	1 = 1
04.41	Event word 1 bit 0 code	Selects the hexadecimal code of an event (warning, fault or pure event) whose status is shown as bit 0 of 04.40 Event word 1. The event codes are listed in chapter Fault tracing (page 237).	2310h
	0000hFFFFh	Default fault 2310 Overcurrent.	1 = 1
04.43	Event word 1 bit 1 code	Selects the hexadecimal code of an event (warning, fault or pure event) whose status is shown as bit 1 of 04.40 Event word 1. The events are listed in chapter Fault tracing (page 237).	3210h
	0000hFFFFh	Default fault 3210 DC link overvoltage.	1 = 1
04.45	Event word 1 bit 2 code	Default fault 4310 Excess temperature.	4310h
04.47	Event word 1 bit 3 code	Default fault 2340 Short circuit.	2340h
04.49	Event word 1 bit 4 code	No default fault	0000h
04.51	Event word 1 bit 5 code	Default fault 3220 DC link undervoltage.	3220h
04.53	Event word 1 bit 6 code	Default fault 80A0 AI supervision.	80A0h
04.55	Event word 1 bit 7 code	No default fault.	0000h
04.57	Event word 1 bit 8 code	Default fault 7122 Motor overload.	7122h
04.59	Event word 1 bit 9 code	Default fault 7081 Control panel loss.	7081h
04.61	Event word 1 bit 10 code	Default fault FF61 ID run.	FF61h
04.63	Event word 1 bit 11 code	Default fault 7121 Motor stall.	7121h
04.65	Event word 1 bit 12 code	Default fault 4110 Control board temperature.	4110h
04.67	Event word 1 bit 13 code	Default fault 9081 External fault 1.	9081h

O5 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.       05.02 Run-time counter     Motor run-time counter in full days. The counter runs when the inverter modulates.     1 = 1 day       05.03 Hours run     Corresponding parameter to 05.02 Run-time counter in hours, that is, 24 * 05.02 value + fractional part of a day.     -       05.04 Fan on-time counter     Running time of the drive cooling fan. Can be reset from the control panel by pressing the Reset softkey for 3 seconds.     -       05.08 Cabinet temperature     (Only visible for ACQ580-07 cabinet drives). Temperature inside the cabinet. Activated by bit 6 of parameter 95.21 HW options word 2.     -       -40 120 °C or °F Temperature inside the cabinet in degrees Celsius or Fahrenheit.     1 = 1 unit fahrenheit.       05.10 Control board temperature     Measured temperature in degrees Celsius or Fahrenheit.     -       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% = Fault limit     -       0.0.0% = Fault limit     -       0.1 = 1%				1
powered.  065535 days On-time counter.  1 = 1 day  05.02 Run-time counter Motor run-time counter in full days. The counter runs when the inverter modulates.  065535 days Motor run-time counter.  1 = 1 day  05.03 Hours run Corresponding parameter to 05.02 Run-time counter in hours, that is, 24 * 05.02 value + fractional part of a day.  0.0 429496729.5 h Hours.  Running time of the drive cooling fan. Can be reset from the control panel by pressing the Reset softkey for 3 seconds.  065535 days Cooling fan run-time counter.  1 = 1 day  05.08 Cabinet temperature (Only visible for ACQ580-07 cabinet drives). Temperature inside the cabinet. Activated by bit 6 of parameter 95.21 HW options word 2.  40 120 °C or °F Temperature inside the cabinet in degrees Celsius or Fahrenheit.  05.10 Control board temperature -100 300 °C or °F Fahrenheit.  Measured temperature in degrees Celsius or Fahrenheit.  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	05 Dia	gnostics	drive maintenance. All parameters in this group are read-only unless otherwise	
Motor run-time counter in full days. The counter runs when the inverter modulates.   1 = 1 day	05.01	On-time counter		-
the inverter modulates.  065535 days  Motor run-time counter.  1 = 1 day  05.03 Hours run  Corresponding parameter to 05.02 Run-time counter in hours, that is, 24 * 05.02 value + fractional part of a day.  1 = 1 h  0.0 429496729.5 h  Hours.  Running time of the drive cooling fan. Can be reset from the counter  065535 days  Cooling fan run-time counter.  1 = 1 day  05.08 Cabinet temperature  (Only visible for ACQ580-07 cabinet drives). Temperature inside the cabinet. Activated by bit 6 of parameter 95.21 HW options word 2.  -40 120 °C or °F  Temperature inside the cabinet in degrees Celsius or Fahrenheit.  05.10 Control board temperature  -100 300 °C or °F  Control board temperature in degrees Celsius or Fahrenheit.  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		065535 days	On-time counter.	1 = 1 day
Corresponding parameter to 05.02 Run-time counter in hours, that is, 24 * 05.02 value + fractional part of a day.   -	05.02	Run-time counter		-
hours, that is, 24 * 05.02 value + fractional part of a day.  0.0 429496729.5 h  Hours.  Running time of the drive cooling fan. Can be reset from the control panel by pressing the Reset softkey for 3 seconds.  065535 days  Cooling fan run-time counter.  (Only visible for ACQ580-07 cabinet drives). Temperature inside the cabinet. Activated by bit 6 of parameter 95.21 HW options word 2.  -40 120 °C or °F  Temperature inside the cabinet in degrees Celsius or Fahrenheit.  05.10  Control board temperature  -100 300 °C or °F  Control board temperature in degrees Celsius or Fahrenheit.  55.11  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		065535 days	Motor run-time counter.	1 = 1 day
429496729.5 h  05.04 Fan on-time counter  Running time of the drive cooling fan. Can be reset from the counter  065535 days  Cooling fan run-time counter.  (Only visible for ACQ580-07 cabinet drives). Temperature inside the cabinet. Activated by bit 6 of parameter 95.21 HW options word 2.  -40 120 °C or °F  Temperature inside the cabinet in degrees Celsius or Fahrenheit.  05.10 Control board temperature  -100 300 °C or °F  Control board temperature  -101 101 102 102 103	05.03	Hours run		-
counter  control panel by pressing the Reset softkey for 3 seconds.  065535 days  Cooling fan run-time counter.  (Only visible for ACQ580-07 cabinet drives). Temperature inside the cabinet. Activated by bit 6 of parameter 95.21 HW options word 2.  -40 120 °C or °F Temperature inside the cabinet in degrees Celsius or Fahrenheit.  Control board temperature  -100 300 °C or °F Control board temperature in degrees Celsius or Fahrenheit.  Control board temperature  -100 300 °C or °F 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			Hours.	1 = 1 h
05.08       Cabinet temperature       (Only visible for ACQ580-07 cabinet drives).       -         Temperature inside the cabinet. Activated by bit 6 of parameter 95.21 HW options word 2.       -         -40 120 °C or °F       Temperature inside the cabinet in degrees Celsius or Fahrenheit.       1 = 1 unit         05.10       Control board temperature of the control board.       -         -100 300 °C or °F       Control board temperature in degrees Celsius or Fahrenheit.       1 = 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       -       -	05.04			-
temperature  Temperature inside the cabinet. Activated by bit 6 of parameter 95.21 HW options word 2.  -40 120 °C or °F  Temperature inside the cabinet in degrees Celsius or Fahrenheit.  05.10 Control board temperature  -100 300 °C or °F  Control board temperature in degrees Celsius or Fahrenheit.  -100 300 °C or °F  Control board temperature in degrees Celsius or Fahrenheit.  1 = 1 unit  5.11 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		065535 days	Cooling fan run-time counter.	1 = 1 day
Fahrenheit.  05.10 Control board temperature  -100 300 °C or °F  Control board temperature in degrees Celsius or Fahrenheit.  1 = 1 unit    1 = 1 unit	05.08		Temperature inside the cabinet. Activated by bit 6 of	-
temperature  -100 300 °C or °F  Control board temperature in degrees Celsius or Fahrenheit. 1 = 1 unit  1 = 1 unit  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		-40 120 °C or °F		1 = 1 unit
°F  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	05.10		Measured temperature of the control board.	-
temperature limit varies according to the type of the drive.  0.0% = 0 °C (32 °F)  100.0% = Fault limit			Control board temperature in degrees Celsius or Fahrenheit.	1 = 1 unit
-40.0160.0% Drive temperature in percent. 1 = 1%	05.11		limit varies according to the type of the drive. 0.0% = 0 °C (32 °F)	-
		-40.0160.0%	Drive temperature in percent.	1 = 1%

1 = 1 rpm

No.	Name/V	/alue	Descri	ption	Def/FbEq16
05.20	Diagnos	stic word 1		stic word 1. For possible causes and remedies, see r Fault tracing.	-
	Bit	Name		Value	
	0	Any warnir fault	ng or	1 = Yes = Drive has generated a warning or tripped or 0 = None active = No warning or fault active.	n a fault.
	1	Any warnir	ng	1 = Yes = Drive has generated a warning. 0 = None active = No warning active.	
	2	Any fault		1 = Yes = Drive has tripped on a fault. 0 = None active = No fault active.	
	3	Reserved		1	
	4	Overcurrer	nt flt	Yes = Drive has tripped on fault 2310 Overcurrent.	
	5	Reserved			
	6	DC overvo	Itage	Yes = Drive has tripped on fault 3210 DC link overvolt	age.
	7	DC underv	oltage	Yes = Drive has tripped on fault 3220 DC link undervo	oltage.
	8	Reserved			
	9	Device ove	ertemp flt	Yes = Drive has tripped on fault 4310 Excess tempera	ature.
	1015	Reserved			
			1		,
	0000h	.FFFFh	Diagno	stic word 1.	1 = 1
05.21	Diagnos	stic word 2	Diagno	stic word 2. For possible causes and remedies, see	_
				r Fault tracing.	
	Bit	Name			
				r Fault tracing.	
	Bit	Name	chapte	r Fault tracing.	
	<b>Bit</b> 09	Name Reserved	chapte	Value   Yes = Drive has tripped on fault 4981 External temper	
	<b>Bit</b> 09	Name Reserved Motor over	chapte	Value   Yes = Drive has tripped on fault 4981 External temper	
	<b>Bit</b> 09	Name Reserved Motor over Reserved	chapter	Value  Yes = Drive has tripped on fault 4981 External temper 4982 External temperature 2.	
05.22	Bit 09 10 1115	Name Reserved Motor over Reserved	chapter	Value  Yes = Drive has tripped on fault 4981 External temper 4982 External temperature 2.  stic word 2.	rature 1 or
05.22	Bit 09 10 1115	Name Reserved Motor over Reserved	chapter	Value  Yes = Drive has tripped on fault 4981 External temper 4982 External temperature 2.	rature 1 or
05.22	Bit 09 10 1115	Name Reserved Motor over Reserved	chapter	Value  Yes = Drive has tripped on fault 4981 External temper 4982 External temperature 2.  stic word 2.	rature 1 or
05.22	Bit 09 10 1115 0000h	Name Reserved Motor over Reserved .FFFFh stic word 3	chapter	Value  Yes = Drive has tripped on fault 4981 External temper 4982 External temperature 2.  stic word 2. stic word 3.	rature 1 or
05.22	Bit 09 10 1115 0000h Diagnos	Name Reserved Motor over Reserved .FFFFh stic word 3	temp fit  Diagno	Value  Yes = Drive has tripped on fault 4981 External temper 4982 External temperature 2.  stic word 2. stic word 3.	rature 1 or
05.22	Bit 09 10 1115 0000h Diagnos	Name Reserved Motor over Reserved  FFFFh Stic word 3  Name Reserved	temp fit  Diagno	Value  Yes = Drive has tripped on fault 4981 External temper 4982 External temperature 2.  stic word 2. stic word 3.	rature 1 or
05.22	Bit 09 10 1115 0000h Diagnos Bit 08 9	Name Reserved Motor over Reserved  FFFFh Stic word 3  Name Reserved KWh pulse	temp flt  Diagno	Value  Yes = Drive has tripped on fault 4981 External temper 4982 External temperature 2.  stic word 2. stic word 3.	rature 1 or
05.22	Bit 09 10 1115 0000h Diagnos Bit 08 9 10	Name Reserved Motor over Reserved  FFFFh Stic word 3  Name Reserved kWh pulse Reserved Reserved	temp flt  Diagno	Value     Yes = Drive has tripped on fault 4981 External temper 4982 External temperature 2.     stic word 2.     stic word 3.     Value     Yes = kWh pulse is active.	rature 1 or
05.22	Bit 09 10 1115 0000h Diagnos Bit 08 9 10 11	Name Reserved Motor over Reserved  FFFFh Stic word 3  Name Reserved kWh pulse Reserved Fan comm	temp flt  Diagno	Value     Yes = Drive has tripped on fault 4981 External temper 4982 External temperature 2.     stic word 2.     stic word 3.     Value     Yes = kWh pulse is active.	rature 1 or
05.22	Bit 09 10 1115 0000h Diagnos Bit 08 9 10 11	Name Reserved Motor over Reserved  FFFFh Stic word 3  Name Reserved kWh pulse Reserved Fan comm Reserved	temp flt  Diagno Diagno and	Value     Yes = Drive has tripped on fault 4981 External temper 4982 External temperature 2.     stic word 2.     stic word 3.     Value     Yes = kWh pulse is active.	rature 1 or

Estimated motor speed.

-30000.00... 30000.00 rpm

No.	Name/Value	Descrip	tion	Def/FbEq16
06 Co words	ntrol and status	Drive co	ntrol and status words.	
06.01 Main control word		control s as digita program For the or related s pages 30 This para <b>Note:</b> W not the s	control word bit descriptions see page 353. The status word and state diagram are presented on 54 and 355 respectively.  ameter is read-only. Then using fieldbus control, this parameter value is same as the Control word value that the drive of from the PLC. For the exact value, see 50.12 FBA A	
		Bit	Name	
		0	Off1 control	
		1	Off2 control	
		2	Off3 control	
		3	Run	
		4	Ramp out zero	
		5	Ramp hold	
		6	Ramp in zero	
		7	Reset	
		8	Reserved	
		9	Reserved	
		10	Remote cmd	
		11	Ext ctrl loc	
		12	User bit 0	
		13	User bit 1	
		14 15	User bit 2	
		15	User bit 3	
	0000hFFFFh	Main cor	ntrol word.	1 = 1

Def/FbEq16

1 = 1

Bit	Name	Description
0	Enabled	1 = If start interlock signals (par. 20.4120.44) are all present. <b>Note:</b> This bit is not affected by the presence of a fault.
1	Inhibited	1 = Start inhibited. To start the drive, the inhibiting signal (see p 06.18) must be removed and the start signal cycled.
2	DC charged	1 = DC circuit has been charged
3	Ready to start	1 = Drive is ready to receive a start command
4	Following reference	1 = Drive is ready to follow given reference
5	Started	1 = Drive has been started
6	Modulating	1 = Drive is modulating (output stage is being controlled)
7	Limiting	1 = Any operating limit (speed, torque, etc.) is active
8	Local control	1 = Drive is in local control
9	Network control	1 = Drive is in <i>network control</i> (see page 25).
10	Ext1 active	1 = Control location EXT1 active
11	Ext2 active	1 = Control location EXT2 active
12	Reserved	<u> </u>
13	Start request	1 = If Start requested. 0 = When Run permissive signal (see pa 20.40) is 0.
14	Running	1 = Drive is controlling speed or frequency, in PID sleep or pre- magnetization.
15	Reserved	•

No.

Name/Value

0000h...FFFFh

Description

Drive status word 1.

lla I	ы
_	-

No.	Name/V	alue	Descriptio	n	Def/FbEq16
06.17	Drive status word 2		Drive statu	s word 2.	-
			This param	neter is read-only.	
	Bit	Name		Description	
	0	Identification	n run done	1 = Motor identification (ID) run has been performe	ed
	1	Magnetized	d	1 = The motor has been magnetized	
	2	Reserved			
	3	Speed con	trol	1 = Speed control mode active	
	4	Reserved			
	5	Safe refere	ence active	1 = A "safe" reference is applied by functions such as parameters 49.05 and 50.02	
	6	Last speed active Reserved		1 = A "last speed" reference is applied by functions parameters 49.05 and 50.02	such as
	7				
	8	Emergency stop failed		1 = Emergency stop failed (see parameters 31.32 and 31.33)	
	9	Reserved			
	10	Above limit		1 = Actual speed or frequency equals or exceeds I (defined by parameters 46.3146.32). Valid in borotation.	
	1112	Reserved			
	13	Start delay	active	1 = Start delay (par. 21.22) active	
	1415	Reserved			
		•			
	0000h	.FFFFh	Drive statu	s word 2.	1 = 1

1 = 1

lo.	Name/	Name/Value Description		n	Def/FbEq16
06.18	Start inhibit status word		inhibiting s The conditi the start co inhibiting c See also p	t status word. This word specifies the source of the ignal that is preventing the drive from starting. ions marked with an asterisk (*) only require that mmand is cycled. In all other instances, the ondition must be removed first. arameter 06.16 Drive status word 1, bit 1. neter is read-only.	-
	Bit	Name		Description	
	0	Not ready	run	1 = DC voltage is missing or drive has not been pacorrectly. Check the parameters in groups 95 and	
	1	Ctrl locatio	n changed	* 1 = Control location has changed	
	2	SSW inhib	it	1 = Control program is keeping itself in inhibited st	ate
	3	Fault reset		* 1 = A fault has been reset	
	4	Start interl	ocked	1 = Start interlocked	
	5	Run permi	ssive	1 = Run permissive signal missing	
	6	Reserved			
	7	STO		1 = Safe torque off function active	
	8	Current ca ended	libration	* 1 = Current calibration routine has finished	
	9	ID run ended		* 1 = Motor identification run has finished	
	10	Reserved			
	11			1 = Emergency stop signal (mode off1)	
	12	Em Off2		1 = Emergency stop signal (mode off2)	
	13	Em Off3		1 = Emergency stop signal (mode off3)	
	14	Auto reset	inhibit	1 = The autoreset function is inhibiting operation	
	15	Reserved			
			1		1
	0000hFFFFh		Start inhibit status word.		1 = 1
19	Speed status	control word		trol status word. neter is read-only.	-
	Bit	Name		Description	
	0	Zero speed	d	1 = Drive has been running below zero speed lim for a time defined by parameter 21.07 Zero spee	
	1	Forward		1 = Drive is running in forward direction above ze (par. 21.06)	'
	2	Reverse		1 = Drive is running in reverse direction above ze (par. 21.06)	ero speed limit
	36	Reserved		T	
	7	Any consta request	ant speed	1 = A constant speed or frequency has been sele 06.20	cted; see par.
	815	Reserved			

Speed control status word.

0000h...FFFFh

1 = 1

0000h...FFFFh

Drive status word 1.

No.	Name/Value	Description	Def/FbEq16
06.22	Hand-off-auto status word	ACQ580 specific status word. This parameter is read-only.	-

mode.    Off mode	Bit	Name	Description	
Auto mode  O = Drive is not in the Auto mode; 1 = Drive is in the Auto mode  Reserved  Pre-heating  O = Motor pre-heating is not active; 1 = Motor pre-heating is active.  Reserved  Run permissive  O = Run permissive is not present, drive is not allowed to run; Run permissive is present, drive is allowed to run.  Start interlock 1  O = Start interlock 1 is not present, drive is not allowed to start.  Start interlock 2  O = Start interlock 1 is present, drive is not allowed to start.  Start interlock 2  O = Start interlock 2 is not present, drive is not allowed to start.  Start interlock 3  O = Start interlock 3 is not present, drive is not allowed to start.  Start interlock 3  O = Start interlock 3 is not present, drive is not allowed to start.  Start interlock 4  O = Start interlock 4 is not present, drive is not allowed to start.  All start interlocks  O = One or more of Start interlock 1, Start interlock 2, Start interlock 3 or Start interlock 4 is not present, drive is not allow to start;  O = One or more of Start interlock 4 is not present, drive is not allow to start;  O = Start interlock 4 is not present, drive is not allow to start;  O = One or more of Start interlock 4 is not present, drive is not allow to start;  O = Start interlock 4 is not present, drive is not allow to start;  O = One or more of Start interlock 4 is not present, drive is not allow to start;  O = Start interlock 4 is not present, drive is not allow to start;  O = One or more of Start interlock 4 is not present, drive is not allow to start;  O = One or more of Start interlock 2 and Start interlock 3 and	0	Hand mode	mode; 1 = Drive is operated from the control panel in the Hand	
Reserved  Pre-heating	1	Off mode	0 = Drive is not in the Off mode; 1 = Drive is in the Off mode.	
4 Pre-heating 0 = Motor pre-heating is not active; 1 = Motor pre-heating is active.  56 Reserved  7 Run permissive 0 = Run permissive is not present, drive is not allowed to run; Run permissive is present, drive is allowed to run.  8 Start interlock 1 0 = Start interlock 1 is not present, drive is not allowed to start 1 = Start interlock 1 is present, drive is allowed to start.  9 Start interlock 2 0 = Start interlock 2 is not present, drive is not allowed to start.  10 Start interlock 3 0 = Start interlock 2 is present, drive is not allowed to start.  11 Start interlock 4 0 = Start interlock 3 is not present, drive is not allowed to start.  12 All start interlocks 0 = One or more of Start interlock 1, Start interlock 2, Start interlock 3 or Start interlock 4 is not present, drive is not allow to start; 1 = Start interlock 1 and Start interlock 2 and Start interlock 3 are	2	Auto mode	0 = Drive is not in the Auto mode; 1 = Drive is in the Auto mode.	
active.  56 Reserved  7 Run permissive	3	Reserved		
Run permissive 0 = Run permissive is not present, drive is not allowed to run; Run permissive is present, drive is allowed to run.  Start interlock 1 0 = Start interlock 1 is not present, drive is not allowed to start 1 = Start interlock 1 is present, drive is allowed to start.  Start interlock 2 0 = Start interlock 2 is not present, drive is not allowed to start 1 = Start interlock 2 is present, drive is allowed to start.  Start interlock 3 0 = Start interlock 3 is not present, drive is not allowed to start 1 = Start interlock 3 is present, drive is allowed to start.  Start interlock 4 0 = Start interlock 4 is not present, drive is not allowed to start 1 = Start interlock 4 is present, drive is allowed to start.  All start interlocks 0 = One or more of Start interlock 1, Start interlock 2, Start interlock 3 or Start interlock 4 is not present, drive is not allow to start;  1 = Start interlock 1 and Start interlock 2 and Start interlock 3 and Start inter	4	Pre-heating		
Run permissive is present, drive is allowed to run.  Start interlock 1  Start interlock 1  Start interlock 2  Start interlock 3  Start interlock 4  Start interlock 5  Start interlock 4  Start interlock 5  Start interlock 6  Start interlock 7  Start interlock 7  Start interlock 7  Start interlock 8  Start interlock 8  Start interlock 9  Start interlock 1  Start interlock 2  Start interlock 4  Start interlock 2  Start interlock 2  Start interlock 3  Start interlock 3  Start interlock 3  Start interlock 2  Start interlock 3  Start interlock 3	56	Reserved		
1 = Start interlock 1 is present, drive is allowed to start.  9 Start interlock 2	7	Run permissive	0 = Run permissive is not present, drive is not allowed to run; 1 = Run permissive is present, drive is allowed to run.	
1 = Start interlock 2 is present, drive is allowed to start.  10 Start interlock 3	8	Start interlock 1	0 = Start interlock 1 is not present, drive is not allowed to start; 1 = Start interlock 1 is present, drive is allowed to start.	
1 = Start interlock 3 is present, drive is allowed to start.  11 Start interlock 4	9	Start interlock 2	0 = Start interlock 2 is not present, drive is not allowed to start; 1 = Start interlock 2 is present, drive is allowed to start.	
1 = Start interlock 4 is present, drive is allowed to start.  All start interlocks 0 = One or more of Start interlock 1, Start interlock 2, Start interlock 3 or Start interlock 4 is not present, drive is not allow to start;  1 = Start interlock 1 and Start interlock 2 and Start interlock 3 are	10	Start interlock 3	0 = Start interlock 3 is not present, drive is not allowed to start; 1 = Start interlock 3 is present, drive is allowed to start.	
interlock 3 or Start interlock 4 is not present, drive is not allow to start;  1 = Start interlock 1 and Start interlock 2 and Start interlock 3 a	11	Start interlock 4	0 = Start interlock 4 is not present, drive is not allowed to start; 1 = Start interlock 4 is present, drive is allowed to start.	
	12	All start interlocks	interlock 3 or Start interlock 4 is not present, drive is not allowed	
1315 Reserved	1315	Reserved		

	0000hFFFFh		1 = 1
06.29	MSW bit 10 selection	Selects a binary source whose status is transmitted as bit 10 of 06.11 Main status word.	See parameter 06.17 Drive status word 2.
	False	0.	0
	True	1.	1
	Above limit	Bit 10 of 06.17 Drive status word 2 (see page 306).	2
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 290).	-
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 304).	2
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 290).	-

0000h...FFFFh

No.	Name/Value	Description	Def/FbEq16
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.	See parameter 06.22 Hand- off-auto status word
	False	0.	0
	True	1.	1
	Reserved	1.	2
	Run permissive	Bit 5 of 06.18 Start inhibit status word status word (see page 307).	3
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 290).	-
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 290).	-
06.33	MSW bit 14 selection	Selects a binary source whose status is transmitted as bit 14 (User bit 3) of 06.11 Main status word.	False
	False	0.	0
	True	1.	1
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 290).	-
06.36	LSU Status word	(Only visible for ACQ580-31 and ACQ580-34). Shows the status of the supply unit. See also section (page 118), and parameter group 60 DDCS communication. This parameter is read-only.	-

Bit	Name	Description
0	Ready on	1 = Ready to switch on
1	Ready run	1 = Ready to operate, DC link charged
2	Ready ref	1 = Operation enabled
3	Tripped	1 = A fault is active
46	Reserved	
7	Warning	1 = A warning is active
8	Modulating	1 = The supply unit is modulating
9	Remote	1 = Remote control (EXT1 or EXT2) 0 = Local control
10	Net ok	1 = Supply network voltage OK
1112	Reserved	
13	Charging or ready run	1 = Bit 1 or bit 14 active
14	Charging	1 = Charging circuit is active
		0 = Charging circuit is not active
15	Reserved	

1 = 1

Supply unit status word.

No.	Name/Value	Description	Def/FbEq16
06.39	Internal state machine LSU CW	(Only visible for ACQ580-31 and ACQ580-34). Shows the control word sent to the supply unit from the INU-LSU (inverter unit/supply unit) state machine. This parameter is read-only.	-

Bit	Name	Description
0	ON/OFF	1 = Start charging 0 = Open main contactor (switch power off)
1	OFF 2	0 = Emergency stop (Off2)
2	OFF 3	0 = Emergency stop (Off3)
3	START	1 = Start modulating 0 = Stop modulating
46	Reserved	
7	RESET	0 -> 1 = Reset an active fault. A fresh start command is required after reset.
815	Reserved	

0000hFFFFh	Supply unit control word.	1 = 1
06.116 LSU drive status word 1	(Only visible for ACQ580-31 and ACQ580-34). Drive status word 1 received from the supply unit. See also section (page 118), and parameter group 60 DDCS communication. This parameter is read-only.	-

Bit	Name	Description
0	Enabled	1 = Run enable and start enable signals are present
1	Inhibited	1 = Start inhibited (see bit 1 of parameter 06.16 Drive status word 1)
2	Operation allowed	1 = Drive is ready to operate
3	Ready to start	1 = Drive is ready to receive a start command
4	Running	1 = Drive is ready to follow given reference
5	Started	1 = Drive has been started
6	Modulating	1 = Drive is modulating (output stage is being controlled)
7	Limiting	1 = Any operating limit is active
8	Local control	1 = Drive is in local control
9	Network control	1 = Drive is in network control
10	Ext1 active	1 = Control location EXT1 active
11	Ext2 active	1 = Control location EXT2 active
12	Charging active	1 = Charging circuit is active 0 = Charging circuit is not active
13	MCB relay	1 = MCB relay is closed
1415	Reserved	

0000hFFFFh Drive status word 1.
---------------------------------

No.	Name/Value	Descrip	tion	Def/FbEq16
06.118	LSU start inhibit status word	This wor is prevent See also commun	sible for ACQ580-31 and ACQ580-34).  In specifies the source of the inhibiting condition that niting the supply unit from starting.  In section (page 118), and parameter group 60 DDCS nication.  In ameter is read-only.	-
		Bit	Name	
		0	Not ready run	
		1	Ctrl location changed	
		2	SSW inhibit	
		3	Fault reset	
		4	Lost start enable	
		5	Lost run enable	
		68	Reserved	
		9	Charging overload	
		1011	Reserved	
		12	Em Off2	
		13	Em Off3	
		14	Auto reset inhibit	
		15	Reserved	
	0000hFFFFh	Start inh	nibit status word of supply unit.	1 = 1

07 Sys	stem info	Drive hardware and firmware information. All parameters in this group are read-only.	
07.03	Drive rating id	Type of the drive. (Rating ID in brackets.)	1 = 1
07.04	Firmware name	Firmware identification.	-
07.05	Firmware version	Version number of the firmware.	-
07.06	Loading package name	Name of the firmware loading package.	-
07.07	Loading package version	Version number of the firmware loading package.	-
07.10	Language file set	The language file set (language package) in use, see parameter <i>96.01 Language</i> .  The language file set value is written to this parameter after the first start-up, and it is available in this parameter through power-ups.	-
	Not known	No language file set in use.	0
	Global	Global language file set in use.	1
	European	European language file set in use.	2
	Asian	Asian language file set in use.	3
07.11	Cpu usage	Microprocessor load in percent.	-
	0100%	Microprocessor load.	1 = 1%
07.25	Customization package name	First five ASCII letters of the name given to the customization package. The full name is visible under System info on the control panel or the Drive composer PC tool.  _N/A_ = None.	-

1 = 1

No.	Name/	Value	Descriptio	n	Def/FbEq1
07.26		nization le version		tion package version number. Also visible under o on the control panel or the Drive composer PC	-
07.30	Adaptive program status			status of the adaptive program.  n Adaptive programming (page 113).	-
	Bit	Name		Description	
	0	Initialized		1 = Adaptive program initialized	
	1	Editing		1 = Adaptive program is being edited	
	2	Edit done		1 = Editing of adaptive program finished	
	3	Running		1 = Adaptive program running	
	413	Reserved		<del>_</del>	
	14	State chan	ging	1 = State change in progress in adaptive programr	ning engine
	15	Faulted		1 = Error in adaptive program	
	0000h.	FFFFh	Adaptive p	rogram status.	1 = 1
07.31			Shows the program pa	number of the active state of the sequence art of the adaptive program (AP). If adaptive ng is not running, or it does not contain a program, the parameter is zero.	
	020				1 = 1
07.35	Drive configuration		shows the the HW init module, the For informa detecting a	by configuration. Performs HW initialization, and detected module configuration of the drive. During tialization, if the drive is not able to detect any evalue is set to 1, Base unit.  ation on automatic setting of parameters after module, see section Automatic drive configuration is control on page 361.	0000h
	Bit	Name		Description	
	0	Not initializ	ed	1 = Drive configuration has not been initialized	
	1	Base unit		1 = Drive has not detected any modules.	
	2	Reserved			
	3	FENA-21		1 = FENA-21 Two-port Ethernet adapter module in	cluded
	4	Reserved			
	5	FPBA-01		1 = FPBA-01 PROFIBUS DP adapter module included	
	6	FCAN-01		1 = FCAN-01 CANopen adapter module included	
	79	Reserved		-	
	10	FSCA-01		1 = FSCA-01 Modbus/RTU adapter module included	
	11	FEIP-21		1 = FEIP-21 Two-port EtherNet/IP adapter module	
	12	FMBT-21		1 = FMBT-21 Two-port Modbus/TCP adapter modu	ıle included
	13	Reserved		I	
	14	FBNO-21		1 = FPNO-21 Two-port PROFINET IO adapter mod	auto includo

0000h...FFFFh

Drive configuration.

No.	Name/V	alue	Description	Def/FbEq16
10.02	DI delayed status		Displays the delayed status of digital inputs DI1DI6. Bits 05 reflect the delayed status of DI1DI6.  Example: 000000000010011b = DI5, DI2 and DI1 are on, DI3, DI4 and DI6 are off.  This word is updated only after a 2 ms activation/deactivation delay. When the value of a digital input changes, it must remain the same in two consecutive samples, that is for 2 ms, for the new value to be accepted.  This parameter is read-only.	-
	0000h	FFFFh	Delayed status for digital inputs.	1 = 1
10.03	DI force selection		The electrical statuses of the digital inputs can be overridden, for example, 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	Name	Value	
	0	DI1	1 = Force DI1 to value of bit 0 of parameter 10.04 DI forced data. (mode)	0 = Normal
	1	DI2	1 = Force DI2 to value of bit 1 of parameter 10.04 DI forced data. (mode)	
	2	DI3	1 = Force DI3 to value of bit 2 of parameter 10.04 DI forced data. (mode)	
	3	DI4	1 = Force DI4 to value of bit 3 of parameter 10.04 DI forced data. (mode)	
	4 DI5 mo		1 = Force DI5 to value of bit 4 of parameter 10.04 DI forced data. (mode)	
			1 = Force DI6 to value of bit 5 of parameter 10.04 DI forced data. (mode)	0 = Normal
	615	Reserve	ed	
	0000h	FFFFh	Override selection for digital inputs.	1 = 1

ło.	Name/Value	Description	Def/FbEq16
0.15	DI6 ON delay	Defines the activation delay for digital input DI6.	0.00 s
	*DI status		1 0
	**Delayed DI status _ _ _	<b>→ →</b>	1 0 Time
		$t_{On}$ $t_{Off}$ $t_{On}$ $t_{Off}$	
	$t_{\rm On}$ = 10.15 DI6 ON delta $t_{\rm Off}$ = 10.16 DI6 OFF delta *Electrical status of digitary transfer to the status of the	elay ital input. Indicated by 10.01 DI status.	
	0.00 3000.00 s	Activation delay for DI6.	10 = 1 s
0.16	DI6 OFF delay	Defines the deactivation delay for digital input DI6. See parameter 10.15 DI6 ON delay.	0.00 s
	0.00 3000.00 s	Deactivation delay for DI6.	10 = 1 s
0.21	RO status	Status of relay outputs RO3RO1.	-
	Bit Value		
	1 1 = RO2 is	s energized. s energized. s energized.	
	0	energized.	1 = 1
10.22	0 1 = RO1 is 1 1 = RO2 is 2 1 = RO3 is 315 Reserved	s energized.	1 = 1 0000h
10.22	0 1 = RO1 is 1 1 = RO2 is 1 1 = RO2 is 2 1 = RO3 is 315 Reserved	Status of relay outputs.  The signals connected to the relay outputs can be overridden for, for example, 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	
0.22	0	Status of relay outputs.  The signals connected to the relay outputs can be overridden for, for example, 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	0000h
0.22	0	Status of relay outputs.  The signals connected to the relay outputs can be overridden for, for example, testing purposes. A bit in parameter 10.23 RO forced data is provided for each relay output, and its value is applied whenever the corresponding bit in this parameter is 1.  Note: Boot and power cycle reset the force selections (parameters 10.22 and 10.23).	0000h
70.22	0 1 = RO1 is 1 1 = RO2 is 2 1 = RO3 is 315 Reserved  0000hFFFFh  RO force selection  Bit Value 0 1 = Force 1 1 = Force	Status of relay outputs.  The signals connected to the relay outputs can be overridden for, for example, 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).	lormal mode)
0.22	0 1 = RO1 is 1 1 = RO2 is 2 1 = RO3 is 315 Reserved  0000hFFFFh  RO force selection  Bit Value 0 1 = Force 1 1 = Force	Status of relay outputs.  The signals connected to the relay outputs can be overridden for, for example, 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).  RO1 to value of bit 0 of parameter 10.23 RO forced data. (0 = NRO2 to value of bit 1 of parameter 10.23 RO forced data. (0 = NRO2 to value of bit 1 of parameter 10.23 RO forced data. (0 = NRO2 to value of bit 1 of parameter 10.23 RO forced data. (0 = NRO2 to value of bit 1 of parameter 10.23 RO forced data. (0 = NRO2 to value of bit 1 of parameter 10.23 RO forced data. (0 = NRO2 to value of bit 1 of parameter 10.23 RO forced data. (0 = NRO2 to value of bit 1 of parameter 10.23 RO forced data. (0 = NRO2 to value of bit 1 of parameter 10.23 RO forced data. (0 = NRO2 to value of bit 1 of parameter 10.23 RO forced data. (0 = NRO2 to value of bit 1 of parameter 10.23 RO forced data. (0 = NRO2 to value of bit 1 of parameter 10.23 RO forced data. (0 = NRO2 to value of bit 1 of parameter 10.23 RO forced data. (0 = NRO2 to value of bit 1 of parameter 10.23 RO forced data. (0 = NRO2 to value of bit 1 of parameter 10.23 RO forced data. (0 = NRO2 to value of bit 1 of parameter 10.23 RO forced data. (0 = NRO2 to value of bit 1 of parameter 10.23 RO forced data. (0 = NRO2 to value of bit 1 of parameter 10.23 RO forced data.	lormal mode)
0.22	0 1 = RO1 is 1 1 = RO2 is 2 1 = RO3 is 315 Reserved  0000hFFFFh  RO force selection  Bit Value 0 1 = Force 1 1 = Force 2 1 = Force	Status of relay outputs.  The signals connected to the relay outputs can be overridden for, for example, 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).  RO1 to value of bit 0 of parameter 10.23 RO forced data. (0 = NRO2 to value of bit 1 of parameter 10.23 RO forced data. (0 = NRO2 to value of bit 1 of parameter 10.23 RO forced data. (0 = NRO2 to value of bit 1 of parameter 10.23 RO forced data. (0 = NRO2 to value of bit 1 of parameter 10.23 RO forced data. (0 = NRO2 to value of bit 1 of parameter 10.23 RO forced data. (0 = NRO2 to value of bit 1 of parameter 10.23 RO forced data. (0 = NRO2 to value of bit 1 of parameter 10.23 RO forced data. (0 = NRO2 to value of bit 1 of parameter 10.23 RO forced data. (0 = NRO2 to value of bit 1 of parameter 10.23 RO forced data. (0 = NRO2 to value of bit 1 of parameter 10.23 RO forced data. (0 = NRO2 to value of bit 1 of parameter 10.23 RO forced data. (0 = NRO2 to value of bit 1 of parameter 10.23 RO forced data. (0 = NRO2 to value of bit 1 of parameter 10.23 RO forced data. (0 = NRO2 to value of bit 1 of parameter 10.23 RO forced data. (0 = NRO2 to value of bit 1 of parameter 10.23 RO forced data. (0 = NRO2 to value of bit 1 of parameter 10.23 RO forced data. (0 = NRO2 to value of bit 1 of parameter 10.23 RO forced data.	0000h  lormal mode)

No.

10 23

Name/Value

RO forced data

Description

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.

Def/FbEa16

0000h

No.	Name/Value	Description	Def/FbEq16
	Timed function 1	Bit 0 of 34.01 Timed functions status (see page 436).	27
	Timed function 2	Bit 1 of 34.01 Timed functions status (see page 436).	28
	Timed function 3	Bit 2 of 34.01 Timed functions status (see page 436).	29
	Reserved		3032
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 423).	33
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 423).	34
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 423).	35
	Reserved		3638
	Start delay	Bit 13 of 06.17 Drive status word 2 (see page 306).	39
	RO/DIO control word bit0	Bit 0 of 10.99 RO/DIO control word (see page 323).	40
	RO/DIO control word bit1	Bit 1 of 10.99 RO/DIO control word (see page 323).	41
	RO/DIO control word bit2	Bit 2 of 10.99 RO/DIO control word (see page 323).	42
	Reserved		4344
	PFC1	Bit 0 of 76.01 PFC status (see page 512).	45
	PFC2	Bit 1 of 76.01 PFC status (see page 512).	46
	PFC3	Bit 2 of 76.01 PFC status (see page 512).	47
	PFC4	Bit 3 of 76.01 PFC status (see page 512).	48
	PFC5	Bit 4 of 76.01 PFC status (see page 512).	49
	PFC6	Bit 5 of 76.01 PFC status (see page 512).	50
	Reserved		5152
	Event word 1	Event word 1 = 1 if any bit of 04.40 Event word 1 (see page 299) is 1, that is, if any warning, fault or pure event that has been defined with parameters 04.4104.71 is on.	53
	Reserved		54
	Run permissive	Bit 7 of 06.22 Hand-off-auto status word.	55
	Start interlock 1	Bit 8 of 06.22 Hand-off-auto status word.	56
	Start interlock 2	Bit 9 of 06.22 Hand-off-auto status word.	57
	Start interlock 3	Bit 10 of 06.22 Hand-off-auto status word.	58
	Start interlock 4	Bit 11 of 06.22 Hand-off-auto status word.	59
	All start interlocks	Bit 12 of 06.22 Hand-off-auto status word.	60
	User load curve	Bit 3 (Outside load limit) of 37.01 ULC output status word (see page 459).	61
	RO/DIO control word	For 10.24 RO1 source: Bit 0 (RO1) of 10.99 RO/DIO control word (see page 323).  For 10.27 RO2 source: Bit 1 (RO2) of 10.99 RO/DIO control word (see page 323).  For 10.30 RO3 source: Bit 2 (RO3) of 10.99 RO/DIO control word (see page 323).	62
	Other [bit]	Source selection (see Terms and abbreviations on page 290).	-

No.	Name/Valu	ie	Description	Def/FbEq16
10.31	RO3 ON de	elay	Defines the activation delay for relay output RO3.	0.0 s
	Status of s	selected source		1 — 0
	R	O status —	+ + +	0 Time
	t <sub>On</sub> = 10.31 R t <sub>Off</sub> = 10.32 R	RO3 ON de RO3 OFF d	t <sub>On</sub> t <sub>Off</sub> t <sub>On</sub> t <sub>Off</sub> elay lelay	
	0.0 3000	0.0 s	Activation delay for RO3.	10 = 1 s
10.32	RO3 OFF a	delay	Defines the deactivation delay for relay output RO3. See parameter 10.31 RO3 ON delay.	0.0 s
	0.0 3000	0.0 s	Deactivation delay for RO3.	10 = 1 s
10.99	word		example, 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.	
	Bit N:	ame	(58.10158.114) to RO/DIO control word. In the source selection parameter of the desired output, select the appropriate bit of this word.	
		ame O1	(58.10158.114) to RO/DIO control word. In the source selection parameter of the desired output, select the appropriate bit of this word.  Description	
	0 R		(58.10158.114) to RO/DIO control word. In the source selection parameter of the desired output, select the appropriate bit of this word.	
	0 R	01	(58.10158.114) to RO/DIO control word. In the source selection parameter of the desired output, select the appropriate bit of this word.    Description     Source bit for relay output RO1. See parameter 10.24.	
	0 R( 1 R( 2 R(	O1 O2	(58.10158.114) to RO/DIO control word. In the source selection parameter of the desired output, select the appropriate bit of this word.    Description	parameter
	0 R( 1 R( 2 R( 3 R(	O1 O2 O3	(58.10158.114) to RO/DIO control word. In the source selection parameter of the desired output, select the appropriate bit of this word.    Description	'
	0 R: 1 R: 2 R: 3 R: 4 R:	O1 O2 O3 O4	(58.10158.114) to RO/DIO control word. In the source selection parameter of the desired output, select the appropriate bit of this word.    Description	parameter
	0 R(1) 1 R(2) 2 R(3) 3 R(4) 5 R(4)	O1 O2 O3 O4	(58.10158.114) to RO/DIO control word. In the source selection parameter of the desired output, select the appropriate bit of this word.    Description	parameter parameter
	0 R(1) 1 R(2) 2 R(3) 3 R(4) 4 R(6) 5 R(6) 7 R(6)	O1 O2 O3 O4 O5 O6 O7	(58.10158.114) to RO/DIO control word. In the source selection parameter of the desired output, select the appropriate bit of this word.    Description	parameter parameter parameter
	0 R(1) 1 R(2) 2 R(3) 3 R(4) 4 R(5) 6 R(6) 7 R(6) 8 D(6)	O1 O2 O3 O4 O5 O6 O7 esserved	(58.10158.114) to RO/DIO control word. In the source selection parameter of the desired output, select the appropriate bit of this word.    Description	parameter parameter parameter
	0 R(1) 1 R(2) 2 R(3) 3 R(4) 4 R(5) 6 R(6) 7 R(6) 8 D(6)	O1 O2 O3 O4 O5 O6 O7	(58.10158.114) to RO/DIO control word. In the source selection parameter of the desired output, select the appropriate bit of this word.    Description	parameter parameter parameter
	0 R(1) 1 R(2) 2 R(3) 3 R(4) 4 R(5) 6 R(6) 7 R(6) 8 D(6)	01 02 03 04 05 06 07 eserved IO1	(58.10158.114) to RO/DIO control word. In the source selection parameter of the desired output, select the appropriate bit of this word.    Description	parameter parameter parameter
10.101	0 Ri 1 Ri 2 Ri 3 Ri 4 Ri 5 Ri 6 Ri 7 Ri 8 Di 915 Ri	01 02 03 04 05 06 07 eserved IO1 eserved	(58.10158.114) to RO/DIO control word. In the source selection parameter of the desired output, select the appropriate bit of this word.    Description	parameter parameter parameter parameter sion module.

No.	Name/Value	Description	Def/FbEq16
10.102	RO2 toggle counter	Displays the number of times relay output RO2 has changed states.  Can be reset from the control panel by pressing the Reset softkey for 3 seconds.	0
	04294967000	State change count.	1 = 1
10.103	RO3 toggle counter	Displays the number of times relay output RO3 has changed states.  Can be reset from the control panel by pressing the Reset softkey for 3 seconds.	5
	04294967000	State change count.	1 = 1

11 Standard DIO, FI, FO	Configuration of the frequency input.	
11.21 DI5 configuration	Selects how digital input 5 is used.	Digital input
Digital input	DI5 is used as a digital input.	0
Frequency input	DI5 is used as a frequency input.	1
11.38 Freq in 1 actual value	Displays the value of frequency input 1 (via DI5 when it is used as a frequency input) before scaling. See parameter 11.42 Freq in 1 min.  This parameter is read-only.	-
0 16000 Hz	Unscaled value of frequency input 1 (DI5).	1 = 1 Hz
11.39 Freq in 1 scaled value	Displays the value of frequency input 1 (via DI5 when it is used as a frequency input) after scaling. See parameter 11.42 Freq in 1 min.  This parameter is read-only.	-
-32768.000 32767.000	Scaled value of frequency input 1 (DI5).	1 = 1
11.42 Freq in 1 min	Defines the minimum for the frequency actually arriving at frequency input 1 (DI5) when it is used as a frequency input). The incoming frequency signal (11.38 Freq in 1 actual value) is scaled into an internal signal (11.39 Freq in 1 scaled value) by parameters 11.4211.45 as follows:  11.39  11.45  11.45  11.45  11.46  11.47	0 Hz
0 16000 Hz	Minimum frequency of frequency input 1 (DI5).	1 = 1 Hz

No.	Name/V	alue	Description	Def/FbEq16
11.43	Freq in 1 max		Defines the maximum for the frequency actually arriving at frequency input 1 (DI5) when it is used as a frequency input). See parameter 11.42 Freq in 1 min.	16000 Hz
	0 16000 Hz		Maximum frequency for frequency input 1 (DI5).	1 = 1 Hz
11.44	44 Freq in 1 at scaled min		d 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
	-32768.0 32767.0		Value corresponding to minimum of frequency input 1.	1 = 1
11.45	Freq in max	1 at scale	d 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; 1800.000 (95.20 b0)
	-32768.0 32767.0		Value corresponding to maximum of frequency input 1.	1 = 1
12 Sta	ndard A	I	Configuration of standard analog inputs.	
12.02	Al force	selection	The true readings of the analog inputs can be overridden, for example, for 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.  Notes:  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).  Boot and power cycle reset the force selections (parameters 12.02 and 12.03).	0000h
	Bit	Name	Value	
	0	Al1	1 = Force Al1 to value of parameter 12.13 Al1 forced value.	
	1	Al2	1 = Force Al2 to value of parameter 12.23 Al2 forced value.	
	215	Reserve	d	
	0000h	.FFFFh	Forced values selector for analog inputs Al1 and Al2.	1 = 1
12.03 AI supervision function			Selects how the drive reacts when an analog input signal moves out of the minimum and/or maximum limits specified for the input.  The supervision applies a margin of 0.5 V or 1.0 mA to the limits. For example, if the maximum limit for the input is 7.000 V, the maximum limit supervision activates at 7.500 V. The inputs and the limits to be observed are selected by parameter 12.04 Al supervision selection.	No action
	No actio	n	No action taken.	0
	Fault		Drive trips on fault 80A0 AI supervision.	1
	Warning	1	Drive generates warning A8A0 AI supervision.	2
	Last spe	eed	Drive generates 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

No.	Name/Value	Description	Def/FbEq16
	Al2 Ext1	If active control location is EXT1, and AI supervision selection is high for AI2 (either bit2 AI2 < MIN or bit3 AI2 > MAX is true) and Supervision force bit 4 (AI2 Ext1) is deactivated, then the corresponding supervision function (fault/warning) can be masked.	4
	Al2 Ext2	If active control location is EXT1, and AI supervision selection is high for AI2 (either bit2 AI2 < MIN or bit3 AI2 > MAX is true) and Supervision force bit 4 (AI2 Ext1) is deactivated, then the corresponding supervision function (fault/warning) can be masked.	5
	Al2 Local	If active control location is Local, and Al supervision selection is high for Al1 (either bit2 Al2 < MIN or bit3 Al2 > MAX is true) and Supervision force bit 6 (Al2 Local) is deactivated, then the corresponding supervision function (fault/warning) can be masked.	6
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).  This parameter is read-only.	-
	0.00022.000 mA or 0.00011.000 V	Value of analog input Al1.	1000 = 1 unit
12.12	Al1 scaled value	Displays the value of analog input Al1 after scaling. See parameters 12.19 Al1 scaled at Al1 min and 12.20 Al1 scaled at Al1 max.  This parameter is read-only.	-
	-32768.000 32767.000	Scaled value of analog input Al1.	1 = 1
12.13	Al1 forced value	Forced value that can be used instead of the true reading of the input. See parameter 12.02 AI force selection.	0.000 V
	0.00022.000 mA or 0.00011.000 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 AI1.	V
	V	Volts.	2
	mA	Milliamperes.	10

No.	Name/Value	Description	Def/FbEq16
12.19	Al1 scaled at Al1 min	Defines the real internal value that corresponds to the minimum analog input Al1 value defined by parameter 12.17 Al1 min. (Changing the polarity settings of 12.19 and 12.20 can effectively invert the analog input.)  Al <sub>scaled</sub> (12.12)  12.20   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; 60.000 (95.20 b0)
	-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.	-
	0.00022.000 mA or 0.00011.000 V	Value of analog input AI2.	1000 = 1 unit
12.22	Al2 scaled value	Displays the value of analog input Al2 after scaling. See parameters 12.29 Al2 scaled at Al2 min and 12.101 Al1 percent value.  This parameter is read-only.	-
	-32768.000 32767.000	Scaled value of analog input Al2.	1 = 1
12.23	Al2 forced value	Forced value that can be used instead of the true reading of the input. See parameter 12.02 AI force selection.	0.000 V
	0.00022.000 mA or 0.00011.000 V	Forced value of analog input AI2.	1000 = 1 unit
12.25	Al2 unit selection	Selects the unit for readings and settings related to analog input Al2.	V
	V	Volts.	2
	mA	Milliamperes.	10
12.26	AI2 filter time	Defines the filter time constant for analog input Al2. See parameter 12.16 Al1 filter time.	0.100 s
	0.00030.000 s	Filter time constant.	1000 = 1 s

No.	Name/\	/alue	Description	Def/FbEq16
13 Sta	ndard A	0	Configuration of standard analog outputs.	
13.02 AO forc		e selection	The source signals of the analog outputs can be overridden, for example, for testing purposes. A forced value parameter is provided for each analog output, and its value is applied whenever the corresponding bit in this parameter is 1.  Note: Boot and power cycle reset the force selections (parameters 13.02 and 13.11).	0000h
	Bit	Name	Value	
	0	AO1	1 = Force AO1 to value of parameter 13.13 AO1 forced value. (0 mode)	= Normal
	1	AO2	1 = Force AO2 to value of parameter 13.23 AO2 forced value. (0 mode)	= Normal
	215	Reserve		
		1		
	0000h	.FFFFh	Forced values selector for analog outputs AO1 and AO2.	1 = 1
13.11	AO1 ac	tual value	Displays the value of AO1 in mA or V. This parameter is read-only.	-
		22.000 m <i>A</i> )11.000 '		1000 = 1 unit
13.12	AO1 so	urce	Selects a signal to be connected to analog output AO1.	Output frequency
	Zero		None.	0
	Motor speed used Reserved		01.01 Motor speed used (page 293).	1
				2
	Output frequency		01.06 Output frequency (page 293).	3
Motor current		urrent	01.07 Motor current (page 293).	4
	Motor current % of motor nominal		f 01.08 Motor current % of motor nom (page 293).	5
	Motor to	orque	01.10 Motor torque (page 293).	6
	DC volta	age	01.11 DC voltage (page 293).	7
	Output	power	01.14 Output power (page 294).	8
	Reserve	ed		9
	Speed r	ef ramp in	23.01 Speed ref ramp input (page 390).	10
	Speed r	ef ramp ou	tt 23.02 Speed ref ramp output (page 390).	11
	Speed r	ef used	24.01 Used speed reference (page 392).	12
	Reserve	ed		13
	Freq ref	used	28.02 Frequency ref ramp output (page 397).	14
	Reserve	ed		15
	Process	PID out	40.01 Process PID output actual (page 462).	16
	Reserved			1719
	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 Programmable protection functions (page 227).	20

_		_		
P	п		п	

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

	,
ы	и

No.	Name/Value	Description	Def/FbEq16
13.20	AO1 out at AO1 src max	Defines the maximum output value for analog output AO1. See also drawing at parameter 13.17 AO1 source min.	10.000 V
	0.00022.000 mA / 0.00011.000 V	Maximum AO1 output value.	1000 = 1 unit
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

No.	Name/Value	Description	Def/FbEq16
13.30	AO2 out at AO2 src max	Defines the maximum output value for analog output AO2. See also drawing at parameter 13.27 AO2 source min.	20.000 mA
	0.000 22.000 mA	Maximum AO2 output value.	1000 = 1 mA
13.91	AO1 data storage	Storage parameter for controlling analog output AO1, for example, through the embedded fieldbus interface. In parameter 13.12 AO1 source, select AO1 data storage. Then set this parameter as the target of the incoming value data. With the embedded fieldbus interface, simply set the target selection parameter of that particular data (58.10158.114) to AO1 data storage.	0.00
	-327.68327.67	Storage parameter for AO1.	100 = 1
13.92	AO2 data storage	Storage parameter for controlling analog output AO2, for example, through the embedded fieldbus interface. In parameter 13.22 AO2 source, select AO2 data storage. Then set this parameter as the target of the incoming value data. With the embedded fieldbus interface, simply set the target selection parameter of that particular data (58.10158.114) to AO2 data storage.	0.00
	-327.68327.67	Storage parameter for AO2.	100 = 1

15 I/O extension module		Configuration of the I/O extension module installed in slot 2. See also section <i>Programmable I/O extensions</i> (page 117). <b>Note:</b> 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 extension module has been installed and the drive is powered (keeping all bits in 07.35 Drive configuration and 07.36 Drive configuration 2 as 0), the drive automatically sets the value to the type it has detected in 15.02 Detected extension module).  Warning A7AB Extension I/O configuration failure is generated if 15.01 Extension module type is not None and not matching with 15.02 Detected extension module. In that case you will have to set the value of this parameter manually.	CMOD-01
	None	Inactive.	0
	CMOD-01	CMOD-01 multifunction extension module (external 24 V AC/DC and digital I/O).	1
	CMOD-02	CMOD-02 multifunction extension module (external 24 V AC/DC and isolated PTC interface).	2
	CHDI-01	CHDI-01 115/230 V digital input extension module.	3
	CPTC-02	CPTC-02 extension module (external 24 V and ATEX certified PTC interface).	4
	CAIO-01	CAIO-01 optional bipolar analog input and unipolar analog output extension module	8
15.02	Detected extension module	I/O extension module detected on the drive.	CMOD-01
	None	Inactive.	0
	CMOD-01	CMOD-01 multifunction extension module (external 24 V AC/DC and digital I/O).	1
	CMOD-02	CMOD-02 multifunction extension module (external 24 V AC/DC and isolated PTC interface).	2

Status of relay/digital outputs.

1 = 1

0000h...FFFFh

No.	Name/Value	Description	Def/FbEq16
15.05	RO/DO force selection	The electrical statuses of the relay/digital outputs can be overridden, for example, for testing purposes. A bit in parameter 15.06 RO/DO forced data is provided for each relay or digital output, and its value is applied whenever the corresponding bit in this parameter is 1.  Note: Boot and power cycle reset the force selections (parameters 15.05 and 15.06).	0000h

Bit	Name	Value	
0	RO4	1 = Force RO4 to value of bit 0 of parameter 15.06 RO/DO forced data. (0 = Normal mode)	
1	RO5	1 = Force RO5 to value of bit 1 of parameter 15.06 RO/DO forced data. (0 = Normal mode)	
2	RO6	1 = Force RO6 to value of bit 2 of parameter 15.06 RO/DO forced data. (0 = Normal mode)	
3	RO7	1 = Force RO7 to value of bit 3 of parameter 15.06 RO/DO forced data. (0 = Normal mode)	
4	Reserved		
5	DO1	1 = Force DO1 to value of bit 5 of parameter 15.06 RO/DO forced data. (0 = Normal mode)	
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

Bit	Name	Description
0	RO4	1 = Force the value of this bit to RO4, if so defined in parameter 15.05 RO/DO force selection.
1	RO5	1 = Force the value of this bit to RO5, if so defined in parameter 15.05 RO/DO force selection.
2	RO6	1 = Force the value of this bit to RO6, if so defined in parameter 15.05 RO/DO force selection.
3	RO7	1 = Force the value of this bit to RO7, if so defined in parameter 15.05 RO/DO force selection.
4	Reserved	
5	DO1	1 = Force the value of this bit to DO1 if so defined in parameter 15.05 RO/DO force selection.
615	Reserved	•

	0000hFFFFh	Forced values of relay/digital outputs.	1 = 1
15.07	RO4 source	Selects a drive signal to be connected to relay output RO4.	Not energized
	Not energized	Output is not energized.	0
	Energized	Output is energized.	1
	Ready run	Bit 1 of 06.11 Main status word (see page 304).	2
	Reserved		3

No.	Name/Value	Description	Def/FbEq16
	PFC2	Bit 1 of 76.01 PFC status (see page 512).	46
	PFC3	Bit 2 of 76.01 PFC status (see page 512).	47
	PFC4	Bit 3 of 76.01 PFC status (see page 512).	48
	PFC5	Bit 4 of 76.01 PFC status (see page 512).	49
	PFC6	Bit 5 of 76.01 PFC status (see page 512).	50
	Reserved		5152
	Event word 1	Event word 1 = 1 if any bit of 04.40 Event word 1 (see page 299) is 1, that is, if any warning, fault or pure event that has been defined with parameters 04.4104.71 is on.	53
	Reserved		54
	Run permissive	Bit 7 of 06.22 Hand-off-auto status word.	55
	Start interlock 1	Bit 8 of 06.22 Hand-off-auto status word.	56
	Start interlock 2	Bit 9 of 06.22 Hand-off-auto status word.	57
	Start interlock 3	Bit 10 of 06.22 Hand-off-auto status word.	58
	Start interlock 4	Bit 11 of 06.22 Hand-off-auto status word.	59
	All start interlocks	Bit 12 of 06.22 Hand-off-auto status word.	60
	User load curve	Bit 3 (Outside load limit) of 37.01 ULC output status word (see page 459).	61
	RO/DIO control word	For 15.07 RO4 source: Bit 3 (RO4) of 10.99 RO/DIO control word (see page 323).  For 15.10 RO5 source: Bit 4 (RO5) of 10.99 RO/DIO control word (see page 323).  For 15.13 RO6 source: Bit 5 (RO6) of 10.99 RO/DIO control word (see page 323).  For 15.16 RO7 source: Bit 6 (RO7) of 10.99 RO/DIO control word (see page 323).	62
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 290).	-
15.08	RO4 ON delay	Defines the activation delay for relay output RO4.	0.0 s
	Status of selected source		1 — 0 1
	RO status _ _ _	ton toff ton toff	0 <b>&gt;</b> Time
	t <sub>On</sub> = 15.08 RO4 ON de t <sub>Off</sub> = 15.09 RO4 OFF d	elay	
	0.0 3000.0 s	Activation delay for RO4.	1 = 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.	1 = 1 s
15.10	RO5 source	Selects a drive signal to be connected to relay output RO5. For the available selections, see parameter 15.07 RO4 source.	Not energized

No.	Name/Value	Description	Def/FbEq16
15.17	RO7 ON delay	Defines the activation delay for relay output RO7.	0.0 s
	Status of selected source		1 0
	RO status		1 0
	t <sub>On</sub> = 15.17 RO7 ON de	$t_{\rm On}$ $t_{\rm Off}$ $t_{\rm On}$ $t_{\rm Off}$	Time
	$t_{\text{On}} = 15.17 \text{ RO7 ON de}$ $t_{\text{Off}} = 15.18 \text{ RO7 OFF de}$		1
	0.0 3000.0 s	Activation delay for RO7.	10 = 1 s
15.18	RO7 OFF delay	Defines the deactivation delay for relay output RO7. See parameter 15.17 RO7 ON delay.	0.0 s
	0.0 3000.0 s	Deactivation delay for RO7.	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.	2
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 304).	2
	Reserved		3
	Enabled	Bit 0 of 06.16 Drive status word 1 (see page 305).	4
	Started	Bit 5 of 06.16 Drive status word 1 (see page 305).	5
	Magnetized	Bit 1 of 06.17 Drive status word 2 (see page 306).	6
	Running	Bit 6 of 06.16 Drive status word 1 (see page 305).	7
	Ready ref	Bit 2 of 06.11 Main status word (see page 304).	8
	At setpoint	Bit 8 of 06.11 Main status word (see page 304).	9
	Reverse	Bit 2 of 06.19 Speed control status word (see page 307).	10
	Zero speed	Bit 0 of 06.19 Speed control status word (see page 307).	11
	Above limit	Bit 10 of 06.17 Drive status word 2 (see page 306).	12
	Warning	Bit 7 of 06.11 Main status word (see page 304).	13
	Fault	Bit 3 of 06.11 Main status word (see page 304).	14
	Fault (-1)	Inverted bit 3 of 06.11 Main status word (see page 304).	15
	Fault/Warning	Bit 3 of 06.11 Main status word OR bit 7 of 06.11 Main status word (see page 304).	16
	Overcurrent	Fault 2310 Overcurrent has occurred.	17
	Overvoltage	Fault 3210 DC link overvoltage has occurred.	18
	Drive temp	Fault 2381 IGBT overload, 4110 Control board temperature, 4210 IGBT overtemperature, 4290 Cooling, 42F1 IGBT temperature, 4310 Excess temperature or 4380 Excess temperature difference has occurred.	19

No.	Name/Value	Description	Def/FbEq16
15.24	DO1 ON delay	Defines the activation delay for digital output DO1 when 15.22 DO1 configuration is set to Digital output.	0.0 s
	Status of selected source		0
	DO status		1 —— 0 —— <sub>Time</sub>
		$t_{\text{On}}$ $t_{\text{Off}}$ $t_{\text{On}}$ $t_{\text{Off}}$	Time
	t <sub>On</sub> = 15.24 DO1 ON de t <sub>Off</sub> = 15.25 DO1 OFF d	lay	
	0.0 3000.0 s	Activation delay for DO1.	1 = 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.	1 =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.	Motor speed used
	Not selected	None.	0
	Motor speed used	01.01 Motor speed used (page 293).	1
	Output frequency	01.06 Output frequency (page 293).	3
	Motor current	01.07 Motor current (page 293).	4
	Motor torque	01.10 Motor torque (page 293).	6
	DC voltage	01.11 DC voltage (page 293).	7
	Output power	01.14 Output power (page 294).	8
	Speed ref ramp in	23.01 Speed ref ramp input (page 390).	10
	Speed ref ramp out	23.02 Speed ref ramp output (page 390).	11
	Speed ref used	24.01 Used speed reference (page 392).	12
	Reserved		13
	Freq ref used	28.02 Frequency ref ramp output (page 397).	14
	Reserved		15
	Process PID out	40.01 Process PID output actual (page 462).	16
	Other	Source selection (see <i>Terms and abbreviations</i> on page 290).	-

11

No.	Name/\	/alue	Description	Def/FbEq16
15.40	Al force selection			06000
	Bit	Name	Value	
	01	Ivaille	Reserved	
	2	AI3	1 = Force Al3 to value of parameter 15.54 Al3 forced value.	
	3	Al4	1 = Force Al4 to value of parameter 15.64 Al4 forced value.	
	4	AI5	1 = Force Al5 to value of parameter 15.74 Al5 forced value.	
	515	-	Reserved	
				1
	0000h	.FFFFh	Bitmask	1 = 1
15.41	AI supe function		Selects how the drive reacts when an analog input signal moves out of the minimum and/or maximum limits specified for the input.  The inputs and the limits to be observed are selected by parameter 15.42 Al supervision selection.  Note: This parameter is visible when CAIO-01 is selected in parameter 15.01.	0000h
	No action	on	No action taken.	0
	Fault		Drive trips on 80A0 Al supervision.	1
	Warning	3	Drive generates an A8A0 AI supervision warning.	2
	Last sp	eed	Drive generates a warning (A8A0 Al supervision) and freezes the speed (or frequency) to the level the drive was operating at.  WARNING! Make sure that it is safe to continue operation in case of a communication break.	3
	Speed r	ef safe	Drive generates a warning (A8A0 Al supervision) and sets the speed to the speed defined by parameter 22.41 Speed ref safe (or 28.41 Frequency ref safe when frequency reference is being used).  WARNING! Make sure that it is safe to continue operation in case of a communication break.	4
15.42	Al supe selectio		Specifies the analog input limits to be supervised. See parameter 15.43 Al supervision function.  Note: This parameter is visible when CAIO-01 is selected in parameter 15.01.	0000h

No.	Name	/Value	Description	Def/FbEq16
	Bit	Name	Value	
	01	Reserved	1-4	
	2	AO3	1 = Force AO3 to value of parameter 15.83 AO3 forced value. (0	= Normal
			mode).	
	3	AO4	1 = Force AO4 to value of parameter 15.93 AO4 forced value. (0 mode).	= Normal
	415	Reserved		
	0000h	ıFFFFh	Bitmask	1 = 1
15.51		ctual value	Displays the value of analog input Al3 in mA or V mode (depending on whether the input is set to current or voltage in 15.55 Al3 unit selection).  This parameter is read-only.  Note: This parameter is visible when CAIO-01 is selected in parameter 15.01.	-
		011.000 022.000		1000 = 1 unit
15.52	AI3 so	caled value	Displays the value of analog input Al3 after scaling. See parameters 15.59 Al3 scaled at Al3 min and 15.60 Al3 scaled at Al3 max.  This parameter is read-only.  Note: This parameter is visible when CAIO-01 is selected in parameter 15.01.	-
	-3276	832767	Scaled analog input Al3 value	1 = 1%
15.53	AI3 pe	ercent value	Value of analog input Al3 in percent of Al3 scaling. Where - 110% = -11V or -22mA and 110% = 11V or 22mA.  Note: This parameter is visible when CAIO-01 is selected in parameter 15.01.	-
	011	0%	Percent analog input Al3 value.	1 = 1%
15.54	AI3 fo	rced value	Forced value that can be used instead of the true reading of the input. See parameter <i>15.40 Al force selection</i> . <b>Note</b> : This parameter is visible when CAIO-01 is selected in parameter <i>15.01</i> .	0.000 units
		011.000 022.000		1 = 1 unit
15.55	Al3 ur	nit selection	Selects the unit for readings and settings related to analog input Al3.  Note: This parameter is visible when CAIO-01 is selected in parameter 15.01.	V
	V		Volts	2
	mA		Milliamperes	10

Def/FbEq16

1 = 1 unit

2

10

		at AI4 max.  This parameter is read-only.  Note: This parameter is visible when CAIO-01 is selected in parameter 15.01.	
	-3276832767	Scaled Al4 value	1 = 1
15.63	Al4 percent value	Value of analog input Al4 in percent of Al4 scaling. Where - 110% = -11 V or -22 mA and 110% = 11 V or 22 mA.  Note: This parameter is visible when CAIO-01 is selected in parameter 15.01.	-
	0110%	Percent Al4 value	1 = 1%
15.64	Al4 forced value	Forced value that can be used instead of the true reading of the input. See parameter 15.40 Al force selection.  Note: This parameter is visible when CAIO-01 is selected in parameter 15.01.	-
	-11.00011.000V / -22.00022.000A	Forced value of analog input Al4	1 = 1 unit
15.65	Al4 unit selection	Selects the unit for readings and settings related to analog input AI4.  Note: This parameter is visible when CAIO-01 is selected in parameter 15.01.	V

Displays the value of analog input Al4 in mA or V mode (depending on whether the input is set to current or voltage in

Note: This parameter is visible when CAIO-01 is selected in

Displays the value of analog input Al4 after scaling. See parameters 15.69 Al4 scaled at Al4 min and 15.70 Al4 scaled

parameter 15.65 AI4 unit selection). This parameter is read-only.

No.

15.61

15.62

٧

mΑ

Name/Value

Al4 actual value

-11.000...11.000V/

-22.000...22.000A

Al4 scaled value

Description

parameter 15.01.

Actual Al4 value

Volts

Milliamperes

No.	Name/Value	Description	Def/FbEq16
15.71	Al5 actual value	Displays the value of analog input Al5 in mA or V mode (depending on whether the input is set to current or voltage in parameter 15.75 Al5 unit selection).	-
		This parameter is read-only. <b>Note</b> : This parameter is visible when CAIO-01 is selected in parameter 15.01.	
	-11.00011.000V / -22.00022.000A	Al5 value	1 = 1 unit
15.72	Al5 scaled value	Displays the value of analog input Al5 after scaling. See parameters 15.79 Al5 scaled at Al5 min and 15.80 Al5 scaled at Al5 max.  This parameter is read-only.  Note: This parameter is visible when CAIO-01 is selected in parameter 15.01.	-
	-3276832767	Value of Al5 after scaling	1 = 1
15.73	Al5 percent value	Value of analog input AI5 in percent of AI5 scaling. Where - 110% = -11 V or -22 mA and 110% = 11 V or 22 mA.  Note: This parameter is visible when CAIO-01 is selected in parameter 15.01.	-
	0110%	Value of Al5 in percent of Al5 scaling	1 = 1%
15.74	Al5 forced value	Forced value that can be used instead of the true reading of the input. See parameter 15.40 Al force selection.  Note: This parameter is visible when CAIO-01 is selected in parameter 15.01.	-
	-11.00011.000V / -22.00022.000A	Forced value	1 = 1 unit
15.75	Al5 unit selection	Selects the unit for readings and settings related to analog input AI5.  Note: This parameter is visible when CAIO-01 is selected in parameter 15.01.	V
	V	Volts	2
	mA	Milliamperes	10

No.	Name/Value	Description	Def/FbEq16
15.81	AO3 actual value	Displays the value of AO3 in mA or V. This parameter is read- only. <b>Note</b> : This parameter is visible when CAIO-01 is selected in parameter 15.01.	-
	-11.00011.000V / -22.00022.000A	Value of AO3	1 = 1 unit
15.82	AO3 source	Selects a signal to be connected to analog output AO3.  Note: The following selection list depends on the parameters available in the product. If a parameter is not available in the product, then the corresponding list item is also not available/not supported.  Note: This parameter is visible when CAIO-01 is selected in parameter 15.01.	-
	Zero	None	0
	Motor speed used	01.01 Motor speed used	1
	Output frequency	01.06 Output frequency	3
	Motor current	01.07 Motor current	4
	Motor current as % of motor nominal	01.08 Motor current % of motor nom	5
	Motor torque	01.10 Motor torque	6
	DC voltage	01.11 DC voltage	7
	Output power	01.14 Output power	8
	Speed ref ramp in	23.01 Speed ref ramp input	10
	Speed ref ramp out	23.02 Speed ref ramp output	11
	Speed ref used	24.01 Used speed reference	12
	Frequency ref used	28.02 Frequency ref ramp output	14
	Process PID out	40.01 Process PID output actual	16
	Temp sensor 1 excitation	The output is used to feed an excitation current to the temperature sensor 1, 35.11 Temperature 1 source	20
	Temp sensor 2 excitation	The output is used to feed an excitation current to the temperature sensor 2, 35.21 Temperature 2 source	21
	Abs motor speed used	01.61 Abs motor speed used	26
	Abs motor speed %	01.62 Abs motor speed %	27
	Abs output frequency	01.63 Abs output frequency	28
	Abs motor torque	01.64 Abs motor torque	30
	Abs output power	01.65 Abs output power	31
	Abs motor shaft power	01.68 Abs motor shaft power	32
	External PID1 out	71.01 External PID act value	33
	AO1 data storage	13.91 AO1 data storage	37
	AO2 data storage	13.92 AO2 data storage	38
	Other	Different source selection	-

No.	Name/Value	Description	Def/FbEq16
15.87	AO3 source min	Defines the real minimum value of the signal (selected by parameter 15.82 AO3 source) that corresponds to the minimum required AO3 output value (defined by parameter 15.89 AO3 out at AO3 source min).  Analog output 15.87 as the maximum value and 15.88 as the minimum value inverts the output as shown below.  Analog output 15.87 as the maximum value and 15.88 as the minimum value inverts the output as shown below.  Analog output 15.89 Source signal  AO has automatic scaling. Every time the source for the AO is changed, the scaling range is changed accordingly. User given minimum and maximum values override the automatic values. See parameter 13.17 for more details.  Note: This parameter is visible when CAIO-01 is selected in parameter 15.01.	-32768.0
	-32768.032767.0	Real minimum value of the AO3 signal	10 = 1
15.88	AO3 source max	Defines the real maximum value of the signal (selected by parameter 15.82 AO3 source) that corresponds to the maximum required AO3 output value (defined by parameter 15.90 AO3 out at AO3 source max). See parameter 15.87 AO3 source min.  Note: This parameter is visible when CAIO-01 is selected in parameter 15.01.	32767.0
	-32768.032767.0	Real maximum value of the AO3 signal	10 = 1
15.89	AO3 out at AO3 source min	Defines the minimum output value for analog output AO3. See also the drawing at parameter 15.87 AO3 source min.  Note: This parameter is visible when CAIO-01 is selected in parameter 15.01.	0.000 mA
	0.00011.000 V / 0.00022.000 mA	Minimum output value of AO3	1000 = 1 unit

No.

15 90

Name/Value

source max

AO3 out at AO3

Description

parameter 15.01.

Def/FbEa16

20 000 mA

Defines the maximum output value for analog output AO3.

See also the drawing at parameter 15.87 AO3 source min.

Note: This parameter is visible when CAIO-01 is selected in

AO1 data storage  AO2 data storage  Other  Different source selection  Forced value  Forced value  15.93 AO4 forced value  Forced value  Storage parameter 15.45 AO force selection.  Note: This parameter is visible when CAIO-01 is selected in parameter 15.01.  Storage parameter for controlling analog output AO4 for example through the embedded fieldbus interface. In parameter 15.92 AO4 data storage. Then set this parameter as the target of the AO4 data storage. Then set this parameter is visible when CAIO-01 is selected in parameter 15.01.  Storage parameter of that particular data (58.10158.114) to AO4 data storage. Then set this parameter of that particular data (58.10158.114) to AO4 data storage.  Note: This parameter is visible when CAIO-01 is selected in parameter 15.01.  Vota This parameter is visible when CAIO-01 is selected in parameter 15.01.  Vots This parameter is visible when CAIO-01 is selected in parameter 15.01.  Vots This parameter is visible when CAIO-01 is selected in parameter 15.01.  The filter timpe to the parameter of the parameter is visible when CAIO-01 is selected in parameter 15.01.  Vots This parameter is visible when CAIO-01 is selected in parameter 15.01.  Filter time constant for analog output AO4.  Defines the filter time constant for analog output AO4.  Defines the filter time constant for analog output AO4.  The parameter is visible when CAIO-01 is selected in parameter.  Note: This parameter is visible when CAIO-01 is selected in parameter.  Note: This parameter is visible when CAIO-01 is selected in parameter.  Note: This parameter is visible when CAIO-01 is selected in parameter.  Note: This parameter is visible when CAIO-01 is selected in parameter.  Note: This parameter is visible when CAIO-01 is selected in parameter.  Note: This parameter is visible when CAIO-01 is selected in parameter.	No.	Name/Value	Description	Def/FbEq16
Other  Different source selection  Forced value Forced value Forced value that can be used instead of the selected output signal. See parameter 15.45 AO force selection  Note: This parameter is visible when CAIO-01 is selected in parameter 15.01.  Forced value  Storage parameter for controlling analog output AO4 for example through the embedded fieldbus interface. In parameter 15.92 AO4 source, select the AO4 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 as the target of the incoming value data. With the embedded fieldbus interface, simply set the target selection parameter is visible when CAIO-01 is selected in parameter 15.01.  Storage parameter for controlling AO4  100 = 1  Storage parameter for controlling AO4  Storage parameter for controlling AO4  Note: This parameter is visible when CAIO-01 is selected in parameter 15.01.  Volts  MA  Milliamperes  Defines the filter time constant for analog output AO4.  O = I \times (1 - e-VT)  I = filter input (step)  O = filter output  t = time  T = filter time constant  Note: This signal is also filtered due to the signal interface hardware. This cannot be changed by any parameter.  Note: This parameter is visible when CAIO-01 is selected in parameter 15.01.		AO1 data storage	13.91 AO1 data storage	37
Forced value   Forced value   Forced value   Forced value that can be used instead of the selected output signal. See parameter 15.45 AO force selection.   Note: This parameter is visible when CAIO-01 is selected in parameter 15.01.     0.00012.000 mA		AO2 data storage	13.92 AO2 data storage	38
signal. See parameter 15.45 AO force selection. Note: This parameter is visible when CAIO-01 is selected in parameter 15.01.  0.00011.000 V/ 0.00022.000 mA  15.94 AO4 data storage  Storage parameter for controlling analog output AO4 for example through the embedded fieldbus interface. In parameter 15.92 AO4 source, select the AO4 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 AO4 data storage. Note: This parameter is visible when CAIO-01 is selected in parameter 15.01.  327.68327.67 Storage parameter for controlling AO4  Note: This parameter is visible when CAIO-01 is selected in parameter 15.01.  V Volts  NO Volts  Defines the filter time constant for analog output AO4.  O = I × (1 - e-t/T)  I = filter input (step) O = filter output I = time T = filter time constant Note: The signal is also filtered due to the signal interface hardware. This cannot be changed by any parameter. Note: This parameter is visible when CAIO-01 is selected in parameter 15.01.		Other	Different source selection	-
15.94 AO4 data storage  Storage parameter for controlling analog output AO4 for example through the embedded fieldbus interface. In parameter 15.92 AO4 source, select the AO4 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 AO4 data storage.  Note: This parameter is visible when CAIO-01 is selected in parameter 15.01.  15.95 AO4 unit selection  Selects the unit for readings and settings related to analog input AO4.  Note: This parameter is visible when CAIO-01 is selected in parameter 15.01.  V Volts  This parameter is visible when CAIO-01 is selected in parameter 15.01.  Defines the filter time constant for analog output AO4.  October 15.96 AO4 filter time  Defines the filter time constant for analog output AO4.  October 15.96 AO4 filter time  T = filter input (step) O = filter output t = time T = filter time constant Note: The signal is also filtered due to the signal interface hardware. This cannot be changed by any parameter. Note: This parameter is visible when CAIO-01 is selected in parameter 15.01.	15.93	AO4 forced value	signal. See parameter 15.45 AO force selection.  Note: This parameter is visible when CAIO-01 is selected in	-
example through the embedded fieldbus interface.  In parameter 15.92 AO4 source, select the AO4 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 as the target of the incoming value data. With the embedded fieldbus interface, simply set the target selection parameter is visible when CAIO-01 is selected in parameter 15.01.  Selects the unit for readings and settings related to analog input AO4.  Note: This parameter is visible when CAIO-01 is selected in parameter 15.01.  V Volts 2  Milliamperes 10  Defines the filter time constant for analog output AO4.  Defines the filter time constant for analog output AO4.  O = I × (1 - e-t/T)  I = filter input (step)  O = filter output  t = time  T = filter time constant  Note: The signal is also filtered due to the signal interface hardware. This cannot be changed by any parameter.  Note: This parameter is visible when CAIO-01 is selected in parameter 15.01.			Forced value	1000 = 1 unit
Selects the unit for readings and settings related to analog input AO4.  Note: This parameter is visible when CAIO-01 is selected in parameter 15.01.  Volts  mA  Milliamperes  Defines the filter time constant for analog output AO4.  O .100 s  O = I × (1 - e-t/T) I = filter input (step) O = filter output t = time T = filter time constant Note: The signal is also filtered due to the signal interface hardware. This cannot be changed by any parameter. Note: This parameter is visible when CAIO-01 is selected in parameter 15.01.	15.94	AO4 data storage	example through the embedded fieldbus interface. In parameter 15.92 AO4 source, select the AO4 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 AO4 data storage.  Note: This parameter is visible when CAIO-01 is selected in	0.00
input AO4. Note: This parameter is visible when CAIO-01 is selected in parameter 15.01.  V Volts 2  mA Milliamperes 10  Defines the filter time constant for analog output AO4.  0.100 s  Unfiltered  Filtered  Filtered  T = filter input (step) O = filter output t = time T = filter time constant Note: The signal is also filtered due to the signal interface hardware. This cannot be changed by any parameter. Note: This parameter is visible when CAIO-01 is selected in parameter 15.01.		-327.68327.67	Storage parameter for controlling AO4	100 = 1
mA  Milliamperes  Defines the filter time constant for analog output AO4.  0.100 s  O = I × (1 - e-t/T) I = filter input (step) O = filter output t = time T = filter time constant Note: The signal is also filtered due to the signal interface hardware. This cannot be changed by any parameter.  Note: This parameter is visible when CAIO-01 is selected in parameter 15.01.	15.95	AO4 unit selection	input AO4. <b>Note</b> : This parameter is visible when CAIO-01 is selected in	mA
Defines the filter time constant for analog output AO4.  O = I × (1 - e-t/T) I = filter input (step) O = filter output t = time T = filter time constant Note: The signal is also filtered due to the signal interface hardware. This cannot be changed by any parameter.  Note: This parameter is visible when CAIO-01 is selected in parameter 15.01.		V	Volts	2
O = I × (1 - e-t/T) I = filter input (step) O = filter output t = time T = filter time constant Note: The signal is also filtered due to the signal interface hardware. This cannot be changed by any parameter. Note: This parameter is visible when CAIO-01 is selected in parameter 15.01.		mA	Milliamperes	10
0.00030.000 s Filter time constant for AO4 1000 = 1 s	15.96	AO4 filter time	O = I × (1 - e-t/T) I = filter input (step) O = filter output t = time T = filter time constant Note: The signal is also filtered due to the signal interface hardware. This cannot be changed by any parameter. Note: This parameter is visible when CAIO-01 is selected in	0.100 s
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		0.00030.000 s	Filter time constant for AO4	1000 = 1 s

11

No.	Name/Value	Description	Def/FbEq16
15.100	AO4 out at AO4 source max	Defines the maximum output value for analog output AO4. See also drawing at parameter 15.97 AO4 source min.  Note: This parameter is visible when CAIO-01 is selected in parameter 15.01.	20.000 mA
	0.00011.000 V / 0.00022.000 mA	Maximum output value for AO4	1000 = 1 unit
19 Ope	eration mode	Selection of local and external control location sources and operating modes.  See also section <i>Operating modes of the drive</i> (page 111).	
19.01	Actual operation mode	Displays the operating mode currently used. See parameter 19.11. This parameter is read-only.	-
	Zero	None.	1
	Speed	Speed control (in vector motor control mode).	2
	Reserved		39
	Scalar (Hz)	Frequency control in scalar motor control mode (in scalar motor control mode).	10
	Forced magn.	Motor is in magnetizing mode.	20
19.11	Ext1/Ext2 selection	Selects the source for external control location EXT1/EXT2 selection.  0 = EXT1 1 = EXT2	EXT1
	EXT1	EXT1 (permanently selected).	0
	EXT2	EXT2 (permanently selected).	1
	FBA A MCW bit 11	Control word bit 11 received through fieldbus interface A.	2
	DI1	Digital input DI1 (10.02 DI delayed status, bit 0).	3
	DI2	Digital input DI2 (10.02 DI delayed status, bit 1).	4
	DI3	Digital input DI3 (10.02 DI delayed status, bit 2).	5
	DI4	Digital input DI4 (10.02 DI delayed status, bit 3).	6
	DI5	Digital input DI5 (10.02 DI delayed status, bit 4).	7
	DI6	Digital input DI6 (10.02 DI delayed status, bit 5).	8
	Reserved		918
	Timed function 1	Bit 0 of 34.01 Timed functions status (see page 436).	19
	Timed function 2	Bit 1 of 34.01 Timed functions status (see page 436).	20
	Timed function 3	Bit 2 of 34.01 Timed functions status (see page 436).	21
	Reserved		2224
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 423).	25
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 423).	26
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 423).	27
	Reserved		2831
	EFB MCW bit 11	Control word bit 11 received through the embedded fieldbus interface.	32
	FBA A connection loss	Detected communication loss of fieldbus interface A changes control mode to EXT2.	33

No.	Name/Value	Description			Def/FbEq16
	In1 Start; In2 Dir	The source selected by signal; the source selected determines the direction bits are interpreted as for	ted by 20.04 Ext1 in2 son. The state transitions	ource	2
		State of source 1 (20.03)	State of source 2 (20.04)	Command	
		0	Any	Stop	
		0 -> 1 (20.02 = Edge)	0	Start forward	
		1 (20.02 = Level)	1	Start reverse	
	In1 Start fwd; In2 Start rev	The source selected by start signal; the source the reverse start signal. bits are interpreted as for	selected by 20.04 Ext1 The state transitions o	in2 source is	3
		State of source 1 (20.03)	State of source 2 (20.04)	Command	
		0	0	Stop	
		0 -> 1 (20.02 = Edge) 1 (20.02 = Level)	0	Start forward	
		0	0 -> 1 (20.02 = Edge) 1 (20.02 = Level)	Start reverse	
		1	1	Stop	
	In1P Start; In2 Stop	The sources of the start parameters 20.03 Ext1. The state transitions of follows:	in1 source and 20.04 E. the source bits are inte	xt1 in2 source.	4
		State of source 1 (20.03)	State of source 2 (20.04)	Command	
		0 -> 1	1	Start	
		Any	0	Stop	
		<ul> <li>Parameter 20.02 Ext at startup of the drive</li> </ul>	art pulse has been give	n. an effect only start input is	

11

No.	Name/Value	Description	Def/FbEq16
20.02	Ext1 start trigger type		
	Edge	The start signal is edge-triggered.	0
	Level	The start signal is level-triggered.	1
20.03	Ext1 in1 source	Selects source 1 for parameter 20.01 Ext1 commands.	DI1
	Always off	0.	0
	Always on	1.	1
	DI1	Digital input DI1 (10.02 DI delayed status, bit 0).	2
	DI2	Digital input DI2 (10.02 DI delayed status, bit 1).	3
	DI3	Digital input DI3 (10.02 DI delayed status, bit 2).	4
	DI4	Digital input DI4 (10.02 DI delayed status, bit 3).	5
	DI5	Digital input DI5 (10.02 DI delayed status, bit 4).	6
	DI6	Digital input DI6 (10.02 DI delayed status, bit 5).	7
	Reserved		817
	Timed function 1	Bit 0 of 34.01 Timed functions status (see page 436).	18
	Timed function 2	Bit 1 of 34.01 Timed functions status (see page 436).	19
	Timed function 3	Bit 2 of 34.01 Timed functions status (see page 436).	20
	Reserved		2123
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 423).	24
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 423).	25
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 423).	26
Reserved			2739
	Constant speed Bit 7 of 06.19 Speed control status word (see page 307).		40
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 290).	-
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.	Always off
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.	Always off
20.06	Ext2 commands	Selects the source of start, stop and direction commands for external control location 2 (EXT2).  See parameter 20.21 for the determination of the actual direction. See also parameters 20.0720.10.	Not selected
	Not selected	No start or stop command sources selected.	0
	In1 Start	The source of the start and stop commands is selected by parameter 20.08 Ext2 in1 source. The state transitions of the source bits are interpreted as follows:	1
		State of source 1 (20.08)   Command	
		1 (20.07 = Edge) 1 (20.07 = Level)	
		0 Stop	

II I	ra III
-	

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 20.08 Ext2 in1 source and 20.09 Ext2 in2 source. The source selected by 20.10 Ext2 in3 source determines the direction. The state transitions of the source bits are interpreted as follows:			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	
		Parameter 2     at startup of	er the start puls 0.07 Ext2 start the drive with th 07 = Level (1) w	trigger type has his setting. If the	en. s an effect only e start input is	
	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:			6
		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	
		before or afte	er the start puls	e has been giv	can be put ON en. s no effect with	
	Reserved					710
	Control panel	The start and stop commands are taken from the control panel (or PC connected to the control panel connector).  Note: This selection requires ACS-AP-I control panel that uses Start/Stop/Loc/Rem logic.  The start and stop commands are taken from fieldbus adapter A.  Note: Set also 20.07 Ext2 start trigger type to Level.				11
	Fieldbus A					12
Reserved					13	
Embedded fieldbus The start and stop commands are taken from the embedded fieldbus interface.			14			

No.	Name/Value	Description	Def/FbEq16
20.07	Ext2 start trigger type	Defines whether the start signal for external control location EXT2 is edge-triggered or level-triggered.  Note: If a pulse type start signal is selected, this parameter is only effective at drive startup. See the descriptions of the selections of parameter 20.06 Ext2 commands.	Level
	Edge	The start signal is edge-triggered.	0
	Level	The start signal is level-triggered.	1
20.08	Ext2 in1 source	Selects source 1 for parameter 20.06 Ext2 commands. For the available selections, see parameter 20.03 Ext1 in1 source.	Always off
20.09	Ext2 in2 source	Selects source 2 for parameter 20.06 Ext2 commands. For the available selections, see parameter 20.03 Ext1 in1 source.	Always off
20.10	Ext2 in3 source	Selects source 3 for parameter 20.06 Ext2 commands. For the available selections, see parameter 20.03 Ext1 in1 source.	Always off

No.	Name/Value	е	Description			Def/FbEq16
20.21	Direction		rather than the sign In the table the acting parameter 20.21 D parameter 20.01 E.	n lock. Defines the direction of the reference, except in a ual drive rotation is shown as irrection and Direction commat1 commands or 20.06 Ext2 diagram Direction lock (page	some cases. s a function of and (from commands).	Forward
		Directio	n command =	Direction command = Reverse	Direction com defined	mand not
	Par. 20.21 Direction = Forward	Forward	i	Forward	Forward	
	Par. 20.21 Direction = Reverse	Reverse	e	Reverse	Reverse	
	Par. 20.21 Direction = Request	I Lorward but		Reverse, but  If reference from Constant or PID, reference used as is.  If reference from the network, Panel, Analog input, Floating point control (Motor potentiometer), Safe speed or Last reference, reference multiplied by -1.	Forward	
	Request		command (parame commands).  If the reference cor speeds/frequencies potentiometer), PIE Panel reference, the lift the reference core if the direction coas is	the direction is selected by a ster 20.01 Ext1 commands or mes from Constant (constant s), Floating point control (Mo ), Speed ref safe, Last speed are reference is used as is. mes from a fieldbus: command is forward, the referonmand is reverse, the referonmand is reverse, the referonment of the control o	tor d reference or	0
	Forward		reference. (Negativ	ard regardless of the sign of the regardless of the sign of the reference values are replated values are used as is.)		1
	Reverse		reference. (Negativ	rse regardless of the sign of reference values are replayed values are multiplied by -1.)		2

No.	Name/Value	Description	Def/FbEq16
20.41	Start interlock 1	Selects the source of the Start interlock 1 signal.  Value 0 of the source deactivates the Start interlock 1 signal and inhibits starting.  Value 1 of the source activates the Start interlock 1 signal and allows starting.  Note: Removal of the Start interlock setting when the drive is running results in the stopping method defined in parameter 20.45 Start interlock stop mode.	Not used
	Not used	0.	0
	Not used	1.	1
	DI1	Digital input DI1 (10.02 DI delayed status, bit 0).	2
	DI2	Digital input DI2 (10.02 DI delayed status, bit 1).	3
	DI3	Digital input DI3 (10.02 DI delayed status, bit 2).	4
	DI4	Digital input DI4 (10.02 DI delayed status, bit 3).	5
	DI5	Digital input DI5 (10.02 DI delayed status, bit 4).	6
	DI6	Digital input DI6 (10.02 DI delayed status, bit 5).	7
	-DI1	Digital input DI1 (10.02 DI delayed status, bit 0).	8
	-DI2	Digital input DI2 (10.02 DI delayed status, bit 1).	9
	-DI3	Digital input DI3 (10.02 DI delayed status, bit 2).	10
	-DI4	Digital input DI4 (10.02 DI delayed status, bit 3).	11
	-DI5	Digital input DI5 (10.02 DI delayed status, bit 4).	12
	-DI6	Digital input DI6 (10.02 DI delayed status, bit 5).	13
	Fieldbus adapter	This selection cannot be used to control Start interlock with ABB drives profile from the fieldbus adapter. Use <i>Other [bit]</i> and map to control word user bits.  This selection is only available for <i>20.41 Start interlock 1</i> and <i>20.42 Start interlock 2</i> .	14
	Embedded fieldbus	Start interlock 1: DCU profile: Inverse of control word bit 18 received through the embedded fieldbus interface. Start interlock 2: Inverse of bit 19. This selection is only available for 20.41 Start interlock 1 and 20.42 Start interlock 2.	15
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 290).	-
20.42	Start interlock 2	Selects the source of the Start interlock 2 signal. For the selections, see parameter 20.41 Start interlock 1.	Not used
20.43	Start interlock 3	Selects the source of the Start interlock 3 signal. Start interlock 3 is not supported over the Fieldbus adapter or Embedded fieldbus. For the other selections than 14 and 15, see parameter 20.41 Start interlock 1.	Not used
20.44	Start interlock 4	Selects the source of the Start interlock 4 signal. Start interlock 4 is not supported over the Fieldbus adapter or Embedded fieldbus. For the other selections than 14 and 15, see parameter 20.41 Start interlock 1.	Not used
20.45	Start interlock stop mode	Follows motor stop mode selection, see parameter 21.03 Stop mode.	Not used
	Not used	Not in use.	0
	Coast	The motor coasts to a stop.	1

No.

20 46

20 47

Name/Value

Run permissive

Run permissive Reserved

Valve opening

Pre-lube cycle

Interlock open

tevt

Start interlock 1

Start interlock 1

Vibration switch Reserved

condition

Ramp

text

Description

Stop along the active deceleration ramp.

Interlocks/Permissives > Label text.

Alternative alarm texts for the run permissive.

Alternative alarm texts for the start interlock 1

> Primary settings > Start, stop, reference > Interlocks/Permissives > Label text.

There is also label text (free text) for the run permissive. The control panel display will display the text when the run permissive becomes unsatisfied. You edit the label text in Menu > Primary settings > Start, stop, reference >

There is also label text (free text) for each start interlock. The control panel display will display that specific text when the interlock becomes unsatisfied. You edit the label text in Menu Def/FbEa16

Run permissive

n

1

2 3

5

0

2...3

command ignored

Start

interlock 1

This parameter determines if the start command is needed

before start interlock warnings are displayed.

Def/FbEq16

4	4
Ш	Ш

ignored	missing.	
Start command required	Start command must be present before the start interlock warnings are displayed if the interlocks are missing.	1
21 Start/stop mode	Start and stop modes; emergency stop mode and signal source selection; DC magnetization settings.	
21.01 Start mode	Selects the motor start function for the vector motor control mode, ie, when 99.04 Motor control mode is set to Vector.  Notes:  • The start function for the scalar motor control mode is selected by parameter 21.19 Scalar start mode.  • Starting into a rotating motor is not possible when DC magnetizing is selected (Fast or Const time).  • With permanent magnet motors, Automatic start mode must be used.  • This parameter cannot be changed while the drive is running.  See also section Start methods – DC magnetization (page 198).	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 (for example, if the motor start must be synchronized with the release of a mechanical brake). This setting also guarantees the highest possible break-away torque when the pre-magnetizing time is set long enough.  WARNING! The drive will start after the set magnetizing time has passed even if motor magnetization is not completed. In applications where a full break-away torque is essential, ensure that the constant magnetizing time is long enough to allow generation of full magnetization and torque.	1
Automatic	Automatic start guarantees optimal motor start in most cases. It includes the flying start function (starting into a rotating motor) and the automatic restart function. The drive motor control program identifies the flux as well as the mechanical state of the motor and starts the motor instantly under all conditions.	2

Start interlock warnings are displayed if the interlocks are

No.

Name/Value

ignored

Start command

Description

missing.

ΣıΙ	Ca III
-	

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
21.05	Emergency stop source	Selects the source of the emergency stop signal. The stop mode is selected by parameter 21.04 Emergency stop mode.  0 = Emergency stop active 1 = Normal operation  Note: This parameter cannot be changed while the drive is running.	Inactive (true)
	Active (false)	0.	0
	Inactive (true)	1.	1
	Reserved		2
	DI1	Digital input DI1 (10.02 DI delayed status, bit 0).	3
	DI2	Digital input DI2 (10.02 DI delayed status, bit 1).	4
	DI3	Digital input DI3 (10.02 DI delayed status, bit 2).	5
	DI4	Digital input DI4 (10.02 DI delayed status, bit 3).	6
	DI5	Digital input DI5 (10.02 DI delayed status, bit 4).	7
	DI6	Digital input DI6 (10.02 DI delayed status, bit 5).	8
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 290).	-
21.06	Zero speed limit	Defines the zero speed limit. The motor is stopped along a speed ramp (when ramped stop is selected or emergency stop time is used) until the defined zero speed limit is reached. After the zero speed delay, the motor coasts to a stop.	30.00 rpm
	0.0030000.00 rpm	Zero speed limit.	See par. 46.01

No.	Name/Value	Description	Def/FbEq16
21.08	DC current control	Activates/deactivates the DC hold and post-magnetization functions. See section Start methods – DC magnetization (page 198).  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	Name	Value
0	DC hold	1 = Enable DC hold. See section <i>DC hold</i> (page 199)
		<b>Note:</b> The DC hold function has no effect if the start signal is switched off.
1	magneti	1 = Enable post-magnetization. See section <i>Settings</i> (page <i>199</i> ). <b>Note:</b> Post-magnetization is only available when ramping is the selected stop mode (see parameter <i>21.03 Stop mode</i> ).
2	DC brake	<ul> <li>1 = Enables DC injection braking after modulation has stopped.</li> <li>Notes:</li> <li>To enable DC brake, parameter 21.03 Stop mode has to be set to Coast.</li> <li>DC braking current can be set with parameter 21.10 DC current reference.</li> <li>DC braking time can be set with parameter 21.11 Post magnetization time.</li> </ul>
315	Reserve	d

	0000h0011h	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 199).	
	0.001000.00 rpm	DC hold speed.	See par. 46.01
21.10	DC current reference	Defines the DC hold current in percent of the motor nominal current. See parameter 21.08 DC current control, and section Start methods – DC magnetization (page 198).  After 100 s post-magnetization time, the maximum magnetization current is limited to the magnetization current corresponding to the actual flux reference.	30.0%
	0.0100.0%	DC hold current.	1 = 1%
21.11	Post magnetization time	Defines the length of time for which post-magnetization is active after stopping the motor. The magnetization current is defined by parameter 21.10 DC current reference.  See parameter 21.08 DC current control.	0 s
	03000 s	Post-magnetization time.	1 = 1 s
21.13	Autophasing mode	Selects the way autophasing is performed. See section <i>Autophasing</i> on page 195. Notes:  This parameter can only be used for PM motors. This parameter cannot be changed while the drive is running.	Turning
	Turning	Injects DC current to the motor to align the angle to a known position.  Note: The motor may turn when it is started as the shaft is aligned with the remanence flux	0

ΒI	la II	

No.	Name/Value	Description	Def/FbEq16
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 216)  When this parameter is set to 0.0 seconds, automatic restarting is disabled. Otherwise, the parameter defines the maximum duration of the power failure after which restarting is attempted. Note that this time also includes the DC precharging delay. See also parameter 21.34 Force auto restart.  This parameter has effect only if parameter 95.04 Control board supply is set to External 24V.  WARNING! Before you activate the function, make sure that no dangerous situations can occur. The function restarts the drive automatically and continues operation after a supply break.	10.0 s
	0.0 s	Automatic restarting disabled.	0
	0.110.0 s	Maximum power failure duration.	10 = 1 s
21.19	Scalar start mode	Selects the motor start function for the scalar motor control mode, ie, when 99.04 Motor control mode is set to Scalar.  Notes:  • The start function for the vector motor control mode is selected by parameter 21.01 Start mode.  • With permanent magnet motors, Automatic start mode must be used.  • This parameter cannot be changed while the drive is running.  See also section Start methods – DC magnetization (page 198).	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 (for example, 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

11

No.	Name/Value	Description	Def/FbEq16	
	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%	
	10.0200.0%	Value in percent of the nominal motor current.	1 = 1%	
21.25	Smooth start speed	Output frequency up to which the current vector rotation is used. See parameter 21.19 Scalar start mode.  Can be used for permanent magnet synchronous motors only.	10.0%	
	2.0100.0%	Value as a percentage of the nominal motor frequency.	1 = 1%	
21.26	Torque boost current	Defines the maximum supplied current to motor when (21.19 Scalar start mode is set to Torque boost (see page 380).  Parameter value is in percent of the motor nominal current. Nominal value of the parameter is 100.0%.  Torque boost is only applied at start, ending when output frequency exceeds 40% of nominal frequency or when output frequency is equal to reference.  Can be used in scalar mode only.	100.0%	
	15.0300.0%	Value in percent of the nominal motor current.	1 = 1%	
21.27	Torque boost time	Defines the minimum and maximum torque boost time. If torque boost time is less than 40% of frequency acceleration time (see parameter 28.72), then torque boost time is set at 40% of frequency acceleration time.	20 s	
	0.060.0 s	Nominal motor time.	1 = 1 s	
21.34	Force auto restart	Forces automatic restart. The parameter is applicable only if parameter 95.04 Control board supply is set to External 24V.	Enable	
	Disable	Force auto restart disabled. Parameter 21.18 Auto restart time is in effect if its value is more than 0.0 s.	0	
	Enable	Force auto restart enabled. Parameter 21.18 Auto restart time is ignored. The drive never trips on the undervoltage fault and the start signal is on forever. When he DC voltage is restored, the normal operation continues.	1	
21.35	Preheating power	Defines the power used to heat the motor.	0.00 kW	
	0.00 10.00 kW	Preheating power.	100 = 1 kW	
21.36	Preheating unit	Defines if preheating is specified as current or power.	Current	
	Current	Preheating specified as current (see parameter 21.16).	0	
	Power	Preheating specified as power (see parameter 21.35).	1	
21.40	Restart delay	Defines the restart delay for pump short cycle protection. The pump cannot be restarted within the set restart delay time. The timer accounts for delay time elapsed while the drive is turned off if the time synchronization source in parameter 96.20 Time sync primary source is active both before and after the drive is powered down.  The timer resumes with the latest value stored in parameter 21.42 Restart delay remaining if power is lost during the restart delay the time synchronization is not available.	0.0 s	

22 Spe select	eed reference ion	Speed reference selection; Motor potentiometer settings. See control chain diagrams <i>Speed reference source selection</i> II (page 272) <i>Speed controller</i> (page 276).	
22.01	Speed ref unlimited	Displays the output of the speed reference selection block. See control chain diagram <i>Speed reference source selection II</i> on page <i>272</i> . 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. A digital source selected by 19.11 Ext1/Ext2 selection can be used to switch between EXT1 reference and the corresponding EXT2 reference defined by parameter 22.18 Ext2 speed ref1.	Al1 scaled
	Zero	None.	0
	Al1 scaled	12.12 Al1 scaled value (see page 327).	1
	Al2 scaled	12.22 Al2 scaled value (see page 329).	2
	Reserved		3
	FB A ref1	03.05 FB A reference 1 (see page 298).	4
	FB A ref2	03.06 FB A reference 2 (see page 298).	5
	Reserved		67
	EFB ref1	03.09 EFB reference 1 (see page 298).	8
	EFB ref2	03.10 EFB reference 2 (see page 298).	9
	Reserved		1014
	Motor potentiometer	22.80 Motor potentiometer ref act (output of the Motor potentiometer).	15
	PID	40.01 Process PID output actual (output of the process PID controller).	16
	Frequency input	11.38 Freq in 1 actual value (when DI5 is used as a frequency input).	17
	Control panel (ref saved)	Control panel reference (03.01 Panel reference, see page 297) saved by the control system for the location where the control returns is used as the reference.  Reference  * - X X - X - X - X - X - X - X - X	18

11

No.	Name/Value Description				
	Control panel (ref copied)	Control panel reference (03.01 Panel reference, see page 297) 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		
	Reserved		2022		
	Al3 scaled	15.52 Al3 scaled value (see page 349).	23		
	Al4 scaled	15.62 Al4 scaled value (see page 351).	24		
	Al5 scaled	15.72 Al5 scaled value (see page 353).	25		
	Level control	Parameter 76.07 LC speed ref (output of the Level control function).	30		
	Other	Source selection (see <i>Terms and abbreviations</i> on page 290).	-		
22.18	Ext2 speed ref1	Selects EXT2 speed reference source 1.	Zero		
	Zero None.				
	Al1 scaled	12.12 Al1 scaled value (see page 327).	1		
	Al2 scaled	12.22 Al2 scaled value (see page 329).	2		
	Reserved		3		
	FB A ref1	03.05 FB A reference 1 (see page 298).	4		
	FB A ref2	03.06 FB A reference 2 (see page 298).	5		
	Reserved		67		
	EFB ref1	03.09 EFB reference 1 (see page 298).	8		
	EFB ref2	03.10 EFB reference 2 (see page 298).	9		
	Reserved		1014		
	Motor potentiometer	22.80 Motor potentiometer ref act (output of the Motor potentiometer).	15		
	PID	40.01 Process PID output actual (output of the process PID controller).	16		
	Frequency input	11.38 Freq in 1 actual value (when DI5 is used as a frequency input).	17		
	Control panel (ref saved)	Control panel reference (03.01 Panel reference, see page 297) 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   EXT1 -> EXT2	18		

0000h...FFFFh

No.	Name/Value			cription	Def/FbEq16
	copied)		when two frequises	trol panel reference (03.01 Panel reference, see page ) for the previous control location is used as the reference en the control location changes if the references for the locations are of the same type (eg uency/speed/torque/PID); otherwise, the actual signal is d as the new reference.  EXT1 reference  EXT1 reference  EXT2 reference  Active reference  Inactive reference	19
	Reserve	ed			2022
	Al3 scal	ed	15.5	52 Al3 scaled value (see page 349).	23
	Al4 scal	ed	15.6	62 Al4 scaled value (see page 351).	24
	Al5 scal	ed	15.7	72 Al5 scaled value (see page 353).	25
	Level co	ontrol	Parameter 76.07 LC speed ref (output of the Level control function).		30
	Other		Sou	rce selection (see <i>Terms and abbreviations</i> on page 290).	-
22.21	function the			Determines how constant speeds are selected, and whether the rotation direction signal is considered or not when applying a constant speed.	
	Bit	Name		Information	
	1	Constant s mode  Direction enable	peed	1 = Packed: 7 constant speeds are selectable using the tridefined by parameters 22.22, 22.23 and 22.24.  0 = Separate: Constant speeds 1, 2 and 3 are separately the sources defined by parameters 22.22, 22.23 and 22.24. In case of conflict, the constant speed with the smaller nu priority.  1 = Start dir: To determine running direction for a constant sign of the constant speed setting (parameters 22.2622 multiplied by the direction signal (forward: +1, reverse: -1) effectively allows the drive to have 14 (7 forward, 7 revers speeds if all values in 22.2622.32 are positive.  WARNING: If the direction signal is reverse and the constant speed is negative, the drive will run in the direction.  0 = According to Par: The running direction for the constant	activated by respectively. mber takes speed, the .32) is . This e) constant e active forward
				determined by the sign of the constant speed setting (para 22.2622.32).	
	215	Reserved			

Constant speed configuration word.

1 = 1

No.	Name/Value	me/Value Description	
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

	Always off	0.	0
	Always on	1.	1
	DI1	Digital input DI1 (10.02 DI delayed status, bit 0).	2
	DI2	Digital input DI2 (10.02 DI delayed status, bit 1).	3
	DI3	Digital input DI3 (10.02 DI delayed status, bit 2).	4
	DI4	Digital input DI4 (10.02 DI delayed status, bit 3).	5
	DI5	Digital input DI5 (10.02 DI delayed status, bit 4).	6
	DI6	Digital input DI6 (10.02 DI delayed status, bit 5).	7
	Reserved		817
	Timed function 1	Bit 0 of 34.01 Timed functions status (see page 436).	18
	Timed function 2	Bit 1 of 34.01 Timed functions status (see page 436).	19
	Timed function 3	Bit 2 of 34.01 Timed functions status (see page 436).	20
	Reserved		2123
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 423).	24
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 423).	25
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 423).	26
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 290).	-
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.	Always off

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 Al supervision function  49.05 Communication loss action  50.02 FBA A comm loss func  80.17 Maximum flow protection  80.18 Minimum flow protection.	0.00 rpm
	-30000.00 30000.00 rpm	Safe speed reference.	See par. 46.01
22.46	Constant speed sel5	When bit 0 of parameter 22.21 Constant speed function is 0 (Separate), selects a source that activates constant speed 5. For the selections, see parameter 22.22 Constant speed sel1.	Always off
22.47	Constant speed sel6	When bit 0 of parameter 22.21 Constant speed function is 0 (Separate), selects a source that activates constant speed 6. For the selections, see parameter 22.22 Constant speed sel1.	Always off
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 160).	0000Ь

Bit	Name	Information
0	Enable	1 = Enable: Critical speeds enabled.
		0 = Disable: Critical speeds disabled.
1	Sign mode	1 = Signed: The signs of parameters 22.5222.57 are 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	

	0000hFFFFh	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. <b>Note:</b> 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
22.73	Motor potentiometer up source	Selects the source of Motor potentiometer counter up signal.  0 = No change  1 = Increase Motor potentiometer counter value. (If both the up and down sources are on, the potentiometer value will not change.)  Note: Motor potentiometer function up/down source control speed or frequency from zero to maximum speed or frequency. The running direction can be changed with parameter 20.04 Ext1 in2 source. See the figure in section Motor potentiometer on page 163.	Not used
	Not used	0.	0
	Not used	1.	1
	DI1	Digital input DI1 (10.02 DI delayed status, bit 0).	2
	DI2	Digital input DI2 (10.02 DI delayed status, bit 1).	3
	DI3	Digital input DI3 (10.02 DI delayed status, bit 2).	4
	DI4	Digital input DI4 (10.02 DI delayed status, bit 3).	5
	DI5	Digital input DI5 (10.02 DI delayed status, bit 4).	6
	DI6	Digital input DI6 (10.02 DI delayed status, bit 5).	7
	Reserved		817
	Timed function 1	Bit 0 of 34.01 Timed functions status (see page 436).	18
	Timed function 2	Bit 1 of 34.01 Timed functions status (see page 436).	19
	Timed function 3	Bit 2 of 34.01 Timed functions status (see page 436).	20
	Reserved		2123
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 423).	24
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 423).	25
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 423).	26
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 290).	-
22.74	Motor potentiometer down source  Motor	Selects the source of Motor potentiometer counter down signal.  0 = No change 1 = Decrease Motor potentiometer counter value. (If both the up and down sources are on, the counter value will not change.)  Note: Motor potentiometer function up/down source control speed or frequency from zero to maximum speed or frequency. The running direction can be changed with parameter 20.04 Ext1 in 2 source. See the figure in section Motor potentiometer on page 163.  For the selections, see parameter 22.73 Motor potentiometer up source.  Defines the change rate of the Motor potentiometer counter. This parameter specifies the time required for the Motor	Not used 40.0 s
	potentiometerramp time	potentiometer to change from minimum (22.76) to maximum (22.77). The same change rate applies in both directions.	
	0.03600.0 s	Counter change time.	1 = 1 s

46.01

30000.00 rpm

ГI	r. II
ии	ии
ш	ш

No.	Name/Value	Description	Def/FbEq16
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.	5.000 s
	0.0001800.000 s	Acceleration time 1.	10 = 1 s
23.13	Deceleration time 1	Defines deceleration time 1 as the time required for the speed to change from the speed defined by parameter 46.01 Speed scaling (not from parameter 30.12 Maximum speed) to zero. If the speed reference decreases slower than the set deceleration rate, the motor speed will follow the reference. If the reference changes faster than the set deceleration rate, the motor speed will follow the deceleration rate. If the deceleration rate is set too short, the drive will automatically prolong the deceleration in order not to exceed drive torque limits (or not to exceed a safe DC link voltage). If there is any doubt about the deceleration time being too short, ensure that DC overvoltage control is on (parameter 30.30 Overvoltage control).  Note: If a short deceleration time is needed for a high inertia application, the drive should be equipped with braking equipment such as a brake chopper and brake resistor.	5.000 s
	0.0001800.000 s	Deceleration time 1.	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.  Notes:  Emergency stop Off1 uses the standard deceleration ramp as defined by parameters 23.1223.13.  The same parameter value is also used in frequency control mode (ramp parameters 28.7228.73).	3.000 s
	0.0001800.000 s	Emergency stop Off3 deceleration time.	10 = 1 s
23.32	Shape time 1	Defines the shape of acceleration ramp at the beginning of acceleration.	0.000 s
	0.0001800.000 s	Shape time 1.	10 = 1 s

No.	Name/Value	Description	Def/FbEq16
24 Speed reference conditioning		Speed error calculation; speed error window control configuration; speed error step.  See control chain diagram <i>Speed error calculation</i> on page 369.	
24.01	Used speed reference	Displays the ramped and corrected speed reference (before speed error calculation). See control chain diagram <i>Speed error calculation</i> on page 369.  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 control chain diagram <i>Speed error calculation</i> on page 369.  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 control chain diagram <i>Speed error calculation</i> on page <i>369</i> .  This parameter is read-only.	-
	-30000.00 30000.00 rpm	Filtered speed error.	See par. 46.01
24.04	Speed error inverted	Displays the inverted (unfiltered) speed error. See control chain diagram <i>Speed error calculation</i> on page <i>369</i> . 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 control chain diagram Speed error calculation on page 369.	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 control chain diagram <i>Speed error calculation</i> on page 369.	
25.01	Torque reference speed control	Displays the speed controller output that is transferred to the torque controller. See control chain diagram <i>Speed error calculation</i> on page 369.  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	5.02 Speed proportional gain (K <sub>p</sub> ) 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.			
		Gain = $K_p = 1$ $T_1$ = Integration time = 0 $T_D$ = Derivation time = 0		
		Error value		
	Controller output = K <sub>p</sub> × e		Error value	
		If gain is set to 1, a 10% change in error value (reference - actual value) causes the speed controller output to change by 10%, ie, the output value is input × gain.		
	0.00250.00	Proportional gain for speed controller.	100 = 1	

No.	Name/Value	Description	Def/FbEq16
25.04	Speed derivation time $ K_p \times T_D \times \frac{\Delta e}{T_s} \left\{ K \right. $	<b> </b>	0.000 s
	К	p × e {	/alue
		<b>\</b>	
		T <sub>I</sub> Time	
		ain = K <sub>p</sub> = 1	
	T	i = Integration time > 0 D= Derivation time > 0	
		= Sample time period = 250 µs e = Error value change between two samples	
	0.00010.000 s	Derivation time for speed controller.	1000 = 1 s
25.05	Derivation filter time	Defines the derivation filter time constant. See parameter 25.04 Speed derivation time.	8 ms
	010000 ms	Derivation filter time constant.	1 = 1 ms
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
25.30	Flux adaptation enable	Enables/disables speed controller adaptation based on motor flux reference (01.24 Flux actual %). The proportional gain of the speed controller is multiplied by a coefficient of 01 between 0100% flux reference respectively.	Enable
	Disable	Speed controller adaptation based on flux reference disabled.	0
	Enable	Speed controller adaptation based on flux reference enabled.	1
25.33	Speed controller auto tune	Activates (or selects a source that activates) the speed controller auto tune function. See section <i>Before activating the autotune routine</i> on page 212.	Off
	Off	Not activated.	0

ency chain equency ref mp input  00.00500.00 cequency ref mp output  00.00500.00 c tt1 frequency ref1 ero 1 scaled 2 scaled eserved 3 A ref1	Settings for the frequency reference chain. See the control chain diagrams on pages 270 and 271.  Displays the used frequency reference before ramping. See the control chain diagrams Frequency reference selection on page 270 and Frequency reference modification on page 271. This parameter is read-only.  Frequency reference before ramping.  Displays the final frequency reference (after selection, limitation and ramping). See control chain diagram on page 270. This parameter is read-only.  Final frequency reference.  Selects EXT1 frequency reference source 1.  None.  12.12 Al1 scaled value (see page 327).  12.22 Al2 scaled value (see page 329).	See par. 46.02 - See par. 46.02 - Al1 scaled 0 1 2 3
on.00500.00  equency ref mp output  on.00500.00  ct frequency ref1 ero 1 scaled 2 scaled esserved	the control chain diagrams Frequency reference selection on page 270 and Frequency reference modification on page 271. This parameter is read-only.  Frequency reference before ramping.  Displays the final frequency reference (after selection, limitation and ramping). See control chain diagram on page 270. This parameter is read-only.  Final frequency reference.  Selects EXT1 frequency reference source 1.  None.  12.12 Al1 scaled value (see page 327).  12.22 Al2 scaled value (see page 329).	46.02 - See par. 46.02 All scaled 0 1
equency ref mp output  00.00500.00  ctt1 frequency ref1 ero 1 scaled 2 scaled eserved	Displays the final frequency reference (after selection, limitation and ramping). See control chain diagram on page 270. This parameter is read-only. Final frequency reference.  Selects EXT1 frequency reference source 1.  None.  12.12 Al1 scaled value (see page 327).  12.22 Al2 scaled value (see page 329).	46.02 - See par. 46.02 All scaled 0 1
mp output  00.00500.00  ct1 frequency ref1 ero 1 scaled 2 scaled eserved	limitation and ramping). See control chain diagram on page 270. This parameter is read-only. Final frequency reference.  Selects EXT1 frequency reference source 1. None.  12.12 Al1 scaled value (see page 327).  12.22 Al2 scaled value (see page 329).	See par. 46.02 Al1 scaled 0 1
ct frequency ref1 ero 1 scaled 2 scaled esserved	Selects EXT1 frequency reference source 1.  None.  12.12 Al1 scaled value (see page 327).  12.22 Al2 scaled value (see page 329).	46.02 Al1 scaled 0 1 2
1 scaled 2 scaled eserved	None.  12.12 Al1 scaled value (see page 327).  12.22 Al2 scaled value (see page 329).	0 1 2
1 scaled 2 scaled eserved	12.12 Al1 scaled value (see page 327). 12.22 Al2 scaled value (see page 329).	1 2
2 scaled eserved	12.22 Al2 scaled value (see page 329).	2
eserved		
	00.05.50.4.4	3
A ref1	00.05 50 4 95 99 94 4 (	
	03.05 FB A reference 1 (see page 298).	4
3 A ref2	03.06 FB A reference 2 (see page 298).	5
eserved		67
B ref1	03.09 EFB reference 1 (see page 298).	8
B ref2	03.10 EFB reference 2 (see page 298).	9
eserved		1014
otor tentiometer	22.80 Motor potentiometer ref act (output of the Motor potentiometer).	15
D	40.01 Process PID output actual (output of the process PID controller).	16
equency input	11.38 Freq in 1 actual value (when DI5 is used as a frequency input).	17
ontrol panel (ref ved)	Control panel reference (03.01 Panel reference, see page 297) 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
E	equency input	40.01 Process PID output actual (output of the process PID controller).  11.38 Freq in 1 actual value (when DI5 is used as a frequency input).  11.38 Freq in 1 actual value (when DI5 is used as a frequency input).  12.38 Freq in 1 actual value (when DI5 is used as a frequency input).  13.38 Freq in 1 actual value (when DI5 is used as a frequency input).  14.38 Freq in 1 actual value (when DI5 is used as a frequency input).  15.30 Freq in 1 actual value (when DI5 is used as a frequency input).  16.30 Freq in 1 actual value (when DI5 is used as a frequency input).  17.38 Freq in 1 actual value (when DI5 is used as a frequency input).  18.30 Freq in 1 actual value (when DI5 is used as a frequency input).  18.30 Freq in 1 actual value (when DI5 is used as a frequency input).  18.30 Freq in 1 actual value (when DI5 is used as a frequency input).  18.30 Freq in 1 actual value (when DI5 is used as a frequency input).  18.30 Freq in 1 actual value (when DI5 is used as a frequency input).  18.30 Freq in 1 actual value (when DI5 is used as a frequency input).  18.30 Freq in 1 actual value (when DI5 is used as a frequency input).  18.30 Freq in 1 actual value (when DI5 is used as a frequency input).  18.30 Freq in 1 actual value (when DI5 is used as a frequency input).  18.30 Freq in 1 actual value (when DI5 is used as a frequency input).  18.30 Freq in 1 actual value (when DI5 is used as a frequency input).

1 = 1

No.	Name/	<b>Value</b>	Description	Def/FbEq16
	Contro copied	ol panel (ref )	Control panel reference (03.01 Panel reference, see page 297) 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
	Reserv	/ed		2022
	Al3 scaled		15.52 Al3 scaled value (see page 349).	23
	Al4 sc	aled	15.62 Al4 scaled value (see page 351).	24
	Al5 sc	aled	15.72 Al5 scaled value (see page 353).	25
	Level	control	Parameter 76.07 LC speed ref (output of the Level control function).	30
	Other		Source selection (see <i>Terms and abbreviations</i> on page 290).	-
28.21	Consta functio	antfrequency n	Determines how constant frequencies are selected, and whether the rotation direction signal is considered or not when applying a constant frequency.	0000Ь
	Bit	Name	Information	
	0	Const freq mode	1 = Packed: 7 constant frequencies are selectable using t sources defined by parameters 28.22, 28.23 and 28.24. 0 = Separate: Constant frequencies 1, 2 and 3 are separa by the sources defined by parameters 28.22, 28.23 and 2 respectively. In case of conflict, the constant frequency winumber takes priority.	ately activated
	1	Direction enable	1 = Start dir: To determine running direction for a constant sign of the constant speed setting (parameters 22.2622 multiplied by the direction signal (forward: +1, reverse: -1) effectively allows the drive to have 14 (7 forward, 7 revers speeds if all values in 22.2622.32 are positive.  WARNING: If the direction signal is reverse and the constant speed is negative, the drive will run in the direction.	2.32) is ). This se) constant ne active

Constant frequency configuration word.

2...15

0000h...FFFFh

Reserved

0 = According to Par: The running direction for the constant speed is determined by the sign of the constant speed setting (parameters 22.26...22.32).

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

	Always off	0.	0
	Always on	1.	1
	DI1	Digital input DI1 (10.02 DI delayed status, bit 0).	2
	DI2	Digital input DI2 (10.02 DI delayed status, bit 1).	3
	DI3	Digital input DI3 (10.02 DI delayed status, bit 2).	4
	DI4	Digital input DI4 (10.02 DI delayed status, bit 3).	5
	DI5	Digital input DI5 (10.02 DI delayed status, bit 4).	6
	DI6	Digital input DI6 (10.02 DI delayed status, bit 5).	7
	Reserved		817
	Timed function 1	Bit 0 of 34.01 Timed functions status (see page 436).	18
	Timed function 2	Bit 1 of 34.01 Timed functions status (see page 436).	19
	Timed function 3	Bit 2 of 34.01 Timed functions status (see page 436).	20
	Reserved		2123
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 423).	24
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 423).	25
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 423).	26
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 290).	-
28.23	Constant frequency sel 2	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.	Always off

No.	Name/Value	Description	Def/FbEq16
28.24	Constant frequency sel3	When bit 0 of parameter 28.21 Constant frequency function is 0 (Separate), selects a source that activates constant frequency 3.  When bit 0 of parameter 28.21 Constant frequency function is 1 (Packed), this parameter and parameters 28.22 Constant frequency sel1 and 28.23 Constant frequency sel2 select three sources that are used to activate constant frequencies. See table at parameter 28.22 Constant frequency sel1.  For the selections, see parameter 28.22 Constant frequency sel1.	Always off
28.25	Constant frequency sel4	When bit 0 of parameter 28.21 Constant frequency function is 0 (Separate), selects a source that activates constant frequency 4. For the selections, see parameter 28.22 Constant frequency sel1.	Always off
28.26	Constant frequency 1	Defines constant frequency 1 (the frequency the motor will turn when constant frequency 1 is selected).	5.00 Hz; 6.00 Hz (95.20 b0)
	-500.00500.00 Hz	Constant frequency 1.	See par. 46.02
28.27	Constant frequency 2	Defines constant frequency 2.	10.00 Hz; 12.00 Hz (95.20 b0)
	-500.00500.00 Hz	Constant frequency 2.	See par. 46.02
28.28	Constant frequency 3	Defines constant frequency 3.	15.00 Hz; 18.00 Hz (95.20 b0)
	-500.00500.00 Hz	Constant frequency 3.	See par. 46.02
28.29	Constant frequency 4	Defines constant frequency 4.	20.00 Hz; 24.00 Hz (95.20 b0)
	-500.00500.00 Hz	Constant frequency 4.	See par. 46.02
28.30	Constant frequency 5	Defines constant frequency 5.	25.00 Hz; 30.00 Hz (95.20 b0)
	-500.00500.00 Hz	Constant frequency 5.	See par. 46.02
28.31	Constant frequency 6	Defines constant frequency 6.	40.00 Hz; 48.00 Hz (95.20 b0)
	-500.00500.00 Hz	Constant frequency 6.	See par. 46.02
28.32	Constant frequency 7	Defines constant frequency 7.	50.00 Hz; 60.00 Hz (95.20 b0)
	-500.00500.00 Hz	Constant frequency 7.	See par. 46.02

No.	Name/Value	Description	Def/FbEq16
28.55	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
	-500.00500.00 Hz	High limit for critical frequency 2.	See par. 46.02
28.56	Critical frequency 3 low	Defines the low limit for critical frequency 3. <b>Note:</b> This value must be less than or equal to the value of 28.57 Critical frequency 3 high.	0.00 Hz
	-500.00500.00 Hz	Low limit for critical frequency 3.	See par. 46.02
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
28.72	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.	5.000 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.	5.000 s
	0.0001800.000 s	Deceleration time 1.	10 = 1 s
28.76	Freq ramp in zero source	Selects a source that forces the frequency reference to zero.  0 = Force frequency reference to zero  1 = Normal operation	Inactive
	Active	0.	0
	Inactive	1.	1
	DI1	Digital input DI1 (10.02 DI delayed status, bit 0).	2
	DI2	Digital input DI2 (10.02 DI delayed status, bit 1).	3
	DI3	Digital input DI3 (10.02 DI delayed status, bit 2).	4
	DI4	Digital input DI4 (10.02 DI delayed status, bit 3).	5
	DI5	Digital input DI5 (10.02 DI delayed status, bit 4).	6
	DI6	Digital input DI6 (10.02 DI delayed status, bit 5).	7
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 290).	-

No.	Name/Value	Description	Def/FbEq16
28.82	Shape time 1	Defines the shape of acceleration ramp at the beginning of acceleration.	0.000 s
	0.0001800.000 s	Shape time 1.	10 = 1 s
28.92	Frequency ref act 3	Displays the frequency reference after selection (19.11 Ext1/Ext2 selection). See control chain diagram Frequency reference selection on page 270.  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 control chain diagram <i>Frequency reference selection</i> on page 270. 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 control chain diagram <i>Frequency reference modification</i> on page 271.  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.	
14	Reserved		
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 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 frequence	
10	Min freq ref lim	1 = Frequency reference is being limited by 30.13 Minimum frequency	
1115	Reserved		

0000hFFFFh	Limit word 1.	1 = 1

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

Bit	Name	Description	
0	Undervoltage	*1 = Intermediate DC circuit undervoltage	
1	Overvoltage	*1 = Intermediate DC circuit overvoltage	
2	Minimum torque	*1 = Torque is being limited by 30.19 Minimum torque 1, 30.26 Power motoring limit or 30.27 Power generating limit	
3	Maximum torque	= Torque is being limited by 30.20 Maximum torque 1, 30.26 Power otoring limit or 30.27 Power generating limit	
4	Internal current	1 = An inverter current limit (identified by bits 811) is active	
5	Load angle	(With permanent magnet motors and reluctance motors only)  1 = Load angle limit is active, ie, the motor cannot produce any more torque	
6	Motor pullout	(With asynchronous motors only) Motor pull-out limit is active, ie, the motor cannot produce any more torque	
7	Reserved		
8	Thermal	1 = Input current is being limited by the main circuit thermal limit	
9	Max current	*1 = Maximum output current (I <sub>MAX</sub> ) is being limited	
10	User current	*1 = Output current is being limited by 30.17 Maximum current	
11	Thermal IGBT	*1 = Output current is being limited by a calculated thermal current value	
12	IGBT overtemperature	*1 = Output current is being limited because of estimated IGBT temperature	
13	IGBT overload	*1 = Output current is being limited because of IGBT junction to case temperature	
1415	Reserved		
	e out of bits 03, the limit that is ex	and one out of bits 911 can be on simultaneously. The bit typically ceeded first.	

	0000hFFFFh	Torque limitation status word.	1 = 1
--	------------	--------------------------------	-------

	Name/Value	Description	Def/FbEq16
30.13	Minimum frequency	Defines together with 30.14 Maximum frequency the allowed frequency range. See the figure.  A positive or zero minimum frequency value defines two ranges, one positive and one negative.  WARNING! The absolute value of 30.13 Minimum frequency must not be higher than the absolute value of 30.14 Maximum frequency.  WARNING! in frequency control mode only.	0.00 Hz
	Frequency	Frequency 20.21 value	= Peguest
	<b>†</b>	30.13 value < 0	
	30.14	30.14 Frequency range allowed	
	0 Frequency r	ange allowed 30.13	
	0	Time -(30,13)	Time
	30.13	-(30.14) Frequency range allowed	
		30.13 value 30.13 30.14 Frequency range allowed  -(30.13) -(30.14)	
	-500.00500.00 Hz	Minimum frequency.	See par. 46.02
30.14	Maximum frequency	Defines together with 30.13 Minimum frequency the allowed frequency range. See parameter 30.13 Minimum frequency.  Note: This parameter does not affect the frequency acceleration and deceleration ramp times. See parameter 46.02 Frequency scaling.	50.00 Hz; 60.00 Hz (95.20 b0)
	-500.00500.00 Hz	Maximum frequency.	See par. 46.02
30.17	Maximum current	Defines the maximum allowed motor current. This depends on the drive type; it is automatically determined on the basis of the rating.  The system sets the default value to 90% of the rated current so you can increase the parameter value by 10% if needed (not valid for ACQ580-01-12A7-4 drive type).	0.00 A
	0.0030000.00 A	Maximum motor current.	1 = 1 A
30.19	0.0030000.00 A  Minimum torque 1	71 7	1 = 1 A -300.0%

No.	Name/Value	Description	Def/FbEq16
30.36	Speed limit selection	Selects a source that switches between two different predefined adjustable speed limit sets.  0 = minimum speed limit defined by 30.11 and maximum speed limit defined by 30.12 are active  1 = minimum speed limit selected by 30.37 and maximum speed limit defined by 30.38 are active.  The user can define two sets of speed limits, and switch between the sets using a binary source such as a digital input.  The first set of limits is defined by parameters 30.11 Minimum speed and 30.12 Maximum speed. The second set has selector parameters for both the minimum (30.37) and maximum (30.38) limits that allows the use of a selectable analog source (such as an analog input).	Not selected
		30.37  Al1 Al2 Minimum speed Other  30.11  Joseph Just defined minimum speed limit	
		30.38  Al1 Al2 Maximum speed Other  30.12  User-defined maximum speed limit	
	Not selected	Adjustable speed limits are disabled.  (Minimum speed limit defined by 30.11 Minimum speed and maximum speed limit defined by 30.12 Maximum speed are active).	0
	Selected	Adjustable speed limits are enabled. (Minimum speed limit defined by 30.37 Minimum speed source and maximum speed limit defined by 30.38 Maximum speed source are active).	1
	Ext1 active	Adjustable speed limits are enabled if EXT1 is active.	2
	Ext2 active	Adjustable speed limits are enabled if EXT2 is active.	3
	Reserved		4
	DI1	Digital input DI1 (10.02 DI delayed status, bit 0).	5
	DI2	Digital input DI2 (10.02 DI delayed status, bit 1).	6
	DI3	Digital input DI3 (10.02 DI delayed status, bit 2).	7
	DI4	Digital input DI4 (10.02 DI delayed status, bit 3).	8
	DI5	Digital input DI5 (10.02 DI delayed status, bit 4).	9
	DI6	Digital input DI6 (10.02 DI delayed status, bit 5).	10
	Reserved		11
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 290).	-

No.	Name/Value Description			
30.37	Minimum speed source	Defines the source of a minimum speed limit for the drive when the source is selected by 30.36 Speed limit selection.  Note: In vector motor control mode only. In scalar motor control mode, use frequency limits 30.13 and 30.14.	Minimum speed	
	Zero	None.	0	
	Al1 scaled	12.12 Al1 scaled value (see page 327).	1	
	Al2 scaled	12.22 Al2 scaled value (see page 329).	2	
	Reserved		310	
	Minimum speed	30.11 Minimum speed.	11	
	Other	Source selection (see <i>Terms and abbreviations</i> on page 290).	-	
30.38	Maximum speed source	Defines the source of a maximum speed limit for the drive when the source is selected by 30.36 Speed limit selection.  Note: In vector motor control mode only. In scalar motor control mode, use frequency limits 30.13 and 30.14.	Maximum speed	
	Zero	None.	0	
	Al1 scaled	12.12 Al1 scaled value (see page 327).	1	
	Al2 scaled	12.22 Al2 scaled value (see page 329).	2	
	Reserved		311	
	Maximum speed	30.12 Maximum speed.	12	
	Other	Source selection (see <i>Terms and abbreviations</i> on page 290).	-	
30.101	LSU limit word 1	(Only visible for ACQ580-31 and ACQ580-34). Displays limit word 1 of the supply unit. This parameter is read-only.	-	

Bit	Name Description		
0	P user ref max		
1	P user ref min	parameters	
2	P user max 1 = Power is being limited by parameter 30.149		
3	Reserved		
4	P cooling 1 = Power reference is being limited because of coolant overtemp overtemperature		
5	P power unit 1 = Power reference is being limited because of supply unit overtemp overtemperature		
615	Reserved		
	•		

0000hFFFFh	Supply unit limit word 1.	1 = 1
------------	---------------------------	-------

No.	Name/Value	Description	Def/FbEq16
30.102	LSU limit word 2	(Only visible for ACQ580-31 and ACQ580-34). Displays limit word 2 of the supply unit. This parameter is read-only.	-

Bit	Name	Description	
0	Q user ref max	1 = Reactive power reference is being limited	
1	Q user ref min		
2	Q cooling overtemp	Reactive power reference is being limited because of coolant overtemperature	
3	Reserved		
4	AC overvoltage	age 1 = AC overvoltage protection	
56	Reserved		
7	AC diff max 1 = (When AC voltage-type reactive power reference is being used)		
8	AC diff min	Input of AC control is being limited	
915	Reserved		

0000hFFFFh	Supply unit limit word 2.	1 = 1
30.103 LSU limit word 3	(Only visible for ACQ580-31 and ACQ580-34). Displays limit word 3 of the supply unit. This parameter is read-only.	-

Bit	Name	Description	
0	Undervoltage limit	1 = Power is being limited by the undervoltage controller	
1	Overvoltage limit	1 = Power is being limited by the overvoltage controller	
2	Motoring power	1 = Power is being limited by temperature or user power limits (see parameter 30.149)	
3	Reserved		
4	Active current limit	1 = Active current is being limited. For details, see bits 69 and 1415.	
5	Reactive current limit	1 = Reactive current is being limited. For details, see bits 1213.	
6	Thermal limit	1 = Active current is being limited by internal main circuit thermal limit	
7	SOA limit	1 = Active current is being limited by internal safe operation area limit	
8	User current limit	Active current is being limited by current limit set by supply control program parameters	
9	Thermal IGBT	1 = Active current is being limited based on internal maximum therma IGBT stress limit	
1011	Reserved		
12	Q act neg	act neg 1 = Negative reactive current is being limited by maximum total current	
13	Q act pos	1 = Positive reactive current is being limited by maximum total current	
14	P act neg	1 = Negative active current is being limited by maximum total current	
15	P act pos	1 = Positive reactive current is being limited by maximum total current	

0000hFFFFh	Supply unit limit word 3.	1 = 1
------------	---------------------------	-------

No. Name/Value Description		Value	Description	Def/FbEq16
30.104	LSU lin	nit word 4	(Only visible for ACQ580-31 and ACQ580-34). Displays limit word 4 of the supply unit. This parameter is read-only.	-
	Bit	Name	Description	
	0	Udc ref ma	1 = DC reference is being limited by supply cor	trol program
	1	Udc ref mir	parameters	
	2	User I max	1 = Current is being limited by supply control p	ogram parameters
	3	Temp I max	1 = Current is being limited based on temperate	ıre

	0000hFFFFh	Supply unit limit word 4.	1 = 1
30.149	LSU maximum power limit	(Only visible for ACQ580-31 and ACQ580-34). Defines a maximum power limit for the supply unit.	130.0%
	0.0 200.0%	Maximum power limit for supply unit.	1 = 1%

31 Fau	ılt 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
	Reserved		2
	DI1	Digital input DI1 (10.02 DI delayed status, bit 0).	3
	DI2	Digital input DI2 (10.02 DI delayed status, bit 1).	4
	DI3	Digital input DI3 (10.02 DI delayed status, bit 2).	5
	DI4	Digital input DI4 (10.02 DI delayed status, bit 3).	6
	DI5	Digital input DI5 (10.02 DI delayed status, bit 4).	7
	DI6	Digital input DI6 (10.02 DI delayed status, bit 5).	8
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 290).	-
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  Notes:  • When the start and stop command is through digital inputs (parameter 20.01 Ext1 commands or 20.06 Ext2 commands) or from local control, and you want to use fault reset from the fieldbus, selection FBA A MCW bit 7 or EFB MCW bit 7 can be used.  • Whenever the drive is in external control through fieldbus (start and stop command and reference are received through fieldbus), the fault can be reset from the fieldbus regardless of the selection of this parameter.	Not used
	Not used	0.	0
	Not used	1.	1
	DI1	Digital input DI1 (10.02 DI delayed status, bit 0).	2
	DI2	Digital input DI2 (10.02 DI delayed status, bit 1).	3
	DI3	Digital input DI3 (10.02 DI delayed status, bit 2).	4
	DI4	Digital input DI4 (10.02 DI delayed status, bit 3).	5
	DI5	Digital input DI5 (10.02 DI delayed status, bit 4).	6
	DI6	Digital input DI6 (10.02 DI delayed status, bit 5).	7
	Reserved		817
	Timed function 1	Bit 0 of 34.01 Timed functions status (see page 436).	18
	Timed function 2	Bit 1 of 34.01 Timed functions status (see page 436).	19

No.	Name/Value	Description	Def/FbEq16
	Timed function 3	Bit 2 of 34.01 Timed functions status (see page 436).	20
	Reserved		2123
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 423).	24
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 423).	25
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 423).	26
	Reserved		2729
	FBAA MCW bit 7	Control word bit 7 received through fieldbus interface A.	30
	Reserved		31
	EFB MCW bit 7	Control word bit 7 received through the embedded fieldbus interface.	32
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 290).	-
31.12	Autoreset selection	Selects faults that are automatically reset. The parameter is a 16-bit word with each bit corresponding to a fault type. Whenever a bit is set to 1, the corresponding fault is automatically reset.  Faults marked with an asterisk (*) in the table below will be reset on the inverter unit (INU) and the supply unit (LSU).  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	Overcurrent*
1	Overvoltage*
2	Undervoltage*
3	Al supervision fault
49	Reserved
10	Selectable fault (see parameter 31.13 Selectable fault)
11	External fault 1 (from source selected by parameter 31.01 External event 1 source)
12	External fault 2 (from source selected by parameter 31.03 External event 2 source)
13	External fault 3 (from source selected by parameter 31.05 External event 3 source)
14	External fault 4 (from source selected by parameter 31.07 External event 4 source)
15	External fault 5 (from source selected by parameter 31.09 External event 5 source)

	0000hFFFFh Automatic reset configuration word.				
31.13	Selectable fault	Defines the fault that can be automatically reset using parameter 31.12 Autoreset selection, bit 10. Faults are listed in chapter Fault tracing (page 240).	0000h		
	0000hFFFFh	Fault code.	1 = 1		

No. Name/Value		Name/Value Description			
31.14	Number of trials	Defines the maximum number of automatic resets that the drive is allowed to attempt within the time specified by 31.15 Total trials time.  If the fault persists, subsequent reset attempts will be made at intervals defined by 31.16 Delay time.	5		
		The faults to be automatically reset are defined by 31.12 Autoreset selection.			
	05	Number of automatic resets.	1 = 1		
31.15	Total trials time	Defines a time window for automatic fault resets. The maximum number of attempts made during any period of this length is defined by 31.14 Number of trials.  Note: If the fault condition remains and cannot be reset, each reset attempt will generate an event and start a new time window. In practice, if the specified number of resets (31.14) at specified intervals (31.16) take longer than the value of 31.15, the drive will continue to attempt resetting the fault until the cause is eventually removed.	30.0 s		
	1.0600.0 s	Time for automatic resets.	10 = 1 s		
31.16	Delay time	Defines the time that the drive will wait after a fault before attempting an automatic reset. See parameter 31.12  Autoreset selection.			
	0.0120.0 s	Autoreset delay.	10 = 1 s		
31.19	Motor phase loss	Selects how the drive reacts when a motor phase loss is detected. In scalar motor control mode: The supervision activates above 10% of the motor nominal frequency. If any of the phase currents stays very small for a certain time limit, the output phase loss fault is given. If the motor nominal current is below 1/6 of the drive nominal current or there is no motor connected, ABB recommends to disable the motor output phase loss function.	Fault		
	No action	No action taken.	0		
	Fault	Drive trips on fault 3381 Output phase loss.	1		
31.20	Earth fault	Selects how the drive reacts when an earth fault or current unbalance is detected in the motor or the motor cable.	Fault		
	No action	No action taken.	0		
	Warning	The drive generates an A2B3 Earth leakage warning.	1		
	Fault	The drive trips on fault 2330 Earth leakage.	2		
31.21	Supply phase loss	Selects how the drive reacts when a supply phase loss is detected.	Fault		
	No action	No action taken.The output current is limited to 50% when supply phase loss is detected. No fault or warning is given.	0		
	Fault	Drive trips on fault 3130 Input phase loss.	1		

No.	Name/Value	Descr	iption			Def/FbEq16				
	Fault/Event					2				
		Inp	uts	Indic	ation					
		IN1	IN2	Running	Stopped					
		0	0	Fault 5091 Safe torque off	Event B5A0 STO event					
		0	1	Faults 5091 Safe torque off and FA81 Safe torque off 1	Event B5A0 STO event and fault FA81 Safe torque off 1					
		1	0	Faults 5091 Safe torque off and FA82 Safe torque off 2	Event B5A0 STO event and fault FA82 Safe torque off 2					
		1	1	(Normal o	operation)					
	Warning/Warning					3				
		Inp IN1	uts IN2	Indication (runr	ning or stopped)					
		0	0	Warning A5A0	Safe torque off					
		0	1		rque off and fault FA81 que off 1					
		1	0		rque off and fault FA82 que off 2					
		1	1	(Normal o	operation)					
	Event/Event					4				
		Inp	uts IN2	- Indication (runr	ning or stopped)					
		0	0	Event B5A0	STO event					
		0	1	torqu	nt and fault FA81 Safe e off 1					
		1	0		nt and fault FA82 Safe e off 2					
		1	1	(Normal o	operation)					
	No indication/No					5				
	indication	Inp	uts							
		IN1	IN2	Indication (runr	ning or stopped)					
		0	0	No	one					
		0	1		afe torque off 1					
		1	0		afe torque off 2					
		1	1	(Normal o	operation)					
31.23	Wiring or earth fault	Selects motor drive n Note:	Fault							
	No action	No act	ion tak	en.		0				

No.	Name/Value	Description	Def/FbEq16
	Fault	Drive trips on fault 3181 Wiring or earth fault.	1
31.24	Stall function	Selects how the drive reacts to a motor stall condition.  A stall condition is defined as follows:  The drive exceeds the stall current limit (31.25 Stall current limit), and  the output frequency is below the level set by parameter 31.27 Stall frequency limit or the motor speed is below the level set by parameter 31.26 Stall speed limit, and  the conditions above have been true longer than the time set by parameter 31.28 Stall time.	No action
	No action	None (stall supervision disabled).	0
	Warning	Drive generates warning A780 Motor stall.	1
	Fault	Drive trips on fault 7121 Motor stall.	2
31.25	Stall current limit	Stall current limit in percent of the nominal current of the motor. See parameter 31.24 Stall function.	200.0%
	0.01600.0%	Stall current limit.	10 = 1%
31.26	Stall speed limit	Stall speed limit in rpm. See parameter 31.24 Stall function.	150.00 rpm; 180.00 rpm (95.20 b0)
	0.0010000.00 rpm	Stall speed limit.	See par. 46.01
31.27	Stall frequency limit	Stall frequency limit. See parameter 31.24 Stall function.  Note: Setting the limit below 10 Hz is not recommended.	15.00 Hz; 18.00 Hz (95.20 b0)
	0.001000.00 Hz	Stall frequency limit.	See par. 46.02
31.28	Stall time	Stall time. See parameter 31.24 Stall function.	20 s
	03600 s	Stall time.	1 = 1 s

No.	Name/Value	Description	Def/FbEq16
31.30	Overspeed trip margin	Defines, together with 30.11 Minimum speed and 30.12  Maximum speed, the maximum allowed speed of the motor (overspeed protection). If the speed (24.02 Used speed feedback) exceeds the speed limit defined by parameter 30.11 or 30.12 by more than the value of this parameter, the drive trips on the 7310 Overspeed fault.  WARNING! This function only supervises the speed in vector motor control mode. The function is not effective in scalar motor control mode.  Example: If the maximum speed is 1420 rpm and speed trip margin is 300 rpm, the drive trips at 1720 rpm.  Speed (24.02)  Overspeed trip level  31.30  Overspeed trip level  31.30  Overspeed trip level  Overspeed trip level  Time  30.11  31.30  Overspeed trip level  Overspeed trip level  Time  30.11  30.11  30.11	500.00 rpm
	0.0010000.00 rpm	Overspeed trip margin.	See par. 46.01

11

No.	Name/Value	Description			
31.33	Emergency ramp supervision delay	If parameter 31.32 Emergency ramp supervision is set to 0%, this parameter defines the maximum time an emergency stop (mode Off1 or Off3) is allowed to take. If the motor has not stopped when the time elapses, the drive trips on fault 7380 Emergency ramp failed, sets bit 8 of 06.17 Drive status word 2, and coasts to a stop.  If 31.32 is set to a value other than 0%, this parameter defines a delay between the receipt of the emergency stop command and the activation of the supervision. It is recommended to specify a short delay to allow the speed change rate to stabilize.	0 s		
	0100 s	Maximum ramp-down time, or supervision activation delay.	1 = 1 s		
31.35	Main fan fault function	Selects how the drive reacts when a main cooling fan speed problem is detected. For frame sizes R6 or larger only.  An event is triggered according to the value of this parameter (fault, warning or no action)  • if the rotation speed signal from the fan is lower than the measured fan maximum speed (determined during the fan ID run)  • if the measured fan maximum speed is lower than the predefined minimum value.	Fault		
	Fault	Drive trips on fault 5080 Fan	0		
	Warning	Drive generates warning A581 Fan.	1		
	No action	No action taken.	2		
31.36	Aux fan fault function	Selects how the drive reacts when an auxiliary fan problem is detected.  Certain drive types (especially those protected to IP55) have an auxiliary fan built into the front cover as standard. if it is necessary to operate the drive without the front cover (for example, during commissioning), you can set the parameter to value <i>No action</i> within two minutes from powerup to temporarily suppress the fault or warning. Return the value to <i>Fault</i> or <i>Warning</i> afterwards.  On frame sizes R1R5, the auxiliary fan is attached to connector X10 and on frame sizes R6 and larger to connector X16.	Fault		
	Fault	The drive trips on fault 5081 Auxiliary fan broken. The fault is suppressed for two minutes after power-up.	0		
	Warning	The drive generates warning <i>A582 Auxiliary fan missing</i> . The warning is suppressed for two minutes after power-up.	1		
	No action	No action taken.	2		

No.	Name/V	alue	Description		Def/FbEq16
·	pervision		Configuration of signal supervision functions 16. Six values can be chosen to be monitored; a warning or fault is generated whenever predefined limits are exceeded. See also section <i>Diagnostics menu</i> (page <i>230</i> ).		
32.01 Supervision status			Indicates wheth supervision fundimits.  Note: This work	sion status word. her the values monitored by the signal actions are within or outside their respective d is independent of the drive actions defined 32.06, 32.16, 32.26, 32.36, 32.46 and 32.56.	0000Ь
	Bit	Name		Description	
	0	Supervision	n 1 active	1 = Signal selected by 32.07 is outside its limits	S.
	1	Supervision	n 2 active	1 = Signal selected by 32.17 is outside its limits	S.
	2	Supervision	n 3 active	1 = Signal selected by 32.27 is outside its limits	3.
	3	Supervision	n 4 active	1 = Signal selected by 32.37 is outside its limits	S.
	4	Supervision		1 = Signal selected by 32.47 is outside its limits	
	5	Supervision	n 6 active	1 = Signal selected by 32.27 is outside its limits	6.
	615	Reserved			
	0000h		0 1	sion status word.	1 = 1
32.05	Supervis function		how the monito	de of signal supervision function 1. Determines pred signal (see parameter 32.07) is compared I upper limits (32.09 and 32.10 respectively). The taken when the condition is fulfilled is 06.	Disabled
	Disabled	t	Signal supervis	sion 1 not in use.	0
	Low		limit - 0.5 * hys	whenever signal is below 'Supervision low' teresis. Action is deactivated whenever signal rvision low' limit + 0.5 * hysteresis.	1
	High		limit + 0.5 * hys	whenever signal is above 'Supervision High' steresis. Action is deactivated whenever signal rvision High' limit - 0.5 * hysteresis.	2
absolute Action is above al hysteres  Abs high Action is absolute Action is below al			absolute value Action is deacti	whenever absolute value of signal is below of 'Supervision Low' limit - 0.5 * hysteresis. ivated whenever absolute value of signal is a value of 'Supervision Low' limit + 0.5 *	3
			absolute value Action is deacti	whenever absolute value of signal is above of 'Supervision High' limit + 0.5 * hysteresis. ivated whenever absolute value of signal is a value of 'Supervision High' limit - 0.5 *	4
Both		limit + 0.5 * hys 0.5*hysteresis. between 'Supe	whenever signal is above 'Supervision High' steresis or below 'Supervision Low' limit - Action is deactivated whenever signal is in rvision High' limit - 0.5 * hysteresis and ow' limit + 0.5*hysteresis.	5	

11

No.	Name/Value	Description	Def/FbEq16
	Al4 scaled	15.62 Al4 scaled value (see page 351).	12
	Al5 scaled	15.72 Al5 scaled value (see page 353).	13
	Reserved		1417
	Speed ref ramp in	23.01 Speed ref ramp input (page 390).	18
	Speed ref ramp out	23.02 Speed ref ramp output (page 390).	19
	Speed ref used	24.01 Used speed reference (page 392).	20
	Reserved		21
	Freq ref used	28.02 Frequency ref ramp output (page 397).	22
	Inverter temperature	05.11 Inverter temperature (page 300).	23
	Process PID output	40.01 Process PID output actual (page 462).	24
	Process PID feedback	40.02 Process PID feedback actual (page 462).	25
	Process PID setpoint	40.03 Process PID setpoint actual (page 462).	26
	Process PID deviation	40.04 Process PID deviation actual (page 463).	27
	Other	Source selection (see <i>Terms and abbreviations</i> on page 290).	-
32.08	Supervision 1 filter time	Defines a filter time constant for the signal monitored by signal supervision 1.	0.000 s
	0.000 30.000 s	Signal filter time.	1000 = 1 s
32.09	Supervision 1 low	Defines the lower limit for signal supervision 1.	0.00
	-21474836.00 21474836.00	Low limit.	
32.10	Supervision 1 high	Defines the upper limit for signal supervision 1.	0.00
	-21474836.00 21474836.00	Upper limit.	
32.11	Supervision 1 hysteresis	Defines the hysteresis for the signal monitored by signal supervision 1. This parameter applies to all selections for parameter 32.05 Supervision 1 function, not just selection Hysteresis (7). Action is taken whenever the signal rises above the value defined by the upper limit + 0.5 $^{\circ}$ hysteresis. The action is deactivated when the signal falls below the value defined by the lower limit - 0.5 $^{\circ}$ hysteresis.	0.00
	0.00100000.00	Hysteresis.	
32.12	Supervision 1 enable	Selects the source of the Supervision 1 enable signal.	Enabled
	Disabled	Supervision is disabled.	0
	Enabled	Supervision is enabled.	1
	DI1	Digital Input DI1 (10.02 DI delayed status, bit 0).	2
	DI2	Digital Input DI1 (10.02 DI delayed status, bit 0).	3
	DI3	Digital Input DI1 (10.02 DI delayed status, bit 0).	4
	DI4	Digital Input DI1 (10.02 DI delayed status, bit 0).	5
	DI5	Digital Input DI1 (10.02 DI delayed status, bit 0).	6
	DI6	Digital Input DI1 (10.02 DI delayed status, bit 0).	7

No.	Name/Value	Description	Def/FbEq16
	Abs both	Action is taken whenever absolute value of signal is above absolute value of 'Supervision High' limit + 0.5 * hysteresis or below absolute value of 'Supervision Low' limit - 0.5*hysteresis. Action is deactivated whenever absolute value of signal is in between absolute value of 'Supervision High' limit - 0.5 * hysteresis and absolute value of 'Supervision Low' limit + 0.5*hysteresis.	6
	Hysteresis	Action is taken whenever signal is above 'Supervision High' limit + 0.5 * hysteresis. Action is deactivated whenever signal is below 'Supervision Low' limit - 0.5 * hysteresis. The status is unchanged when signal value is in between 'Supervision High' limit + 0.5 * hysteresis and 'Supervision Low' limit - 0.5 * hysteresis.	7
	Low falling	Action taken whenever the signal falls from a value higher than 'Supervision low' limit + 0.5 * hysteresis to a value which is lower than 'Supervision low' limit - 0.5 * hysteresis.  Action is deactivated when the signal rises to higher than 'Supervision low' limit + 0.5*hysteresis.  Note: Supervision action is also deactivated for every motor start command.	8
	High rising	Action taken whenever the signal rises from a value lower than 'Supervision high' limit - 0.5 * hysteresis to a value which is higher than 'Supervision high' limit + 0.5 * hysteresis.  Action is deactivated when the signal falls to lower than 'Supervision high' limit - 0.5*hysteresis.  Note: Supervision action is also deactivated for every motor start command.	9
32.16	Supervision 2 action	Selects whether the drive generates a fault, warning or neither when the value monitored by signal supervision 2 exceeds its limits.  Note: This parameter does not affect the status indicated by 32.01 Supervision status.	No action
	No action	No warning or fault generated.	0
	Warning	Drive generates warning A8B1 ABB Signal supervision 2.	1
	Fault	Drive trips on fault 80B1 Signal supervision 2.	2
	Fault if running	If running, the drive trips on fault 80B1 Signal supervision 2.	3
32.17	Supervision 2 signal	Selects the signal to be monitored by signal supervision function 2. For the available selections, see parameter 32.07 Supervision 1 signal.	Current
32.18	Supervision 2 filter time	Defines a filter time constant for the signal monitored by signal supervision 2.	0.000 s
	0.000 30.000 s	Signal filter time.	1000 = 1 s
32.19	Supervision 2 low	Defines the lower limit for signal supervision 2.	0.00
	-21474836.00 21474836.00	Low limit.	
32.20	Supervision 2 high	Defines the upper limit for signal supervision 2.	0.00
	-21474836.00 21474836.00	Upper limit.	

No.	Name/Value	Description	Def/FbEq16
	Hysteresis	Action is taken whenever signal is above 'Supervision High' limit + 0.5 * hysteresis. Action is deactivated whenever signal is below 'Supervision Low' limit - 0.5 * hysteresis. The status is unchanged when signal value is in between 'Supervision High' limit + 0.5 * hysteresis and 'Supervision Low' limit - 0.5 * hysteresis.	7
	Low falling	Action taken whenever the signal falls from a value higher than 'Supervision low' limit + 0.5 * hysteresis to a value which is lower than 'Supervision low' limit - 0.5 * hysteresis.  Action is deactivated when the signal rises to higher than 'Supervision low' limit + 0.5*hysteresis.  Note: Supervision action is also deactivated for every motor start command.	8
	High rising	Action taken whenever the signal rises from a value lower than 'Supervision high' limit - 0.5 * hysteresis to a value which is higher than 'Supervision high' limit + 0.5 * hysteresis.  Action is deactivated when the signal falls to lower than 'Supervision high' limit - 0.5*hysteresis.  Note: Supervision action is also deactivated for every motor start command.	9
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	Drive generates warning A8B2 ABB Signal supervision 3.	1
	Fault	Drive trips on fault 80B2 Signal supervision 3.	2
	Fault if running	If running, the drive trips on fault 80B2 Signal supervision 3.	3
32.27	Supervision 3 signal	Selects the signal to be monitored by signal supervision function 3.  For the available selections, see parameter 32.07  Supervision 1 signal.	Torque
32.28	Supervision 3 filter time	Defines a filter time constant for the signal monitored by signal supervision 3.	0.000 s
	0.000 30.000 s	Signal filter time.	1000 = 1 s
32.29	Supervision 3 low	Defines the lower limit for signal supervision 3.	0.00
	-21474836.00 21474836.00	Low limit.	
32.30	Supervision 3 high	Defines the upper limit for signal supervision 3.	0.00
	-21474836.00 21474836.00	Upper limit.	
32.31	Supervision 3 hysteresis	Defines the hysteresis for the signal monitored by signal supervision 3. This parameter applies to all selections for parameter 32.25 Supervision 3 function, not just selection Hysteresis (7).  Action is taken whenever the signal rises above the value defined by the upper limit + 0.5 · hysteresis. The action is deactivated when the signal falls below the value defined by the lower limit - 0.5 · hysteresis.	0.00
	0.00100000.00	Hysteresis.	

No.

Name/Value

Description

Def/FbEa16

No.	Name/Value	Description	Def/FbEq16
	Low falling	Action taken whenever the signal falls from a value higher than 'Supervision low' limit + 0.5 * hysteresis to a value which is lower than 'Supervision low' limit - 0.5 * hysteresis.	8
		Action is deactivated when the signal rises to higher than 'Supervision low' limit + 0.5*hysteresis.  Note: Supervision action is also deactivated for every motor start command.	
	High rising	Action taken whenever the signal rises from a value lower than 'Supervision high' limit - 0.5 * hysteresis to a value which is higher than 'Supervision high' limit + 0.5 * hysteresis.  Action is deactivated when the signal falls to lower than 'Supervision high' limit - 0.5*hysteresis.  Note: Supervision action is also deactivated for every motor start command.	9
32.36	Supervision 4 action	Selects whether the drive generates a fault, warning or neither when the value monitored by signal supervision 4 exceeds its limits.  Note: This parameter does not affect the status indicated by 32.01 Supervision status.	No action
	No action	No warning or fault generated.	0
	Warning	Drive generates warning A8B3 ABB Signal supervision 4.	1
	Fault	Drive trips on fault 80B3 Signal supervision 4.	2
	Fault if running	If running, the drive trips on fault 80B3 Signal supervision 4.	3
32.37	Supervision 4 signal	Selects the signal to be monitored by signal supervision function 4.  For the available selections, see parameter 32.07  Supervision 1 signal.	Zero
32.38	Supervision 4 filter time	Defines a filter time constant for the signal monitored by signal supervision 4.	0.000 s
	0.000 30.000 s	Signal filter time.	1000 = 1 s
32.39	Supervision 4 low	Defines the lower limit for signal supervision 4.	0.00
	-21474836.00 21474836.00	Low limit.	
32.40	Supervision 4 high	Defines the upper limit for signal supervision 4.	0.00
	-21474836.00 21474836.00	Upper limit.	
32.41	Supervision 4 hysteresis	Defines the hysteresis for the signal monitored by signal supervision 4. This parameter applies to all selections for parameter 32.35 Supervision 4 function, not just selection Hysteresis (7).  Action is taken whenever the signal rises above the value defined by the upper limit + 0.5 · hysteresis. The action is deactivated when the signal falls below the value defined by the lower limit - 0.5 · hysteresis.	0.00
	0.00100000.00	Hysteresis.	
32.42	Supervision 4 enable	Selects the source of the Supervision 4 enable signal. See parameter 32.12 Supervision 1 enable.	Enabled
32.43	Supervision 4 ON delay	Defines the activation delay for Supervision 4. See parameter 32.13 Supervision 1 ON delay.	0.00 s
	0.00 3000.00 s	Supervision activation delay.	10 = 1 s

No.

32 44

32 45

Name/Value

delay

function

Disabled

LOW

Hiah

Abs low

Supervision 4 OFF

0.00 ... 3000.00 s

Supervision 5

Description

selected by 32.46.

Defines the deactivation delay for supervision 4

See parameter 32.14 Supervision 1 OFF delay.

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

Action is taken whenever signal is below 'Supervision low' limit - 0.5 \* hysteresis. Action is deactivated whenever signal is above 'Supervision low' limit + 0.5 \* hysteresis.

Action is taken whenever signal is above 'Supervision High'

Action is taken whenever absolute value of signal is below

absolute value of 'Supervision Low' limit - 0.5 \* hysteresis. Action is deactivated whenever absolute value of signal is

limit + 0.5 \* hysteresis. Action is deactivated whenever signal is below 'Supervision High' limit - 0.5 \* hysteresis.

Supervision deactivation delay.

Signal supervision 5 not in use.

Def/FbEa16

0.00 s

10 = 1 s

Disabled

0

2

3

No.	Name/Value	Description	Def/FbEq16
	High rising	Action taken whenever the signal rises from a value lower than 'Supervision high' limit - 0.5 * hysteresis to a value which is higher than 'Supervision high' limit + 0.5 * hysteresis.  Action is deactivated when the signal falls to lower than	9
		Supervision high limit - 0.5*hysteresis.  Note: Supervision action is also deactivated for every motor start command.	
32.46	Supervision 5 action	Selects whether the drive generates a fault, warning or neither when the value monitored by signal supervision 5 exceeds its limits.  Note: This parameter does not affect the status indicated by 32.01 Supervision status.	No action
	No action	No warning or fault generated.	0
	Warning	Drive generates warning A8B4 ABB Signal supervision 5.	1
	Fault	Drive trips on fault 80B4 Signal supervision 5.	2
	Fault if running	If running, the drive trips on fault 80B4 Signal supervision 5.	3
32.47	Supervision 5 signal	Selects the signal to be monitored by signal supervision function 5. For the available selections, see parameter 32.07 Supervision 1 signal.	Zero
32.48	Supervision 5 filter time	Defines a filter time constant for the signal monitored by signal supervision 5.	0.000 s
	0.000 30.000 s	Signal filter time.	1000 = 1 s
32.49	Supervision 5 low	Defines the lower limit for signal supervision 5.	0.00
	-21474836.00 21474836.00	Low limit.	
32.50	Supervision 5 high	Defines the upper limit for signal supervision 5.	0.00
	-21474836.00 21474836.00	Upper limit.	
32.51	Supervision 5 hysteresis	Defines the hysteresis for the signal monitored by signal supervision 5. This parameter applies to all selections for parameter 32.45 Supervision 5 function, not just selection Hysteresis (7).  Action is taken whenever the signal rises above the value defined by the upper limit + 0.5 · hysteresis. The action is deactivated when the signal falls below the value defined by the lower limit - 0.5 · hysteresis.	0.00
	0.00100000.00	Hysteresis.	
32.52	Supervision 5 enable	Selects the source of the Supervision 5 enable signal. See parameter 32.12 Supervision 1 enable.	Enabled
32.53	Supervision 5 ON delay	Defines the activation delay for Supervision 5. See parameter 32.13 Supervision 1 ON delay.	0.00 s
	0.00 3000.00 s	Supervision activation delay.	10 = 1 s
32.54	Supervision 5 OFF delay	Defines the deactivation delay for supervision 5. See parameter 32.14 Supervision 1 OFF delay.	0.00 s
	0.00 3000.00 s	Supervision deactivation delay.	10 = 1 s

No.

32 55

Name/Value

Supervision 6

function

Disabled

Low

High

Ahs low

Abs high

Description

hysteresis.

hysteresis

start command

selected by 32.56.

Signal supervision 6 not in use.

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

Action is taken whenever signal is below 'Supervision low' limit - 0.5 \* hysteresis. Action is deactivated whenever signal

Action is taken whenever signal is above 'Supervision High'

Action is taken whenever absolute value of signal is below

absolute value of 'Supervision Low' limit - 0.5 \* hysteresis. Action is deactivated whenever absolute value of signal is above absolute value of 'Supervision Low' limit + 0.5 \*

Action is taken whenever absolute value of signal is above

absolute value of 'Supervision High' limit + 0.5 \* hysteresis. Action is deactivated whenever absolute value of signal is below absolute value of 'Supervision High' limit - 0.5 \*

limit + 0.5 \* hysteresis. Action is deactivated whenever signal is below 'Supervision High' limit - 0.5 \* hysteresis.

is above 'Supervision low' limit + 0.5 \* hysteresis.

Def/FbEa16

Disabled

0

2

P 1	_
ы	иш
-	-

No.	Name/Value	Description	Def/FbEq16
32.56	Supervision 6 action	Selects whether the drive generates a fault, warning or neither when the value monitored by signal supervision 6 exceeds its limits. <b>Note:</b> This parameter does not affect the status indicated by	No action
		32.01 Supervision status.	
	No action	No warning or fault generated.	0
	Warning	Drive generates warning A8B5 ABB Signal supervision 6.	1
	Fault	Drive trips on fault 80B5 Signal supervision 6.	2
	Fault if running	If running, the drive trips on fault 80B5 Signal supervision 6.	3
32.57	Supervision 6 signal	Selects the signal to be monitored by signal supervision function 6. For the available selections, see parameter 32.07 Supervision 1 signal.	Zero
32.58	Supervision 6 filter time	Defines a filter time constant for the signal monitored by signal supervision 6.	0.000 s
	0.000 30.000 s	Signal filter time.	1000 = 1 s
32.59	Supervision 6 low	Defines the lower limit for signal supervision 6.	0.00
	-21474836.00 21474836.00	Low limit.	
32.60	Supervision 6 high	Defines the upper limit for signal supervision 6.	0.00
	-21474836.00 21474836.00	Upper limit.	
32.61	Supervision 6 hysteresis	Defines the hysteresis for the signal monitored by signal supervision 6. This parameter applies to all selections for parameter 32.55 Supervision 6 function, not just selection Hysteresis (7).  Action is taken whenever the signal rises above the value defined by the upper limit + 0.5 · hysteresis. The action is deactivated when the signal falls below the value defined by the lower limit - 0.5 · hysteresis.	0.00
	0.00100000.00	Hysteresis.	
32.62	Supervision 6 enable	Selects the source of the Supervision 6 enable signal. See parameter 32.12 Supervision 1 enable.	Enabled
32.63	Supervision 6 ON delay	Defines the activation delay for Supervision 6. See parameter 32.13 Supervision 1 ON delay.	0.00 s
	0.00 3000.00 s	Supervision activation delay.	10 = 1 s
32.64	Supervision 6 OFF delay	Defines the deactivation delay for supervision 6. See parameter 32.14 Supervision 1 OFF delay.	0.00 s
•	0.00 3000.00 s	Supervision deactivation delay.	10 = 1 s

1 = 1

0000h...FFFFh

Timer status.

No.	Name/V	alue	Description	Description					
34.04	Season/ day statu	exception us	holiday. Only o	ons 14, exception weekday and exception one season can be active at a time. A day can and a holiday at the same time.  r is read-only.	-				
	Bit	Name		Description					
	0	Season 1		1 = Active.					
	1	Season 2		1 = Active.					
	2	Season 3		1 = Active.					
	3	Season 4		1 = Active.					
	49	Reserved							
	10	Exception	workday	1 = Active.					
	11	Exception	holiday	1 = Active.					
	1215	Reserved							
	0000h	FFFFh	Status of the se	easons and exception weekday and holiday.	1 = 1				
34.10	Timed fu enable	ınctions	Selects the sou 0 = Disabled. 1 = Enabled.	Disabled					
	Disabled	I	0.		0				
	Enabled		1.		1				
	DI1 DI2 DI3		Digital input DI	Digital input DI1 (10.02 DI delayed status, bit 0).					
			Digital input DI	2 (10.02 DI delayed status, bit 1).	3				
			Digital input DI3 (10.02 DI delayed status, bit 2). 4						
	DI4		Digital input DI	5					
	DI5		Digital input DI	5 (10.02 DI delayed status, bit 4).	6				
	DI6		Digital input DI	6 (10.02 DI delayed status, bit 5).	7				

Source selection (see Terms and abbreviations on page 290).

Other [bit]

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

Bit	Name	Description
0	Monday	1 = Monday is an active start day.
1	Tuesday	1 = Tuesday is an active start day.
2	Wednesday	1 = Wednesday is an active start day.
3	Thursday	1 = Thursday is an active start day.
4	Friday	1 = Friday is an active start day.
5	Saturday	1 = Saturday is an active start day.
6	Sunday	1 = Sunday is an active start day.
7	Season 1	1 = Timer is active in season 1.
8	Season 2	1 = Timer is active in season 2.
9	Season 3	1 = Timer is active in season 3.
10	Season 4	1 = Timer is active in season 4.
11	Exceptions	0 = Exceptions days are disabled. The timer follows only weekday and season settings (bits 010 in the timer configuration) and the start time and duration of the timer (see 34.12 and 34.13).  Exception day settings, parameters 34.7034.90, do not have any effect on this timer.  1 = Exception days are enabled. The timer is active during the weekdays and seasons defined with bits 010 and the times defined by 34.12 and 34.13.  In addition, the timer is active during the exception days defined with bit 12, bit 13 and parameters 34.7034.90. If bit 12 and bit 13 are both zero, the timer is inactive during the exception days.
12	Holidays	This bit has no effect unless bit 11 = 1 (Exceptions days are enabled).  When bits 11 and 12 are both 1, the timer is active during the weekdays and seasons defined with bits 010 and times defined by parameters 34.12 and 34.13.  In addition, the timer is active when the ongoing day is defined as Exception day Holiday by parameters 34.7034.90 and the current time matches with the time range defined by 34.12 and 34.13. During Exception days, weekday and season bits are ignored.
13	Workdays	This bit has no effect unless bit 11 = 1 (Exceptions enabled). When bits 11 and 13 are both 1, the Timer is active during the weekdays and seasons defined with bits 010 and the times defined by parameters 34.12 and 34.13. In addition, the timer is active when the ongoing day is defined as Exception day Workday by parameters 34.7034.90 and the current time matches with the time range defined by 34.12 and 34.13. During Exception days, weekday and season bits are ignored.
1415	Reserved	

No.	Na	me	/Va	alue	е			De	sc	rip	tio	n				Def/FbEq16
	Ex	am	ple	s o	f ho	OW	the	tim	ner	COI	nfig	ura	itio	n d	efines when the Timer is active are showr	below.
		s o														
	34	. 11	Tii	nei	r 1	cor	nfig	ura	tior	7	1	1				
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Season1	Season2	Season3	Season4	Exceptions	Holidays	Workdays		
	1	1	1	1	1	1	1	1	1	1	1	0	0	0	Example 1: Timer is active during the tim defined by other parameters every Weeks Season.  Exception day settings (34.7034.90) do effect on the Timer.	day and every
	1	1	1	1	1	0	0	1	1	1	1	0	0	0	<b>Example 2:</b> Timer is active during the tim defined by other parameters from Mon to Season.  Exception day settings (34.7034.90) do effect on the Timer.	<u>Fri,</u> every
	1	1	1	1	1	0	0	0	0	1	0	0	0	0	<b>Example 3:</b> Timer is active during the tim defined by other parameters from Mon to during Season 3 (can be configured as, a Exception day settings (34.7034.90) do effect on the Timer.	Fri, <u>only</u> eg, summer).
	1	1	1	1	1	0	0	1	1	1	1	1	1	0	Example 4: Timer is active during the tim defined by other parameters from Mon to Season. In addition, the Timer is active every Excellibriates, regardless what is the day or se	Fri, every
	1	0	1	0	1	0	1	1	1	0	0	1	0	1	Example 5: Timer is active during the tim defined by other parameters on Mon, We Sun, during Season1 and Season 2. In addition, the Timer is active every Excu Workdays, regardless what is the day or	d, Fri and
	1	1	1	1	1	1	1	1	1	1	1	1	0	0	Example 6: Timer is active during the tim defined by other parameters every Weeks Season. The Timer is <u>inactive during all Exception</u>	day and every
	00	00h	١	FFI	FFh	1		Сс	onfi	gur	atio	on (	of t	ime	er 1.	1 = 1
34.12	Tin	ner	1 :	staı	rt tii	me		ch Th Fo	anç ne ti or e: e ac	ged ime xar ctiv	in erc npl e s	se an e, i	con be f th	id s sta e ti sta	nt time of timer 1. The time can be steps. In ted at an other time than the start time. In the dat an other time than one day and sarts during the time, the timer is started at when there is no duration left.	00:00:00
	00:00:0023:59:5 Daily start time of the tir								aily	sta	rt t	ime	of	the	e timer.	-

No.	Name/Value	Description	Def/FbEq16
34.41	Timer 11 configuration	See 34.11 Timer 1 configuration.	0000 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.	0000 0111 1000 0000b
34.45	Timer 12 start time	See 34.12 Timer 1 start time.	00:00:00
34.46	Timer 12 duration	See 34.13 Timer 1 duration.	00 00:00
34.60	Season 1 start date	Defines the start date of season 1 in format dd.mm, where dd is the number of the day and mm is the number of the month. The season changes at midnight. One season can be active at a time. Timers are started on exception days even if they are not inside the active season.  The season start dates (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.
	01.0131.12	Season start date.	-
34.61	Season 2 start date	Defines the start date of season 2. See 34.60 Season 1 start date.	01.01.
34.62	Season 3 start date	Defines the start date of season 3. See 34.60 Season 1 start date.	01.01.
34.63	Season 4 start date	Defines the start date of season 4. See 34.60 Season 1 start date.	01.01.
34.70	Number of active exceptions	Defines how many of the exceptions are active by specifying the last active one. All preceding exceptions are active. Exceptions 13 are periods (duration can be defined) and exceptions 416 are days (duration is always 24 hours). <b>Example:</b> If the value is 4, exceptions 14 are active, and exceptions 516 are not active.	3
	016	Number of active exception periods or days.	1 = 1

No.	Name/Value	Description	Def/FbEq16
34.83	Exception day 9	See 34.79 Exception day 4.	01.01
34.84	Exception day 10	See 34.79 Exception day 4.	01.01
34.85	Exception day 11	See 34.79 Exception day 4.	01.01
34.86	Exception day 12	See 34.79 Exception day 4.	01.01
34.87	Exception day 13	See 34.79 Exception day 4.	01.01
34.88	Exception day 14	See 34.79 Exception day 4.	01.01
34.89	Exception day 15	See 34.79 Exception day 4.	01.01
34.90	Exception day 16	See 34.79 Exception day 4.	01.01
34.100	Timed function 1	Defines which timers are connected to combined timer 1.  0 = Not connected.  1 = Connected.  See 34.01 Timed functions status.	0000 0000 0000ь

Bit	Name	Description
0	Timer 1	0 = Inactive. 1 = Active.
1	Timer 2	0 = Inactive. 1 = Active.
2	Timer 3	0 = Inactive. 1 = Active.
3	Timer 4	0 = Inactive. 1 = Active.
4	Timer 5	0 = Inactive. 1 = Active.
5	Timer 6	0 = Inactive. 1 = Active.
6	Timer 7	0 = Inactive. 1 = Active.
7	Timer 8	0 = Inactive. 1 = Active.
8	Timer 9	0 = Inactive. 1 = Active.
9	Timer 10	0 = Inactive. 1 = Active.
10	Timer 11	0 = Inactive. 1 = Active.
11	Timer 12	0 = Inactive. 1 = Active.
1215	Reserved	

	0000hFFFFh	Timers connected to combined timer 1.	1 = 1
34.101	Timed function 2	Defines which timers are connected to combined timer 2. See 34.01 Timed functions status.	0000 0000b
34.102	Timed function 3	Defines which timers are connected to combined timer 3. See 34.01 Timed functions status.	0000 0000b
34.110	Boost time function	Defines which combined timers (that is, timers that are connected to the combined timers) are activated with the extra time function.	0000 0000 0000 0000b

Bit	Name	Description
0	Timed function 1	0 = Inactive. 1 = Active.
1	Timed function 2	0 = Inactive. 1 = Active.
2	Timed function 3	0 = Inactive. 1 = Active.
315	Reserved	•

0000hFFFFh	Combined timers including the extra timer.	1 = 1

No.	Name/Value	Description	Def/FbEq16
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.  Notes:  With a PTC sensor, the value shown is not a valid measurement. Either 0 ohm (normal temperature) or the value of parameter 35.12 Temperature 1 fault limit (excessive temperature) is shown.  With a PTC sensor connected to DI6, the unit is ohms.  If the measured temperature source selection (35.11) is PTC analog I/O, the motor thermal protection function converts the analog input signal (35.14) to PTC resistance value (ohms) and shows it in this parameter. This is the case even if the parameter name and unit refer to motor temperature (°C or F). You cannot change the unit to ohm for the time being (96.16).  This parameter is read-only.	-
	-605000 °C or -769032 °F, or 05000 ohm or [35.12] ohm or [35.14] ohm	Measured temperature 2.	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.  Notes:  With a PTC sensor, the value shown is not a valid measurement. Either 0 ohm (normal temperature) or the value of parameter 35.22 Temperature 2 fault limit (excessive temperature) is shown.  With a PTC sensor connected to DI6, the unit is ohms.  If the measured temperature source selection (35.21) is PTC analog I/O, the motor thermal protection function converts the analog input signal (35.24) to PTC resistance value (ohms) and shows it in this parameter. This is the case even if the parameter name and unit refer to motor temperature (°C or F). You cannot change the unit to ohm for the time being (96.16).	-
	-605000 °C or -769032 °F or 05000 ohm or [35.22] ohm or [35.24] ohm	Measured temperature 2.	1 = 1 unit
35.05	Motor overload level	Motor overload level as a percent of the motor overload fault limit. See section <i>Motor overload protection</i> (page 207). This parameter is read-only.	0.0%
	0.0300.0%	Motor overload level.  0.0% No motor overloading  88.0% Motor overloaded to warning level  100.0% Motor overloaded to fault level.	-

Name/Value

source

Temperature 1

Description

Def/FbEq16

temperature

Estimated

No.

35.11

	controlled by the drive, but it could be used to measure and monitor a temperature from other parts of the process as long as a suitable sensor is used as per the selection list.	
Disabled	None. Temperature monitoring function 1 is disabled.	0
Estimated temperature	Estimated motor temperature (see parameter 35.01 Motor estimated temperature).  The temperature is estimated from an internal drive calculation. It is important to set up the ambient temperature of the motor in 35.50 Motor ambient temperature.	1
KTY84 analog I/O	KTY84 sensor connected to the analog input selected by parameter 35.14 Temperature 1 AI source and an analog output.  The following settings are required:  Set the appropriate analog input unit selection parameter in group 12 Standard AI to V (volt).  In parameter group 13 Standard AO, set the source selection parameter of the analog output to Temp sensor 1 excitation.  The analog output feeds a constant current through the sensor. As the resistance of the sensor increases along with its temperature, the voltage over the sensor increases. The voltage is read by the analog input and converted into degrees.	2
Reserved		34
1 × Pt100 analog I/O	Pt100 sensor connected to a standard analog input selected by parameter 35.14 Temperature 1 AI source and an analog output.  The following settings are required:  Set the appropriate analog input unit selection parameter in group 12 Standard AI to V (volt).  In parameter group 13 Standard AO, set the source selection parameter of the analog output to Temp sensor 1 excitation.  The analog output feeds a constant current through the sensor. As the resistance of the sensor increases along with its temperature, the voltage over the sensor increases. The voltage is read by the analog input and converted into degrees.	5
2 × Pt100 analog I/O	As selection 1 × Pt100 analog I/O, but with two sensors connected in series. Using multiple sensors improves measurement accuracy significantly.	6
3 × Pt100 analog I/O	As selection 1 × Pt100 analog I/O, but with three sensors connected in series. Using multiple sensors improves measurement accuracy significantly.	7
PTC DI6	PTC sensor is connected to DI6.  Note: With a PTC sensor, the value shown is not a valid measurement. Either 0 ohm (normal temperature) or the value of parameter 35.13 Temperature 1 warning limit (excessive temperature) will be shown by parameter 35.02 Measured temperature 1. If the user wants a fault to be triggered, the value of parameter 35.12 Temperature 1 fault limit has to be set below or equal to the warning limit.	8

Selects the source from which measured temperature 1 is

Usually this source is from a sensor connected to the motor

No.	Name/Value	Description	Def/FbEq16
	Reserved		910
	Direct temperature	The temperature is taken from the source selected by parameter 35.14. The value of the source is assumed to be in the unit of temperature specified by 96.16.	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 appropriate analog input unit selection parameter in group 12 Standard AI to V (volt).  In parameter group 13 Standard AO, set the source selection parameter of the analog output to Temp sensor 1 excitation.  The analog output feeds a constant current through the sensor. As the resistance of the sensor increases along with its temperature, the voltage over the sensor increases. The voltage is read by the analog input and converted into degrees.	12
	1 × Pt1000 analog I/O	Pt1000 sensor connected to a standard analog input selected by parameter 35.14 Temperature 1 AI source and an analog output.  The following settings are required:  Set the appropriate analog input unit selection parameter in group 12 Standard AI to V (volt).  In parameter group 13 Standard AO, set the source selection parameter of the analog output to Temp sensor 1 excitation.  The analog output feeds a constant current through the sensor. As the resistance of the sensor increases along with its temperature, the voltage over the sensor increases. The voltage is read by the analog input and converted into degrees.	13
	2 × Pt1000 analog I/O	As selection 1 × Pt1000 analog I/O, but with two sensors connected in series. Using multiple sensors improves measurement accuracy significantly.	14
	3 × Pt1000 analog I/O	As selection 1 × Pt1000 analog I/O, but with three sensors connected in series. Using multiple sensors improves measurement accuracy significantly.	15
	Ni1000	Ni1000 sensor connected to the analog input selected by parameter 35.14 Temperature 1 AI source and an analog output.  The following settings are required:  Set the appropriate analog input unit selection parameter in group 12 Standard AI to V (volt).  In parameter group 13 Standard AO, set the source selection parameter of the analog output to Temp sensor 1 excitation.  The analog output feeds a constant current through the sensor. As the resistance of the sensor increases along with its temperature, the voltage over the sensor increases. The voltage is read by the analog input and converted into degrees.	16
	Reserved		1718

No.

Name/Value

module

PTC extension

Description

PTC is connected to the CMOD-02 multifunction extension.

module, which is installed in drive slot 2. See chapter

Def/FbEa16

4	и
Ш	Ш
	ш

Specifies the analog input when the setting of 35.11   Temperature 1 Source requires measurement through an analog input.   Note: If parameter 35.11 Temperature 1 source is set to Direct temperature, use selection Other here, and point to 12.12 A11 scaled value.   O	No.	Name/Value	Description	Def/FbEq16
Al1 actual value Analog input Al1 on the control unit.  Al2 actual value Analog input Al2 on the control unit.  Al3 actual value Analog input Al3 on the control unit.  Al4 actual value Analog input Al4 on the control unit.  Al5 actual value Analog input Al5 on the control unit.  Al5 actual value Analog input Al5 on the control unit.  5  Other Source selection (see Terms and abbreviations on page 290)  35.21 Temperature 2 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 None. Temperature monitoring function 2 is disabled.  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.  KTY84 analog I/O KTY84 sensor connected to the analog input selected by parameter 35.24 Temperature 2 Al source and an analog output.  The following settings are required:  Set the appropriate analog input unit selection parameter in group 12 Standard Al to V (vott).  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	35.14	•	Temperature 1 source requires measurement through an analog input.  Note: If parameter 35.11 Temperature 1 source is set to Direct temperature, use selection Other here, and point to	Not selected
Al2 actual value Analog input Al2 on the control unit.  Al3 actual value Analog input Al3 on the control unit.  Al4 actual value Analog input Al4 on the control unit.  Al5 actual value Analog input Al5 on the control unit.  5  Other Source selection (see Terms and abbreviations on page 290).  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 None. Temperature monitoring function 2 is disabled.  Estimated 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.  KTY84 analog I/O  KTY84 sensor connected to the analog input selected by parameter 35.24 Temperature 2 Al source and an analog output. The following settings are required: Set the appropriate analog input unit selection parameter in group 12 Standard Al to V (volt).  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		Not selected	None.	0
Al3 actual value Analog input Al3 on the control unit.  Al4 actual value Analog input Al4 on the control unit.  Al5 actual value Analog input Al5 on the control unit.  Other Source selection (see Terms and abbreviations on page 290).  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 None. Temperature monitoring function 2 is disabled.  Estimated temperature.  Estimated from an internal drive calculation. It is important to set up the ambient temperature of the motor in 35.50 Motor ambient temperature.  KTY84 analog I/O  KTY84 sensor connected to the analog input selected by parameter 35.24 Temperature 2 Al source and an analog output. The following settings are required:  Set the appropriate analog input unit selection parameter in group 12 Standard Al to V (volt).  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		Al1 actual value	Analog input Al1 on the control unit.	1
Al4 actual value Analog input Al4 on the control unit.  Al5 actual value Analog input Al5 on the control unit.  5  Other Source selection (see Terms and abbreviations on page 290).  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 None. Temperature monitoring function 2 is disabled.  Estimated temperature  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.  KTY84 analog I/O  KTY84 sensor connected to the analog input selected by parameter 35.24 Temperature 2 Al source and an analog output. The following settings are required: Set the appropriate analog input unit selection parameter in group 12 Standard Al to V (volt). 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		Al2 actual value	Analog input Al2 on the control unit.	2
Al5 actual value  Analog input Al5 on the control unit.  5  Other  Source selection (see Terms and abbreviations on page 290).  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  None. Temperature monitoring function 2 is disabled.  Estimated temperature.  Estimated 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.  KTY84 analog I/O  KTY84 sensor connected to the analog input selected by parameter 35.24 Temperature 2 Al source and an analog output.  The following settings are required:  Set the appropriate analog input unit selection parameter in group 12 Standard Al to V (volt).  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		Al3 actual value	Analog input Al3 on the control unit.	3
Source selection (see Terms and abbreviations on page 290)   35.21   Temperature 2   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   None. Temperature monitoring function 2 is disabled.   Disabled   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.   KTY84 sensor connected to the analog input selected by parameter 35.24 Temperature 2 Al source and an analog output.   The following settings are required:		Al4 actual value	Analog input Al4 on the control unit.	4
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 None. Temperature monitoring function 2 is disabled.  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.  KTY84 analog I/O  KTY84 sensor connected to the analog input selected by parameter 35.24 Temperature 2 AI source and an analog output.  The following settings are required:  Set the appropriate analog input unit selection parameter in group 12 Standard AI to V (volt).  In parameter group 13 Standard AO, set the source selection parameter of the analog output to Temp sensor 2 excitation.  The analog output feeds a constant current through the sensor. As the resistance of the sensor increases along with its temperature, the voltage over the sensor increases. The voltage is read by the analog input and converted into		Al5 actual value	Analog input Al5 on the control unit.	5
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  None. Temperature monitoring function 2 is disabled.  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.  KTY84 sensor connected to the analog input selected by parameter 35.24 Temperature 2 AI source and an analog output.  The following settings are required:  Set the appropriate analog input unit selection parameter in group 12 Standard AI to V (volt).  In parameter group 13 Standard AO, set the source selection parameter of the analog output to Temp sensor 2 excitation.  The analog output feeds a constant current through the sensor. As the resistance of the sensor increases along with its temperature, the voltage over the sensor increases. The voltage is read by the analog input and converted into		Other	Source selection (see <i>Terms and abbreviations</i> on page 290).	
Estimated 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.  KTY84 analog I/O  KTY84 sensor connected to the analog input selected by parameter 35.24 Temperature 2 AI source and an analog output.  The following settings are required:  • Set the appropriate analog input unit selection parameter in group 12 Standard AI to V (volt).  • In parameter group 13 Standard AO, set the source selection parameter of the analog output to Temp sensor 2 excitation.  The analog output feeds a constant current through the sensor. As the resistance of the sensor increases along with its temperature, the voltage over the sensor increases. The voltage is read by the analog input and converted into	35.21	•	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	
temperature  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.  KTY84 analog I/O  KTY84 sensor connected to the analog input selected by parameter 35.24 Temperature 2 AI source and an analog output.  The following settings are required:  • Set the appropriate analog input unit selection parameter in group 12 Standard AI to V (volt).  • In parameter group 13 Standard AO, set the source selection parameter of the analog output to Temp sensor 2 excitation.  The analog output feeds a constant current through the sensor. As the resistance of the sensor increases along with its temperature, the voltage over the sensor increases. The voltage is read by the analog input and converted into		Disabled	None. Temperature monitoring function 2 is disabled.	0
parameter 35.24 Temperature 2 Al source and an analog output.  The following settings are required:  • Set the appropriate analog input unit selection parameter in group 12 Standard Al to V (volt).  • 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			estimated temperature). The temperature is estimated from an internal drive calculation. It is important to set up the ambient temperature	1
3		KTY84 analog I/O	parameter 35.24 Temperature 2 AI source and an analog output.  The following settings are required:  Set the appropriate analog input unit selection parameter in group 12 Standard AI to V (volt).  In parameter group 13 Standard AO, set the source selection parameter of the analog output to Temp sensor 2 excitation.  The analog output feeds a constant current through the sensor. As the resistance of the sensor increases along with its temperature, the voltage over the sensor increases. The voltage is read by the analog input and converted into	2
Reserved 34		Reserved		34

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 appropriate analog input unit selection parameter in group 12 Standard AI to V (volt).  • In parameter group 13 Standard AO, set the source selection parameter of the analog output to Temp sensor 2 excitation.  The analog output feeds a constant current through the sensor. As the resistance of the sensor increases along with its temperature, the voltage over the sensor increases. The voltage is read by the analog input and converted into degrees.	5
	2 × Pt100 analog I/O	As selection 1 × Pt100 analog I/O, but with two sensors connected in series. Using multiple sensors improves measurement accuracy significantly.	6
	3 × Pt100 analog I/O	As selection 1 × Pt100 analog I/O, but with three sensors connected in series. Using multiple sensors improves measurement accuracy significantly.	7
	PTC DI6	PTC sensor is connected to DI6.  Note: With a PTC sensor, the value shown is not a valid measurement. Either 0 ohm (normal temperature) or the value of parameter 35.22 Temperature 2 fault limit (excessive temperature) is shown.	8
	Reserved		910
	Direct temperature	The temperature is taken from the source selected by parameter 35.24. The value of the source is assumed to be in the unit of temperature specified by 96.16.	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 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 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 appropriate analog input unit selection parameter in group 12 Standard AI to V (volt).  In parameter group 13 Standard AO, set the source selection parameter of the analog output to Temp sensor 2 excitation.  The analog output feeds a constant current through the sensor. As the resistance of the sensor increases along with its temperature, the voltage over the sensor increases. The voltage is read by the analog input and converted into degrees.	16
	Reserved		1718
	PTC 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
	PTC analog I/O	PTC sensor connected to the analog input selected by parameter 35.24 and an analog output.  The required settings are the same as with selection KTY84 analog I/O. If a PTC sensor is used, the voltage ready by the analog input is converted into ohms.  Note: With this selection, the control program converts the analog signal to PTC resistance value in ohms and shows it in parameter 35.03. The parameter name and unit still refer to temperature.	20
	Therm(0)	PTC sensor or a normally closed thermistor relay connected to digital input DI6. The motor is overheated when the digital input is 0.	21
	Therm(1)	Normally open thermistor relay connected to digital input DI6. The motor is overheated when the digital input is 1.	22

No.	Name/Value	Description	Def/FbEq16
35.50	Motor ambient temperature	Defines the ambient temperature of the motor for the motor thermal protection model. The unit is selected by parameter 96.16 Unit selection.	20 °C or 68 °F
		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.	
	-60100 °C or -76 212 °F	Ambient temperature.	1 = 1 unit
35.51	Motor load curve	Defines the maximum thermal load of the motor. If the load is above the curve, the motor can be overheated.  The load curve is used by the motor thermal protection model to estimate the motor temperature.  When the parameter is set to 100%, the maximum load is taken as the value of parameter 99.06 Motor nominal current (higher loads heat up the motor). The load curve level should be adjusted if the ambient temperature differs from the nominal value set in 35.50 Motor ambient temperature.	110%
	// <sub>N</sub> (%)	<ul><li>I = Motor current</li><li>I<sub>N</sub> = Nominal motor current</li></ul>	
	150 —	05.54	
	100 50 - 35.52	35.51	
		35.53 Drive outp	
	50150%	Maximum load for the motor load curve.	1 = 1%
35.52	Zero speed load	Defines the motor load curve together with parameters 35.51 Motor load curve and 35.53 Break point. Defines the maximum motor load at zero speed of the load curve. A higher value can be used if the motor has an external motor fan to boost the cooling. See the motor manufacturer's recommendations.  See parameter 35.51 Motor load curve.	70%
	25150%	Zero speed load for the motor load curve.	1 = 1%

No.	Name/Value	Description	Def/FbEq16
35.55	Motor thermal time constant	Defines the thermal time constant for use with the motor thermal protection model, defined as the time to reach 63% of the nominal motor temperature. See the motor manufacturer's recommendations.  For thermal protection according to UL requirements for NEMA class motors, use the rule of thumb: Motor thermal time equals 35 times t6, where t6 (in seconds) is specified by the motor manufacturer as the time that the motor can safely operate at six time its rated current.  Motor current	256 s
		Temperature rise	
		Motor thermal time Time	
	10010000 s	Motor thermal time constant.	1 = 1 s
35.56	Motor overload action	Selects the action taken when the system detects the motor overload specified by parameter 35.57.  See section <i>Motor overload protection</i> (page 207).	Warning and fault
	No action	No action taken.	0
	Warning only	Drive generates warning <i>A783 Motor overload</i> when the motor is overloaded to the warning level, that is, parameter <i>35.05 Motor overload level</i> reaches value 88.0%.	1
	Warning and fault	Drive generates warning <i>A783 Motor overload</i> when the motor is overloaded to the warning level, that is, parameter 35.05 Motor overload level reaches value 88.0%.  Drive trips on fault 7122 Motor overload when the motor is overloaded to the fault level, that is, parameter 35.05 Motor overload level reaches value 100.0%.	2
35.57	Motor overload class	Defines the motor overload class to be used. The class of protection is specified by the user as the time for tripping at 7.2 times (IEC 60947-4-1) or 6 times (NEMA ICS) the tripping level current.  See section <i>Motor overload protection</i> (page 207).	Class 20
	Class 5	Motor overload class 5.	0
	Class 10	Motor overload class 10.	1
	Class 20	Motor overload class 20.	2

36 Load analyzer		Peak value and amplitude logger settings. See also section <i>Load analyzer</i> (page 225).	
36.01	PVL signal source	Selects the signal to be monitored by the peak value logger. The signal is filtered using the filtering time specified by parameter 36.02 PVL filter time.  The peak value is stored, along with other pre-selected signals at the time, into parameters 36.1036.15.  The peak value logger can be reset using parameter 36.09 Reset loggers. The logger is also reset whenever the signal source is changed. The date and time of the last reset are stored into parameters 36.16 and 36.17 respectively.	Motor current
	Not selected	None (peak value logger disabled).	0
	Motor speed used	01.01 Motor speed used (page 293).	1
	Reserved		2
	Output frequency	01.06 Output frequency (page 293).	3
	Motor current	01.07 Motor current (page 293).	4
	Reserved		5
	Motor torque	01.10 Motor torque (page 293).	6
	DC voltage	01.11 DC voltage (page 293).	7
	Output power	01.14 Output power (page 294).	8
	Reserved		9
	Speed ref ramp in	23.01 Speed ref ramp input (page 390).	10
	Speed ref ramp out	23.02 Speed ref ramp output (page 390).	11
	Speed ref used	24.01 Used speed reference (page 392).	12
	Reserved		13
	Freq ref used	28.02 Frequency ref ramp output (page 397).	14
	Reserved		15
	Process PID out	40.01 Process PID output actual (page 462).	16
	Other	Source selection (see <i>Terms and abbreviations</i> on page 290).	-
36.02	PVL filter time	Peak value logger filtering time. See parameter 36.01 PVL signal source.	2.00 s
	0.00120.00 s	Peak value logger filtering time.	100 = 1 s
36.06	AL2 signal source	Selects the signal to be monitored by amplitude logger 2. The signal is sampled at 200 ms intervals.  The results are displayed by parameters 36.4036.49. Each parameter represents an amplitude range, and shows what portion of the samples fall within that range.  The signal value corresponding to 100% is defined by parameter 36.07 AL2 signal scaling.  Amplitude logger 2 can be reset using parameter 36.09 Reset loggers. The logger is also reset whenever the signal source or scaling is changed. The date and time of the last reset are stored into parameters 36.50 and 36.51 respectively.  For the selections, see parameter 36.01 PVL signal source.	Output power

No.	Name/Value	Description	Def/FbEq16
36.07	AL2 signal scaling	Defines the signal value that corresponds to 100% amplitude.	100.00
	0.0032767.00	Signal value corresponding to 100%.	1 = 1
36.09	Reset loggers	Resets the peak value logger and/or amplitude logger 2. (Amplitude logger 1 cannot be reset.)	Done
	Done	Reset completed or not requested (normal operation).	0
	All	Reset both the peak value logger and amplitude logger 2.	1
	PVL	Reset the peak value logger.	2
	AL2	Reset amplitude logger 2.	3
36.10	PVL peak value	Peak value recorded by the peak value logger.	0.00
	-32768.00 32767.00	Peak value.	1 = 1
36.11	PVL peak date	The date on which the peak value was recorded.	01.01.1980
	-	Peak occurrence date.	-
36.12	PVL peak time	The time at which the peak value was recorded.	00:00:05
	-	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.	00:00:05
	-	Last reset time of the peak value logger.	
36.20	AL1 0 to 10%	Percentage of samples recorded by amplitude logger 1 that fall between 0 and 10%. 100% corresponds to the $I_{\rm max}$ value given in the ratings table in chapter Technical data in the Hardware manual of the drive.	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%

No.	Name/	Value	Description	Def/FbEq16		
36.49	.49 AL2 over 90%		Percentage of samples recorded by amplitude logger 2 that exceed 90%.		0.00%	
	0.00100.00%		Amplitude logg	er 2 samples over 90%.	1 = 1%	
36.50	AL2 reset date The d		The date on wh	hich amplitude logger 2 was last reset.	01.01.1980	
	-		Last reset date	of amplitude logger 2.		
36.51	AL2 res	set time	The time at wh	ich amplitude logger 2 was last reset.	00:00:05	
	-		Last reset time	Last reset time of amplitude logger 2.		
37 Us	er load	curve	Settings for use See also section	er load curve. on <i>User load curve</i> (page <i>230</i> ).		
37.01	ULC output status word		Displays the status of the monitored signal. The status is shown only while the drive is running. (The status word is independent of the actions and delays selected by parameters 37.03, 37.04, 37.41 and 37.42.)  This parameter is read-only.		-	
	Bit	Name		Description		
	0	Under load	l limit	1 = Signal lower than the underload curve.		
	1	Within load	l range	1 = Signal between the underload and overload curve.		
	2	Overload I		1 = Signal higher than the overload curve.		
	3 Outside load limit		ad limit	1 = Signal lower than the underload curve or higher than the overload curve.		
	415	415 Reserved				
	0000hFFFFh		Status of the monitored signal.		1 = 1	
37.02	ULC supervision signal		Selects the signal to be monitored. The function compares the absolute value of the signal against the load curve.		Motor torque %	
	Not selected		No signal selected (monitoring disabled).		0	
	Motor speed %		01.03 Motor speed % (page 293).		1	
	Motor current %		01.08 Motor current % of motor nom (page 293).		2	
	Motor torque %		01.10 Motor torque (page 293).		3	
	Output power % of motor nominal		01.15 Output power % of motor nom (page 294).		4	
	Other		Source selection (see <i>Terms and abbreviations</i> on page 290).		-	
37.03	ULC overload actions		Selects how the drive reacts if the absolute value of the monitored signal stays continuously above the overload curve for longer than the value of 37.41 ULC overload timer.		Disabled	
	Disabled		No action taken.		0	
	Warning		Drive generates warning A8BE ULC overload warning.		1	
	Fault		Drive trips on fault 8002 ULC overload fault.		2	
	Warning/Fault		Drive generates warning A8BE ULC overload warning if the signal stays continuously above the overload curve for half of the time defined by parameter 37.41 ULC overload timer.  Drive trips on fault 8002 ULC overload fault if the signal stays continuously above the overload curve for a time defined by parameter 37.41 ULC overload timer.		3	

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

No. Name/Value		Description	Def/FbEq16	
40.04	Process PID deviation actual  Displays the process PID deviation. By default, this value equals setpoint - feedback, but deviation can be inverted by parameter 40.31 Set 1 deviation inversion. See control chain diagram Process PID controller on page 376.  This parameter is read-only. See parameter 40.79 Set 1 units for information about the units used.			
	-200000.00 200000.00 PID unit 1	PID deviation.	1 = 1 PID unit 1	
40.06	06 Process PID status word Displays status information on process PID control. This parameter is read-only.		-	

Bit	Name	Value		
0	PID active	1 = Process PID control active.		
1	Setpoint frozen	1 = Process PID setpoint frozen.		
2	Output frozen	1 = Process PID controller output frozen.		
3	PID sleep mode	1 = Sleep mode active.		
4	Sleep boost	1 = Sleep boost active.		
5	Reserved			
6	Tracking mode	1 = Tracking function active.		
7	Output limit high	1 = PID output is being limited by par. 40.37.		
8	Output limit low	1 = PID output is being limited by par. 40.36.		
9	Deadband active 1 = Feedback value is in the deadband range (40.39).			
10	PID set	0 = Parameter set 1 in use. 1 = Parameter set 2 in use.		
11	Reserved			
12	Internal setpoint active	1 = Internal setpoint active (see par. 40.1640.23).		
1315	Reserved			

0000hFFFFh		Process PID control status word.	1 = 1	
40.07	Process PID operation mode	Activates/deactivates process PID control.  Note: Process PID control is only available in external control; see section Local control vs. external control (page 107).	Off	
	Off	Process PID control inactive.	0	
	On	Process PID control active.	1	
On when drive running		Process PID control is active when the drive is running.	2	
40.08	Set 1 feedback 1 source	Selects the primary source of process feedback. See control chain diagram <i>PID setpoint compensation</i> on page 374.	AI2 scaled	
	Not selected	Not selected None.		
	Al1 scaled	12.12 Al1 scaled value (see page 327).	1	
	Al2 scaled	12.22 Al2 scaled value (see page 329).	2	
	Freq in scaled	11.39 Freq in 1 scaled value (see page 324).	3	
	Reserved		47	
	Al1 percent	12.101 Al1 percent value (see page 330).	8	
	Al2 percent	12.102 Al2 percent value (see page 330).	9	

No.	Name/Value	Description	Def/FbEq16	
40.14	Set 1 setpoint scaling	Defines, together with parameter 40.15 Set 1 output scaling, a general scaling factor for the process PID control chain. If the parameter is set to zero, automatic setpoint scaling is activated, where suitable setpoint scale is calculated according to selected setpoint source. Actual setpoint scale is shown in parameter 40.61 Setpoint scaling actual.  The scaling can be utilized when, for example, the process setpoint is input in Hz, and the output of the PID controller is used as an rpm value in speed control. In this case, this parameter might be set to 50, and parameter 40.15 to the nominal motor speed at 50 Hz.  In effect, the output of the PID controller = [40.15] when deviation (setpoint - feedback) = [40.14] and [40.32] = 1.  Note: The scaling is based on the ratio between 40.14 and 40.15. For example, the values 50 and 1500 would produce the same scaling as 1 and 30.	0.00	
	-200000.00 200000.00	Process setpoint base.	1 = 1	
40.15	Set 1 output scaling	See parameter 40.14 Set 1 setpoint scaling.  If the parameter is set to zero, scaling is automatic:  Operation mode (see par. 19.01)  Scaling	0.00	
		Speed control 46.01 Speed scaling Frequency control 46.02 Frequency scaling		
	-200000.00 200000.00	Process PID controller output base.	1 = 1	
40.16	Set 1 setpoint 1 source	Selects the primary source of process PID setpoint. See the control chain diagram on page 374.	Internal setpoint	
	Not selected	None.	0	
	Reserved		1	
	Internal setpoint	Internal setpoint. See parameter 40.19 Set 1 internal setpoint sel1.	2	
	Al1 scaled	12.12 Al1 scaled value (see page 327).	3	
	Al2 scaled	12.22 Al2 scaled value (see page 329).	4	
	Reserved		57	
	Motor potentiometer	22.80 Motor potentiometer ref act (output of the Motor potentiometer).	8	
	Reserved		9	
	Freq in scaled	11.39 Freq in 1 scaled value (see page 324).	10	
	Al1 percent	12.101 Al1 percent value (see page 330)	11	
	Al2 percent	12.102 Al2 percent value (see page 330)	12	

No.	Name/Value	Description			Def/FbEq16	
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.  The result of the function (for any selection) is multiplied by			In1	
			Set 1 setpoint multi	<i>plier</i> . (That is why in		
	In1	Source 1.	0			
	ln1+ln2	Sum of sources 1	and 2.		1	
	ln1-ln2	Source 2 subtracte	2			
	ln1*ln2	Source 1 multiplie	3			
	ln1/ln2	Source 1 divided b	4			
	MIN(In1,In2)	Smaller of the two	5			
	MAX(In1,In2)	Greater of the two	6			
	AVE(In1,In2)	Average of the two	sources.		7	
	sqrt(In1)	Square root of sou	irce 1.		8	
	sqrt(In1-In2)	Square root of (so	9			
	sqrt(In1+In2)	Square root of (so	10			
	sqrt(ln1)+sqrt(ln2)	Square root of sou	11			
40.19	Set 1 internal setpoint sel1	Selects together winternal setpoint o 40.2140.24.  Note: Parameters Set 1 setpoint 2 so	Selected			
		Source defined by par. 40.19	Source defined by par. 40.20	Setpoint preset active		
		0	0	0 (par. <b>40.24</b> )		
		1	0	1 (par. 40.21)		
		0	1	2 (par. <b>40.22</b> )		
		1	1	3 (par. <b>40.23</b> )		
	Not selected	0.	0			
	Selected	1.	1			
	DI1	Digital input DI1 (1	0.02 DI delayed s	tatus, bit 0).	2	
	DI2	Digital input DI2 (1	0.02 DI delayed s	tatus, bit 1).	3	
	DI3	Digital input DI3 (1	Digital input DI3 (10.02 DI delayed status, bit 2).			
	DI4	Digital input DI4 (1	5			
	DI5	Digital input DI5 (1	6			
	DI6	Digital input DI6 (1	7			
	Reserved		817			
	Timed function 1	Bit 0 of 34.01 Time	18			
	Timed function 2	Bit 1 of 34.01 Time	19			
	Timed function 3	Bit 2 of 34.01 Time	20			
	Supervision 1	Bit 0 of 32.01 Sup	21			
	Supervision 2	Bit 1 of 32.01 Sup	22			

No.	Name/Value	Description	Def/FbEq16
40.27	Set 1 setpoint max	Defines a maximum limit for the process PID controller setpoint.	5.00 PID unit 1
	-200000.00 200000.00 set 1 units	Maximum limit for process PID controller setpoint.	1 = 1 set 1 unit
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
	0.032767.0 s	Setpoint increase time.	1 = 1 s
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
	0.032767.0 s	Setpoint decrease time.	1 = 1 s
40.30	Set 1 setpoint freeze enable	Freezes, or defines a source that can be used to freeze, the setpoint of the process PID controller. This feature is useful when the reference is based on a process feedback connected to an analog input, and the sensor must be serviced without stopping the process.  1 = Process PID controller setpoint frozen See also parameter 40.38 Set 1 output freeze enable.	Not selected
	Not selected	Process PID controller setpoint not frozen.	0
	Selected	Process PID controller setpoint frozen.	1
	DI1	Digital input DI1 (10.02 DI delayed status, bit 0).	2
	DI2	Digital input DI2 (10.02 DI delayed status, bit 1).	3
	DI3	Digital input DI3 (10.02 DI delayed status, bit 2).	4
	DI4	Digital input DI4 (10.02 DI delayed status, bit 3).	5
	DI5	Digital input DI5 (10.02 DI delayed status, bit 4).	6
	DI6	Digital input DI6 (10.02 DI delayed status, bit 5).	7
	Reserved		817
	Timed function 1	Bit 0 of 34.01 Timed functions status (see page 436).	18
	Timed function 2	Bit 1 of 34.01 Timed functions status (see page 436).	19
	Timed function 3	Bit 2 of 34.01 Timed functions status (see page 436).	20
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 423).	21
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 423).	22
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 423).	23
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 290).	-
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 167).	Not inverted (Ref - Fbk)
	Not inverted (Ref - Fbk)	0.	0
	Inverted (Fbk - Ref)	1.	1
	Other [bit]	Source selection (see Terms and abbreviations on page 290).	-
40.32	Set 1 gain	Defines the gain for the process PID controller. See parameter 40.33 Set 1 integration time.	1.00
	0.01100.00	Gain for PID controller.	100 = 1

No.	Name/Value	Description	Def/FbEq16
	Timed function 1	Bit 0 of 34.01 Timed functions status (see page 436).	18
	Timed function 2	Bit 1 of 34.01 Timed functions status (see page 436).	19
	Timed function 3	Bit 2 of 34.01 Timed functions status (see page 436).	20
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 423).	21
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 423).	22
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 423).	23
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 290).	-
40.43	Set 1 sleep level	Defines the start limit for the sleep function. If the value is 0.0, set 1 sleep mode is disabled.  The sleep function compares PID output (parameter 40.01 Process PID output actual) to the value of this parameter. If PID output remains below this value longer than the sleep delay defined by 40.44 Set 1 sleep delay, the drive enters the sleep mode and stops the motor.	0.0
	0.0200000.0	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.	0.00 set 1 units
	0.00200000.00 set 1 units	Sleep boost step.	1 = 1 set 1 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 set 1 unit
	-200000.00 200000.00 set 1 units	Wake-up level (as deviation between process setpoint and feedback).	1 = 1 set 1 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
	Timed function 3	Bit 2 of 34.01 Timed functions status (see page 436).	20
	Supervision 1	Bit 0 of 32.01 Supervision status (see page 423).	21
	Supervision 2	Bit 1 of 32.01 Supervision status (see page 423).	22
	Supervision 3	Bit 2 of 32.01 Supervision status (see page 423).	23
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 290).	-
40.58	Set 1 increase prevention	Activates increase prevention of PID integration term for PID set 1	No
	No	Increase prevention not in use.	0
	Limiting	The process PID integration term is not increased.	1
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 290).	-
40.59	Set 1 decrease prevention	Activates decrease prevention of PID integration term for PID set 1.	No
	No	Decrease prevention not in use.	0
	Limiting	The process PID integration term is not decreased.	1
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 290).	-
40.60	Set 1 PID activation source	Selects a source that enables/disables process PID control.  See also parameter 40.07 Process PID operation mode.  0 = Process PID control disabled.  1 = Process PID control enabled.	On
	Off	0.	0
	On	1.	1
	Follow Ext1/Ext2 selection	Process PID control is disabled when external control location EXT1 is active, and enabled when external control location EXT2 is active.  See also parameter 19.11 Ext1/Ext2 selection.	2
	DI1	Digital input DI1 (10.02 DI delayed status, bit 0).	3
	DI2	Digital input DI2 (10.02 DI delayed status, bit 1).	4
	DI3	Digital input DI3 (10.02 DI delayed status, bit 2).	5
	DI4	Digital input DI4 (10.02 DI delayed status, bit 3).	6
	DI5	Digital input DI5 (10.02 DI delayed status, bit 4).	7
	DI6	Digital input DI6 (10.02 DI delayed status, bit 5).	8
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 290).	-
40.61	Setpoint scaling actual	Actual setpoint scaling. See parameter 40.14 Set 1 setpoint scaling.	50.00
	-200000.00 200000.00	Scaling.	1 = 1
40.62	PID internal setpoint actual	Displays the value of the internal setpoint. See control chain diagram <i>PID setpoint compensation</i> on page <i>374</i> . This parameter is read-only.	-
	-200000.00 200000.00 set 1 units	Process PID internal setpoint.	1 = 1 set 1 unit

No.	Name/Value	Description	Def/FbEq16
	FB A ref2	03.06 FB A reference 2 (see page 298).	16
	Reserved		1718
	EFB ref1	03.09 EFB reference 1 (see page 298).	19
	EFB ref2	03.10 EFB reference 2 (see page 298).	20
	Reserved		2123
	Setpoint data storage	40.92 Setpoint data storage (see page 479).	24
	Other	Source selection (see <i>Terms and abbreviations</i> on page 290).	-
40.72	Set 1 compensation input 1	Point x1 on the setpoint compensation curve, see parameter 40.71 Compensated setpoint.	0.00
	-200000.00 200000.00	Setpoint value.	1 = 1
40.73	Set 1 compensated output 1	Point y1 (= the compensated output of parameter 40.72 Set 1 compensation input 1) on the setpoint compensation curve, see parameter 40.70 Compensated setpoint.	0.00 set 1 units
	-200000.00 200000.00 set 1 units	Compensated setpoint value.	1 = 1 set 1 unit
40.74	Set 1 compensation input 2	Point x2 on the setpoint compensation curve, see parameter 40.71 Compensated setpoint.	0.00
	-200000.00 200000.00	Setpoint value.	1 = 1
40.75	Set 1 compensated output 2	Point y2 (= the compensated output of parameter 40.74 Set 1 compensation input 2) on the setpoint compensation curve, see parameter 40.70 Compensated setpoint.	0.00 set 1 units
	-200000.00 200000.00 set 1 units	Compensated setpoint value.	1 = 1 set 1 unit
40.76	Set 1 compensation non- linearity	Describes the non-linearity of the setpoint compensation curve, see parameter 40.70 Compensated setpoint.	0%
	0100%	Percentage.	1 = 1%
40.79	Set 1 units	Unit used for PID set 1.	bar
	User text	User editable text.	0
	%	Percent.	4
	bar	Bar.	74
	kPa	Kilo pascal.	75
	Pa	Pascal.	77
	psi	Pound per square inch.	76
	CFM	Cubic feet per minute.	26
	inH <sub>2</sub> O	Inch of water.	58
	°C	Degree Celsius.	150
	°F	Degree Fahrenheit.	151
	mbar	Millibar.	44
	m <sup>3</sup> /h	Cubic meter per hour.	78

No.	Name/Value	Description	Def/FbEq16
40.91	Feedback data storage	Storage parameter for receiving a process feedback value, for example, through the embedded fieldbus interface.  The value can be sent to the drive as Modbus I/O data. Set the target selection parameter of that particular data (58.10158.114) to Feedback data storage. In 40.08 Set 1 feedback 1 source (or 40.09 Set 1 feedback 2 source), select Feedback data storage.	0.00
	-327.68327.67	Storage parameter for process feedback.	100 = 1
40.92	Setpoint data storage	Storage parameter for receiving a process setpoint value, for example, 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.	0.00
	-327.68327.67	Storage parameter for process setpoint.	100 = 1
40.96	Process PID output %	Percentage scaled signal of parameter 40.01 Process PID feedback actual.	0.00%
	-100.00100.00%	Percentage.	100 = 1%
40.97	Process PID feedback %	Percentage scaled signal of parameter 40.02 Process PID feedback actual.	0.00%
	-100.00100.00%	Percentage.	100 = 1%
40.98	Process PID setpoint %	Percentage scaled signal of parameter 40.03 Process PID setpoint actual.	0.00%
	-100.00100.00%	Percentage.	100 = 1%
40.99	Process PID deviation %	Percentage scaled signal of parameter 40.04 Process PID deviation actual.	0.00%
	-100.00100.00%	Percentage.	100 = 1%
41 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 control chain diagram PID setpoint compensation on page 374.	
41.08	Set 2 feedback 1 source	See parameter 40.08 Set 1 feedback 1 source.	AI2 percent

		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 control chain diagram PID setpoint compensation on page 374.	
41.08	Set 2 feedback 1 source	See parameter 40.08 Set 1 feedback 1 source.	Al2 percent
41.09	Set 2 feedback 2 source	See parameter 40.09 Set 1 feedback 2 source.	Not selected
41.10	Set 2 feedback function	See parameter 40.10 Set 1 feedback function.	In1
41.11	Set 2 feedback filter time	See parameter 40.11 Set 1 feedback filter time.	0.000 s
41.14	Set 2 setpoint scaling	See parameter 40.14 Set 1 setpoint scaling.	0.00
41.15	Set 2 output scaling	See parameter 40.15 Set 1 output scaling.	0.00
41.16	Set 2 setpoint 1 source	See parameter 40.16 Set 1 setpoint 1 source.	Internal setpoint
41.17	Set 2 setpoint 2 source	See parameter 40.17 Set 1 setpoint 2 source.	Not selected

No.	Name/Value	Description	Def/FbEq16
41.46	Set 2 sleep boost step	See parameter 40.46 Set 1 sleep boost step.	0.00 set 2 units
41.47	Set 2 wake-up deviation	See parameter 40.47 Set 1 wake-up deviation.	0.00 set 2 units
41.48	Set 2 wake-up delay	See parameter 40.48 Set 1 wake-up delay.	0.50 s
41.49	Set 2 tracking mode	See parameter 40.49 Set 1 tracking mode.	Not selected
41.50	Set 2 tracking ref selection	See parameter 40.50 Set 1 tracking ref selection.	Not selected
41.58	Set 2 increase prevention	See parameter 40.58 Set 1 increase prevention.	No
41.59	Set 2 decrease prevention	See parameter 40.59 Set 1 decrease prevention.	No
41.60	Set 2 PID activation source	See parameter 40.60 Set 1 PID activation source.	On
41.71	Set 2 compensation input source	See parameter 40.71 Set 1 compensation input source.	Not selected
41.72	Set 2 compensation input 1	See parameter 40.72 Set 1 compensation input 1.	0.00
41.73	Set 2 compensated output 1	See parameter 40.73 Set 1 compensated output 1.	0.00 set 2 units
41.74	Set 2 compensation input 2	See parameter 40.74 Set 1 compensation input 2.	0.00
41.75	Set 2 compensated output 2	See parameter 40.75 Set 1 compensated output 2.	0.00 set 2 units
41.76	Set 2 compensation non- linearity	See parameter 40.76 Set 1 compensation non-linearity.	0%
41.79	Set 2 units	See parameter 40.79 Set 1 units.	bar
41.80	Set 2 PID output min source	Selects the source for set 2 PID output minimum.	Set2 output min
	None	None.	0
	Set2 output min	41.36 Set 2 output min.	1
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 290).	-
41.81	Set 2 PID output max source	Selects the source for set 2 PID output maximum.	Set2 output max
	None	None.	0
	Set2 output max	41.37 Set 2 output max.	1
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 290).	-
41.89	Set 2 setpoint multiplier	See parameter 40.89 Set 1 setpoint multiplier.	1.00
41.90	Set 2 feedback multiplier	Defines the multiplier k used in formulas of parameter 41.10 Set 2 feedback function. See parameter 40.90 Set 1 feedback multiplier.	1.00

11

No.	Name/Value	Description	Def/FbEq16
43.07	Brake chopper run enable	Selects the source for quick brake chopper on/off control.  0 = Brake chopper IGBT pulses are cut off 1 = Normal brake chopper IGBT modulation allowed.	On
	Off	0.	0
	On	1.	1
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 290).	-
43.08	Brake resistor thermal tc	Defines the thermal time constant for the brake resistor thermal model.	0 s
	010000 s	Brake resistor thermal time constant, ie, the rated time to achieve 63% temperature.	1 = 1 s
43.09	Brake resistor Pmax cont	Defines the maximum continuous load of the brake resistor that will eventually raise the resistor temperature to the maximum allowed value (= continuous heat dissipation capacity of the resistor in kW) but not above it. The value is used in the resistor overload protection based on the thermal model. See parameter 43.06 Brake chopper function and the data sheet of the brake resistor used.	0.00 kW
	0.00 10000.00 kW	Maximum continuous load of the brake resistor.	1000 = 1 kW
43.10	Brake resistance	Defines the resistance value of the brake resistor. The value is used for the brake resistor protection based on the thermal model. See parameter 43.06 Brake chopper function.	0.0 ohm
	0.01000.0 ohm	Brake resistor resistance value.	1000 = 1 ohm
43.11	Brake resistor fault limit	Defines the fault limit for the brake resistor protection based on the thermal model. See parameter 43.06 Brake chopper function. When the limit is exceeded, the drive trips on fault 7183 BR excess temperature.  The value is given in percent of the temperature the resistor reaches when loaded with the power defined by parameter 43.09 Brake resistor Pmax cont.	105%
	0150%	Brake resistor temperature fault limit.	100= 1%
43.12	Brake resistor warning limit	Defines the warning limit for the brake resistor protection based on the thermal model. See parameter 43.06 Brake chopper function. When the limit is exceeded, the drive generates warning A793 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.	95%
	0150%	Brake resistor temperature warning limit.	100 = 1%
45.50		Cattings for the appropriate calculators as well as near and	

	45 Energy efficiency	Settings for the energy saving calculators as well as peak and energy loggers.  See also section <i>Diagnostics menu</i> (page 230).	
	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).	-
Į	065535 GWh	Energy savings in GWh.	1 = 1 GWh

11

No.	Name/Value	Description	Def/FbEq16
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).	-
		If you have not set the currency during the first start-up, you can specify it in Main menu > Primary settings > Clock, region display > Units > Currency.  This parameter is read-only (see parameter 45.21 Energy calculations reset).	
	0.00 21474830.0 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
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).	-
	0.0214748304.0 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 and a synchronous reluctance motor, energy optimization is always enabled regardless of this parameter.	Disable
	Disable	Energy optimization disabled.	0
	Enable	Energy optimization enabled.	1

No.	Name/Value	Description	Def/FbEq16
45.24	Hourly peak power value	Value of the peak power during the last hour, that is, the most recent 60 minutes after the drive has been powered up.  The parameter is updated once every 10 minutes unless the hourly peak is found in the most recent 10 minutes. In that case, the values is shown immediately.	0.00 kW
	-3000.00 3000.00 kW	Peak power value.	10 = 1 kW
45.25	Hourly peak power time	Time of the peak power value during the last hour.	00:00:00
		Time.	-
45.26	Hourly total energy (resettable)	Total energy consumption during the last hour, that is, the most recent 60 minutes.  You can reset the value by setting it to zero.	0.00 kWh
	-3000.00 3000.00 kWh	Total energy.	10 = 1 kWh
45.27	Daily peak power value (resettable)	Value of the peak power since midnight of the present day. You can reset the value by setting it to zero.	0.00 kW
	-3000.00 3000.00 kW	Peak power value.	10 = 1 kW
45.28	Daily peak power time	Time of the peak power since midnight of the present day.	00:00:00
		Time.	-
45.29	Daily total energy (resettable)	Total energy consumption since midnight of the present day. You can reset the value by setting it to zero.	0.00 kWh
	-30000.00 30000.00 kWh	Total energy.	1 = 1 kWh
45.30	Last day total energy	Total energy consumption during the previous day, that is, between midnight of the previous day and midnight of the present day	0.00 kWh
	-30000.00 30000.00 kWh	Total energy.	1 = 1 kWh
45.31	Monthly peak power value (resettable)	Value of the peak power during the present month, that is, since midnight of the first day of the present month.  You can reset the value by setting it to zero.	0.00 kW
	-30000.00 30000.00 kWh	Peak power value.	10 = 1 kW
45.32	Monthly peak power date	Date of the peak power during the present month.	1.1.1980
		Date.	-
45.33	Monthly peak power time	Time of the peak power during the present month.	00:00:00
		Time.	-
45.34	Monthly total energy (resettable)	Total energy consumption from the beginning of the present month.  You can reset the value by setting it to zero.	0.00 kWh
	-1000000.00 1000000.00 kWh	Total energy.	1 = 100 kWh

46 Mo	nitoring/scaling ys	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, for example, in fieldbus communication.	1500.00 rpm; 1800.00 rpm (95.20 b0)
	0.1030000.00 rpm	Acceleration/deceleration terminal/initial speed.	1 = 1 rpm
46.02	Frequency scaling	Defines the maximum frequency value used to define the acceleration ramp rate and the initial frequency value used to define deceleration ramp rate (see parameter group 28 Frequency reference chain). The frequency acceleration and deceleration ramp times are therefore related to this value (not to parameter 30.14 Maximum frequency).  Also defines the 16-bit scaling of frequency-related parameters. The value of this parameter corresponds to 20000, for example, in fieldbus communication.	50.00 Hz; 60.00 Hz (95.20 b0)
	0.101000.00 Hz	Acceleration/deceleration terminal/initial frequency.	10 = 1 Hz
46.03	Torque scaling	Defines the 16-bit scaling of torque parameters. The value of this parameter (in percent of nominal motor torque) corresponds to 10000, for example, in fieldbus communication.	100.0%
	0.11000.0%	Torque corresponding to 10000 on fieldbus.	10 = 1%
46.04	Power scaling	Defines the 16-bit scaling of power parameters. The value of this parameter corresponds to 10000, for example, in fieldbus communication.  The unit is selected by parameter 96.16 Unit selection. For 32-bit scaling see parameter 46.43 Power decimals.	1000.00 unit
	0.1030000.00 kW or 0.1040214.48 hp	Power corresponding to 10000 on fieldbus.	1 = 1 unit

11

ш	ж	al
	ш	ш

No.	Name/Value	Description	Def/FbEq16
	0.001 1000.000 kWh	"kWh pulse" on trigger level.	1 = 1 kWh
46.43	Power decimals	Defines the number of decimals shown for parameter 99.10 Motor nominal power on the control panel and Drive composer PC tool. It also defines 32-bit scaling of power parameters.  The value of this parameter corresponds to the number of decimals assumed in the 32-bit integer fieldbus communication.  For 16-bit scaling, see parameter 46.04 Power scaling.	2
	03	Number of decimals.	1 = 1
46.44	Current decimals	Defines the number of decimals shown for parameter 99.06 Motor nominal current on the control panel and Drive composer PC tool. It also defines 32-bit scaling of current parameters.  The value of this parameter corresponds to the number of decimals assumed in the 32-bit integer fieldbus communication.  For 16-bit scaling, see parameter 46.05 Current scaling.	1
	03	Number of decimals.	1 = 1

47.0		D	
4/ 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 Data storage parameters (page 232).	
47.01	Data storage 1 real32	Data storage parameter 1.	0.000
	-2147483.000 2147483.000	32-bit data.	
47.02	Data storage 2 real32	Data storage parameter 2.	0.000
	-2147483.000 2147483.000	32-bit data.	
47.03	Data storage 3 real32	Data storage parameter 3.	0.000
	-2147483.000 2147483.000	32-bit data.	
47.04	Data storage 4 real32	Data storage parameter 4.	0.000
	-2147483.000 2147483.000	32-bit data.	
47.05	Data storage 5 real32	Data storage parameter 5.	0.000
	-2147483.000 2147483.000	32-bit data.	
47.06	Data storage 6 real32	Data storage parameter 6.	0.000
	-2147483.000 2147483.000	32-bit data.	

No.	Name/Value	Description	Def/FbEq16
47.24	Data storage 4 int16	Data storage parameter 20.	0
	-3276832767	16-bit data.	1 = 1
47.25	Data storage 5 int16	Data storage parameter 21.	0
	-3276832767	16-bit data.	1 = 1
47.26	Data storage 6 int16	Data storage parameter 22.	0
	-3276832767	16-bit data.	1 = 1
47.27	Data storage 7 int16	Data storage parameter 23.	0
	-3276832767	16-bit data.	1 = 1
47.28	Data storage 8 int16	Data storage parameter 24.	0
	-3276832767	16-bit data.	1 = 1

49 Panel port communication		Communication settings for the control panel port on the drive.	
49.01	Node ID number	Defines the node ID of the drive. All devices connected to the network must have a unique node ID.  Note: For networked drives, it is advisable to reserve ID 1 for spare/replacement drives.	1
	132	Node ID.	1 = 1
49.03	Baud rate	Defines the transfer rate of the link.	115.2 kbps
	38.4 kbps	38.4 kbit/s.	1
	57.6 kbps	57.6 kbit/s.	2
	86.4 kbps	86.4 kbit/s.	3
	115.2 kbps	115.2 kbit/s.	4
	230.4 kbps	230.4 kbit/s.	5
49.04	Communication loss time	Sets a timeout for control panel (or PC tool) communication. If a communication break lasts longer than the timeout, the action specified by parameter 49.05 Communication loss action is taken.	10.0 s
	0.33000.0 s	Control 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 fault 7081 Control panel loss.	1
	Last speed	Drive generates warning A7EE Panel loss and freezes the speed to the level the drive was operating at. The speed is determined on the basis of actual speed using 850 ms low-pass filtering.  WARNING! Make sure that it is safe to continue operation in case of a communication break.	2

No.	Name/Value	Description	Def/FbEq16
	Speed ref safe	Drive generates warning ATEE Panel loss 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
(FBA)	ldbus adapter	Fieldbus communication configuration. See also chapter <i>Fieldbus control through a fieldbus adapter</i> (page <i>347</i> ).	
50.01	FBA A enable	Enables/disables communication between the drive and fieldbus adapter A, and specifies the slot the adapter is installed into.	Disable
	Disable	Communication between drive and fieldbus adapter A disabled.	0
	Enable	Communication between drive and fieldbus adapter A enabled. The adapter is in slot 1.	1
50.02	FBA A comm loss func	Selects how the drive reacts upon a fieldbus communication break. The time delay is defined by parameter 50.03 FBA A comm loss t out.	No action
	No action	No action taken.	0
	Fault	Drive trips on fault 7510 FBA A communication. This only occurs if control is expected from the fieldbus (FBA A selected as source of start/stop/reference in the currently active control location).	1
	Last speed	Drive generates warning A7C1 FBA A communication and freezes the speed to the level the drive was operating at. This only occurs if control is expected from the fieldbus.  The speed is determined on the basis of actual speed using 850 ms low-pass filtering.  WARNING! Make sure that it is safe to continue operation in case of a communication break.	2
	Speed ref safe	Drive generates warning A7C1 FBA A communication and sets the speed to the value defined by parameter 22.41 Speed ref safe (when speed reference is being used) or 28.41 Frequency ref safe (when frequency reference is being used). This only occurs if control is expected from the fieldbus.  WARNING! Make sure that it is safe to continue operation in case of a communication break.	3
	Fault always	Drive trips on fault 7510 FBA A communication. This occurs even though no control is expected from the fieldbus.	4
	Warning	Drive generates warning A7C1 FBA A communication. This only occurs if control is expected from the fieldbus.  WARNING! Make sure that it is safe to continue operation in case of a communication break.	5

No.	Name/Value	Description		Def/FbEq16
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.  Notes:  There is a 60-second boot-up delay immediately after power-up. During the delay, the communication break monitoring is disabled (but communication itself can be active).  This timer starts after the value of parameter 51.31 D2FBA A comm status becomes Off-line. This timer only delays the function selected in 50.02 FBA A comm loss func.		0.3 s
	0.36553.5 s	Time delay.		10 = 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 parameters	of the reference is defined by ending on which reference	Speed or frequency
	Speed or frequency	Type and scaling is chosen au currently active operation mod		0
		Operation mode (see par. 19.01)	Reference 1 type	
		Speed control	Speed	
		Frequency control	Frequency	
	Transparent	No scaling is applied (the 16-b <b>Note:</b> All decimal information is	,	1
	General	Generic reference with a 16-bi integer and two decimals). <b>Note:</b> All data after two decimals.	,	2
	Speed	The scaling is defined by parar	meter 46.01 Speed scaling.	4
	Frequency	The scaling is defined by parar	meter 46.02 Frequency scaling.	5
50.05	FBA A ref2 type	Selects the type and scaling of fieldbus adapter A. The scaling parameters 46.0146.04, dep type is selected by this parameters	of the reference is defined by ending on which reference	Speed or frequency
	Speed or frequency	Type and scaling is chosen au currently active operation mod		0
		Operation mode (see par. 19.01)	Reference 2 type	
		Speed control	Speed	
		Frequency control	Frequency	
		Select Speed (selection 4) or F manually.	Frequency (selection 5)	
	Transparent	No scaling is applied (the 16-b <b>Note:</b> All decimal information is		1
	General	Generic reference with a 16-bi integer and two decimals). <b>Note:</b> All data after two decimal 123.	•	2

No.	Name/Value	Description		Def/FbEq16
	Speed	The scaling is defined by paran	neter 46.01 Speed scaling.	4
	Frequency	The scaling is defined by paran	The scaling is defined by parameter 46.02 Frequency scaling.	
50.06	FBA A SW sel		Selects the source of the Status word to be sent to the fieldbus network through fieldbus adapter A.	
	Auto	Source of the Status word is ch	osen automatically.	0
	Transparent mode	The source selected by parametransparent source is transmitted fieldbus network through fieldbus	ed as the Status word to the	1
50.07	FBA A actual 1 type	Selects the type and scaling of actual value 1 transmitted to the fieldbus network through fieldbus adapter A. The scaling of the value is defined by parameters 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 1 type	
		Speed control	Speed	
		Frequency control	Frequency	
	Transparent	The value selected by parameter 50.10 FBA A act1 transparent source is sent as actual value 1. No scaling is applied (the 16-bit scaling is 1 = 1 unit).  Note: All decimal information is lost, for example, 1.23 = 1.  The value selected by parameter 50.10 FBA A act1 transparent source is sent as actual value 1 with a 16-bit scaling of 100 = 1 unit (that is, integer and two decimals).  Note: All data after two decimals is lost, for example, 1.234 = 123.		1
	General			2
	Speed	01.01 Motor speed used is sent is defined by parameter 46.01		4
	Frequency	01.06 Output frequency is sent is defined by parameter 46.02		5
50.08	FBA A actual 2 type	Selects the type and scaling of actual value 2 transmitted to the fieldbus network through fieldbus adapter A. The scaling of the value is defined by parameters 46.0146.04, depending on which actual value type is selected by this parameter.  Type and scaling is chosen automatically according to the currently active operation mode as follows:		Speed or frequency
	Speed or frequency			0
		Operation mode (see par. 19.01)	Actual value 2 type	
		Speed control	Speed	
		Frequency control	Frequency	
		Select Speed (selection 4) or F manually.	requency (selection 5)	

No.	Name/Value	Description	Def/FbEq16
	Transparent	The value selected by parameter 50.10 FBA A act1 transparent source is sent as actual value 1. No scaling is applied (the 16-bit scaling is 1 = 1 unit).  Note: All decimal information is lost, for example, 1.23 = 1.	1
	General	The value selected by parameter 50.10 FBA A act1 transparent source is sent as actual value 1 with a 16-bit scaling of 100 = 1 unit (that is, integer and two decimals).  Note: All data after two decimals is lost, for example, 1.234 = 123.	2
	Speed	01.01 Motor speed used is sent as actual value 1. The scaling is defined by parameter 46.01 Speed scaling.	4
	Frequency	01.06 Output frequency is sent as actual value 1. The scaling is defined by parameter 46.02 Frequency scaling.	5
50.09	FBA A SW transparent source	Selects the source of the fieldbus status word when parameter 50.06 FBA A SW sel is set to Transparent mode.	Not selected
	Not selected	No source selected.	-
	Other	Source selection (see <i>Terms and abbreviations</i> on page 290).	-
50.10	FBA A act1 transparent source	When parameter 50.07 FBA A actual 1 type is set to Transparent, this parameter selects the source of actual value 1 transmitted to the fieldbus network through fieldbus adapter A.	Not selected
	Not selected	No source selected.	-
	Other	Source selection (see <i>Terms and abbreviations</i> on page 290).	-
50.11	FBA A act2 transparent source	When parameter 50.08 FBA A actual 2 type is set to Transparent, this parameter selects the source of actual value 2 transmitted to the fieldbus network through fieldbus adapter A.	Not selected
	Not selected	No source selected.	-
	Other	Source selection (see Terms and abbreviations on page 290).	-
50.12	FBA A debug mode	This parameter enables debug mode. Displays raw (unmodified) data received from and sent to fieldbus adapter A in parameters 50.1350.18.	Disable
	Disable	Debug mode disabled.	0
	Fast	Debug mode enabled. Cyclical data update is as fast as possible which increases CPU load on the drive.	1
50.13	FBA A control word	Displays the raw (unmodified) control word sent by the master (PLC) to fieldbus adapter A if debugging is enabled by parameter 50.12 FBA A debug mode.  This parameter is read-only.	-
	00000000h FFFFFFFh	Control word sent by master to fieldbus adapter A.	-
50.14	FBA A reference 1	Displays raw (unmodified) reference REF1 sent by the master (PLC) to fieldbus adapter A if debugging is enabled by parameter 50.12 FBA A debug mode.  This parameter is read-only.	
	-2147483648 2147483647	Raw REF1 sent by master to fieldbus adapter A.	-

No.

50 15

Name/Value

FBA A reference 2

Description

Def/FbEa16

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.

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 partable 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.  Note: After the FBA detects a comm loss, it will wait for a time delay before changing this comm status parameter to Off-line. If this time delay exists for an FBA module, then it will be in module specific section. See parameters 51.0251.26 for more information.	Not configured
	Not configured	Adapter is not configured.	0
	Initializing	Adapter is initializing.	1
	Time out	A timeout has occurred in the communication between the adapter and the drive.	2
	Configuration error	Adapter configuration error: mapping file not found in the file system of the drive, or mapping file upload has failed more than three times.	3
	Off-line	Fieldbus communication is off-line.	4
	On-line	Fieldbus communication is on-line, or fieldbus adapter has been configured not to detect a communication break. For more information, see the documentation of the fieldbus adapter.	5
	Reset	Adapter is performing a hardware reset.	6
51.32	FBA A comm SW ver	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.	-

No.	Name/Value	Description	Def/FbEq16
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.	-

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
Reserved		710
CW 32bit	Control Word (32 bits)	11
Ref1 32bit	Reference REF1 (32 bits)	12
Ref2 32bit	Reference REF2 (32 bits)	13
SW 32bit	Status Word (32 bits)	14
Act1 32bit	Actual value ACT1 (32 bits)	15
Act2 32bit	Actual value ACT2 (32 bits)	16
Reserved		1723
SW2 16bit	Status Word 2 (16 bits)	24
Other	Source selection (see <i>Terms and abbreviations</i> on page 290).	-
52.12 FBA A data in12	See parameter 52.01 FBA A data in1.	None

53 FB.	A A data out	Selection of data to be transferred from fieldbus controller to drive through fieldbus adapter A.  Note: 32-bit values require two consecutive parameters.  Whenever a 32-bit value is selected in a data parameter, the next parameter is automatically reserved.	
53.01	FBA A data out1	Parameters 53.0153.12 select data to be transferred from the fieldbus controller to the drive through fieldbus adapter A.	None
	None	None.	0
	CW 16bit	Control Word (16 bits)	1
	Ref1 16bit	Reference REF1 (16 bits)	2
	Ref2 16bit	Reference REF2 (16 bits)	3
	Reserved		710
	CW 32bit	Control Word (32 bits)	11

No.	Name/Value	Description	Def/FbEq16
	Ref1 32bit	Reference REF1 (32 bits)	12
	Ref2 32bit	Reference REF2 (32 bits)	13
	Reserved		1420
	CW2 16bit	Control Word 2 (16 bits)	21
	Other	Source selection (see <i>Terms and abbreviations</i> on page 290).	-
53.12	FBA A data out12	See parameter 53.01 FBA A data out1.	None

58 Embedded fieldbus		Configuration of the embedded fieldbus (EFB) interface.  See also chapter Modbus RTU control through the embedded fieldbus interface (EFB) (page 271).	
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
	Reserved		23
	None / IPC communication	Embedded fieldbus interface is enabled and is used for IPC communication.	4
58.02	Protocol ID	Displays the protocol ID and revision. First 4 bits specify the protocol ID and last 12 bits specify the revision.  This parameter is read-only.	-
		Protocol ID and revision.	
58.03	Node address	Defines the node address of the drive on the fieldbus link. Values 1247 are allowable. Also called Station ID, MAC Address or Device Address. Two devices with the same address are not allowed on-line. Changes to this parameter take effect after the control unit is rebooted or the new settings validated by parameter 58.06 Communication control (Refresh settings).	1
	0255	Node address (values 1247 are allowed).	1 = 1
58.04	Baud rate	Selects the transfer rate of the fieldbus link.  When using selection <i>Autodetect</i> , the parity setting of the bus must be known and configured in parameter 58.05 Parity.  When parameter 58.04 Baud rate is set to Autodetect, the EFB settings must be refreshed with parameter 58.06. The bus is monitored for a period of time and the detected baud rate is set as the value of this parameter.  Changes to this parameter take effect after the control unit is rebooted or the new settings validated by parameter 58.06 Communication control (Refresh settings).	Modbus RTU: 19.2 kbps
	Autodetect	Baud rate detected automatically.	0
	4.8 kbps	4.8 kbit/s.	1
	9.6 kbps	9.6 kbit/s.	2
	19.2 kbps	19.2 kbit/s.	3
	38.4 kbps	38.4 kbit/s.	4
	57.6 kbps	57.6 kbit/s.	5
	76.8 kbps	76.8 kbit/s.	6

No.	Name/Value	Description	Def/FbEq16
	115.2 kbps	115.2 kbit/s.	7
58.05	Parity	Modbus RTU only: 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 <i>Refresh settings</i> selection of this parameter.	2

No.	Name/Value	Description	Def/FbEq16
58.07	Communication diagnostics	Displays the status of the EFB communication. This parameter is read-only. Note that the name is only visible when the error is present (bit value is 1).	-

Bit	Name	Description	
0	Init failed	1 = EFB initialization failed	
1	Addr config err	1 = Node address not allowed by protocol	
2	Silent mode	1 = Drive not allowed to transmit	
		0 = Drive allowed to transmit	
3	Autobauding	1 = Automatic detection of baud rate is in use (see parameter 58.04)	
4	Wiring error	1 = Errors detected (A/B wires possibly swapped)	
5	Parity error	1 = Error detected: check parameters 58.04 and 58.05	
6	Baud rate error	1 = Error detected: check parameters 58.05 and 58.04	
7	No bus activity	1 = 0 bytes received during last 5 seconds	
8	No packets	1 = 0 packets (addressed to any device) detected during last 5 seconds	
9	Noise or addressing error	1 = Errors detected (interference, or another device with the same address on line)	
10	Comm loss	1 = 0 packets addressed to the drive received within timeout (58.16)	
11	CW/Ref loss	1 = No control word or references received within timeout (58.16)	
12	Reserved		
13	Protocol 1	1 = Duplicate ID detected on the network. Used for IPC.	
14	Reserved		
15	Internal error	1 = One or more communication errors have occurred between the drive and the control system. This bit indicates that an invalid or unsupported request has been made. The presence of this bit does not prevent further communication nor indicate a hardware issue.	

	0000hFFFFh	EFB communication status.	1 = 1
58.08	Received packets	Displays a count of valid packets addressed to the drive. During normal operation, this number increases constantly. Can be reset from the control panel by pressing the Reset softkey for 3 seconds.	-
	04294967295	Number of received packets addressed to the drive.	
58.09	Transmitted packets	Displays a count of valid packets transmitted by the drive. During normal operation, this number increases constantly. Can be reset from the control panel by pressing the Reset softkey for 3 seconds.	-
	04294967295	Number of transmitted packets.	
58.10	All packets	Displays a count of valid packets addressed to any device on the bus. During normal operation, this number increases constantly.  Can be reset from the control panel by pressing the Reset softkey for 3 seconds.	-
	04294967295	Number of all received packets.	

ы	иш
	-

No.	Name/Value	Description	Def/FbEq16
58.11	UART errors	Displays a count of character errors received by the drive. An increasing count indicates a configuration problem on the bus.  Can be reset from the control panel by pressing the Reset softkey for 3 seconds.	-
	04294967295	Number of UART errors.	
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 pressing the Reset softkey for 3 seconds.	-
	04294967295	Number of CRC errors.	
58.14	Communication loss action	Selects how the drive reacts to an EFB communication break. Changes to this parameter take effect after the control unit is rebooted or the new settings validated by parameter 58.06 Communication control (Refresh settings).  See also parameters 58.15 Communication loss mode and 58.16 Communication loss time.	No action
	No action	No action taken (monitoring disabled).	0
	Fault	Drive monitors communication loss when start/stop is expected from the EFB on the currently active control location.  The drive trips on fault 6681 EFB comm loss if control in the currently active control location is expected from the EFB or reference is coming from the EFB, and the communication is lost.	1
	Last speed	Drive generates warning A7CE EFB comm loss and freezes the speed to the level the drive was operating at. The speed is determined on the basis of actual speed using 850 ms low-pass filtering. This occurs if control or reference is expected from the EFB.  WARNING! Make sure that it is safe to continue operation in case of a communication break.	2
	Speed ref safe	Drive generates warning A7CE EFB comm loss and sets the speed to the speed defined by parameter 22.41 Speed ref safe (or 28.41 Frequency ref safe when frequency reference is being used). This occurs if control or reference is expected from the EFB.  WARNING! Make sure that it is safe to continue operation in case of a communication break.	3
	Fault always	Drive continuously monitors for communication loss. Drive trips on fault 6681 EFB comm loss. This happens even though the drive is in a control location where the EFB start/stop or reference is not used.	4
	Warning	Drive generates warning A7CE EFB comm loss. 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

No.	Name/Value	Description	Def/FbEq16
58.15	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
58.16	Communication loss time	Sets a timeout for EFB communication. If a communication break lasts longer than the timeout, the action specified by parameter 58.14 Communication loss action is taken. Changes to this parameter take effect after the control unit is rebooted or the new settings validated by parameter 58.06 Communication control (Refresh settings). See also parameter 58.15 Communication loss mode.  Note: There is a 30-second boot-up delay immediately after power-up.	10.0 s
	0.06000.0 s	EFB communication timeout.	1 = 1 s
58.17	Transmit delay	Modbus RTU only: Defines a minimum response delay in addition to any fixed delay imposed by the protocol. Changes to this parameter take effect after the control unit is rebooted or the new settings validated by parameter 58.06 Communication control (Refresh settings).	0 ms
	065535 ms	Minimum response delay.	1 = 1 ms
58.18	EFB control word	Modbus RTU only: Displays the raw (unmodified) control word sent by the Modbus controller to the drive. For debugging purposes.  This parameter is read-only.	-
	00000000h FFFFFFFh	Control word sent by Modbus controller to the drive.	1 = 1
58.19	EFB status word	Modbus RTU only: Displays the raw (unmodified) status word for debugging purposes. This parameter is read-only.	-
	00000000h FFFFFFFh	Status word sent by the drive to the Modbus controller.	1 = 1
58.25	Control profile	Modbus RTU only: Defines the communication profile used by the Modbus protocol.  Changes to this parameter take effect after the control unit is rebooted or the new settings validated by parameter 58.06 Communication control (Refresh settings).  See section About the control profiles on page 280.  Note: If you want to use the ABB drives limited profile, set parameter 96.79 Legacy control profile accordingly (supported in firmware revisions 2.15 or later).	ABB Drives
	ABB Drives	ABB Drives control profile (with a 16-bit control word)	0
	DCU Profile	DCU control profile (with a 16 or 32-bit control word)	5

No.	Name/Value	Description	Def/FbEq16
58.33	Addressing mode	Modbus RTU only: Defines the mapping between parameters and holding registers in the 400101465535 Modbus register range.  Changes to this parameter take effect after the control unit is rebooted or the new settings validated by parameter 58.06 Communication control (Refresh settings).	Mode 0
	Mode 0	16-bit values (groups 199, indexes 199): Register address = 400000 + 100 × parameter group + parameter index. For example, parameter 22.80 would be mapped to register 400000 + 2200 + 80 = 402280.  32-bit values (groups 199, indexes 199): Register address = 420000 + 200 × parameter group + 2 × parameter index. For example, parameter 22.80 would be mapped to register 420000 + 4400 + 160 = 424560.	0
	Mode 1	16-bit values (groups 1255, indexes 1255): Register address = 400000 + 256 × parameter group + parameter index. For example, parameter 22.80 would be mapped to register 400000 + 5632 + 80 = 405712.	1
	Mode 2	32-bit values (groups 1127, indexes 1255): Register address = 400000 + 512 × parameter group + 2 × parameter index. For example, parameter 22.80 would be mapped to register 400000 + 11264 + 160 = 411424.	2
58.34	Word order	Modbus RTU only: 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	Modbus RTU only: Defines the address in the drive which the Modbus master accesses when it reads from or writes to the register address corresponding to Modbus register 1 (400001).  The master defines the type of the data (input or output). The value is transmitted in a Modbus frame consisting of two 16-bit words. If the value is 16-bit, it is transmitted in the LSW (least significant word). If the value is 32-bit, the subsequent parameter is also reserved for it and must be set to None.	CW 16bit
	None	No mapping, register is always zero.	0
	CW 16bit	ABB Drives profile: 16-bit ABB drives control word; DCU Profile: lower 16 bits of the DCU control word.	1
	Ref1 16bit	Reference REF1 (16 bits).	2
	Ref2 16bit	Reference REF2 (16 bits).	3
	SW 16bit	ABB Drives profile: 16-bit ABB drives status word; DCU Profile: lower 16 bits of the DCU status word.	4
	Act1 16bit	Actual value ACT1 (16 bits).	5
	Act2 16bit	Actual value ACT2 aha(16 bits).	6
	Reserved		710
	CW 32bit	Control Word (32 bits).	11

No.	Name/Value	Description	Def/FbEq16
60 DD	CS nunication	DCS communication configuration. (Only visible for ACQ580-31 and ACQ580-34).	
		The DDCS protocol is used in the communication between the drive (or more precisely, an inverter unit) and the supply unit of the drive system. See section (page 118). The communication utilizes the internal communication channel between the inverter unit (INU) and the supply unit (LSU).	
60.78	INU-LSU comm loss timeout	Sets a timeout for communication with another converter (such as the supply unit). If a communication break lasts longer than the timeout, the action specified by parameter 60.79 INU-LSU comm loss function is taken.	100 ms
	065535 ms	Timeout for communication between converters.	1 = 1 ms
60.79	INU-LSU comm loss function	Selects how the inverter unit reacts to a communication break between the inverter unit and the other converter (typically the supply unit).  WARNING! With settings other than Fault, the inverter unit will continue operating based on the status information that was last received from the other converter. Make sure this does not cause danger.	Fault
	No action	No action taken.	0
	Warning	Drive generates warning AF80 INU-LSU comm loss.	1
	Fault	Drive trips on fault 7580 INU-LSU comm loss.	2
	D and DDCS nit data	Defines the data sent to the DDCS link. (Only visible for ACQ580-31 and ACQ580-34). See also parameter group 60 DDCS communication.	
61.201	INU-LSU data set 10 data 1 value	Displays (in integer format) the data to be sent to the other converter as word 1 of data set 10.	0
	065535	Data to be sent as word 1 of data set 10.	1 = 1
61.202	INU-LSU data set 10 data 2 value	Displays (in integer format) the data to be sent to the other converter as word 2 of data set 10.	0
	065535	Data to be sent as word 2 of data set 10.	1 = 1
61.203	INU-LSU data set 10 data 3 value	Displays (in integer format) the data to be sent to the other converter as word 3 of data set 10.	0
	065535	Data to be sent as word 3 of data set 10.	1 = 1
	D and DDCS re data	Defines the data sent to the DDCS link. (Only visible for ACQ580-31 and ACQ580-34). See also parameter group 60 DDCS communication.	
62.201	INU-LSU data set 11 data 1 value	Displays (in integer format) the data to be sent to the other converter as word 1 of data set 10.	0
•	065535	Data to be sent as word 1 of data set 10.	1 = 1
71 Ext	ternal PID1	Configuration of external PID. See control chain diagrams External PID setpoint and feedback source selection, and External PID controller on pages 377 and 378, respectively.	
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.	-

Bit	Name	Value
0	PID active	1 = Process PID control active.
1	Reserved	
2	Output frozen	1 = Process PID controller output frozen. Bit is set if parameter 71.38 Output freeze enable is TRUE, or the deadband function is active (bit 9 is set).
36	Reserved	
7	Output limit high	1 = PID output is being limited by par. 71.37.
8	Output limit low	1 = PID output is being limited by par. 71.36.
9	Deadband active	1 = Deadband is active.
1011	Reserved	
12	Internal setpoint active	1 = Internal setpoint active (see par. 71.1671.23)
1315	Reserved	

	0000hFFFFh	Process PID control status word.	1 = 1
71.07	PID operation mode	See parameter 40.07 Process PID operation mode.	Off
71.08	Feedback 1 source	See parameter 40.08 Set 1 feedback 1 source.	Not selected
71.11	Feedback filter time	See parameter 40.11 Set 1 feedback filter time.	0.000 s
71.14	Setpoint scaling	Defines, together with parameter 71.15 Output scaling, a general scaling factor for the external PID control chain. The scaling can be utilized when, for example, the process setpoint is input in Hz, and the output of the PID controller is used as an rpm value in speed control. In this case, this parameter might be set to 50, and parameter 71.15 to the nominal motor speed at 50 Hz.  In effect, the output of the PID controller [71.15] when deviation (setpoint - feedback) = [71.14] and [71.32] = 1.  Note: The scaling is based on the ratio between 71.14 and 71.15. For example, the values 50 and 1500 would produce the same scaling as 1 and 3.	1500.00
	-200000.00 200000.0	Process setpoint base.	1 = 1
71.15	Output scaling	See parameter 71.14 Setpoint scaling.	1500.00
	-200000.00 200000.0	Process PID controller output base.	1 = 1
71.16	Setpoint 1 source	See parameter 40.16 Set 1 setpoint 1 source.	Not selected
71.19	Internal setpoint sel1	See parameter 40.19 Set 1 internal setpoint sel1.	Not selected
71.20	Internal setpoint sel2	See parameter 40.20 Set 1 internal setpoint sel2.	Not selected
71.21	Internal setpoint 1	See parameter 40.21 Set 1 internal setpoint 1.	0.00%

No.	Name/Value	Description	Def/FbEq16
71.22	Internal setpoint 2	See parameter 40.22 Set 1 internal setpoint 2.	0.00%
71.23	Internal setpoint 3	See parameter 40.23 Set 1 internal setpoint 3.	0.00%
71.26	Setpoint min	See parameter 40.26 Set 1 setpoint min.	0.00%
71.27	Setpoint max	See parameter 40.27 Set 1 setpoint max.	200000.00%
71.31	Deviation inversion	See parameter 40.31 Set 1 deviation inversion.	Not inverted (Ref - Fbk)
71.32	Gain	See parameter 40.32 Set 1 gain.	1.00
71.33	Integration time	See parameter 40.33 Set 1 integration time.	60.0 s
71.34	Derivation time	See parameter 40.34 Set 1 derivation time.	0.000 s
71.35	Derivation filter time	See parameter 40.35 Set 1 derivation filter time.	0.0 s
71.36	Output min	See parameter 40.36 Set 1 output min.	-200000.00%
71.37	Output max	See parameter 40.37 Set 1 output max.	200000.00%
71.38	Output freeze enable	See parameter 40.38 Set 1 output freeze enable.	Not selected
71.39	Deadband range	The control program compares the absolute value of parameter 71.04 Deviation act value to the deadband range defined by this parameter. If the absolute value is within the deadband range for the time period defined by parameter 71.40 Deadband delay, PID's deadband mode is activated and 71.06 PID status word bit 9 Deadband active is set. Then PID's output is frozen and 71.06 PID status word bit 2 Output frozen is set.  If the absolute value is equal or greater than the deadband range, PID's deadband mode is deactivated.	0.0%
	0.02000000.0 %	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	Activates increase prevention of PID integration term for Ext PID 1.	No
	No	Increase prevention not in use.	0
	Limiting	The Ext PID integration term is not increased.	1
	Process PID min lim	The Ext PID integration term is not increased when the output of the PID process has reached its minimum limit. In this setup, the external PID is used as a source for the PID process. This parameter is valid for the PID set 1.	2
	Process PID max lim	The Ext PID integration term is not increased when the output of the PID process has reached its maximum limit. In this setup, the external PID is used as a source for the PID process.	3
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 290).	-
71.59	Decrease prevention	Activates decrease prevention of PID integration term for Ext PID 1.	No
	No	Increase prevention not in use.	0
	Limiting	The Ext PID integration term is not decreased.	1

No.	Name/Value	Description	Def/FbEq16
	PFC inactive (local control)	PFC is inactive because the drive is in local control.	5
	PFC inactive (invalid operation mode)	PFC is inactive because of an invalid operation mode.	6
	Drive motor interlocked	The motor connected to the drive is interlocked (not available). Warning D503 VSD controlled PFC motor interlocked (page 251) is generated.	7
	All motors interlocked	All motors are interlocked (not available). Warning <i>D502 All motors interlocked</i> (page <i>251</i> ) is generated.	8
	PFC inactive (ext1 active)	PFC is inactive because external control location EXT1 is in use. PFC is supported in EXT2 only.	9
	Running with VSD	The drive is controlling one pump motor, no auxiliary motors are used.	100
	Running with VSD + 1 Aux	One auxiliary motor has been taken in use.	101
	Running with VSD + 2 Aux	Two auxiliary motor have been taken in use.	102
	Running with VSD + 3 Aux	Three auxiliary motor have been taken in use.	103
	Starting Aux1	Auxiliary motor 1 is being started.	200
	Starting Aux2	Auxiliary motor 2 is being started.	201
	Starting Aux3	Auxiliary motor 3 is being started.	202
	Stopping Aux1	Auxiliary motor 1 is being stopped.	300
	Stopping Aux2	Auxiliary motor 2 is being stopped.	301
	Stopping Aux3	Auxiliary motor 3 is being stopped.	302
	Autochange active	Autochange, that is, automatic rotation of the start order is active.	400
	No auxiliary motors available to be started	No auxiliary motors are available to be started, for example, all are already running, or a motor in not available due to maintenance.	500
	Regulator bypass active	Direct-on-line pumps are automatically started and stopped.	600
	MPFC connection ok	Multipump control connection is OK.	700
	Interlocked	Pump is interlocked.	701
	Not ready	IPC is not ready.	702
	Standby	Drive is in standby mode.	703
	Master	Drive is master, running.	704
	Master (limited)	Drive is master, one or more pumps are offline or inhibited.	705
	Follower	Drive is follower.	706
	Follower (limited)	Drive is follower, one or more pumps are offline or inhibited.	707
	Follower (starting)	Drive is follower, starting.	708
	Master (stop delay)	Drive is master, waiting until stop delay time has passed.	709
	Master (start delay)	Drive is master, waiting until start delay time has passed.	710
	Master (wait start ack)	Waiting for master pump.	711

No.	Name/	Value	Description		Def/FbEq16
76.06	Measu	red level %	operation area.	Displays the measured level as a percentage of level control operation area.  The signal is scaled to stop level 1 and full speed level.	
	0100	%	Measured level in	ı %.	1 = 1%
76.07	LC spe	ed ref	Displays the leve	I control speed reference.	-
	-30000 30000		Level control spe-	ed reference.	1 = 1 Hz
76.11	Pump s	status 1	Shows the status	of pump 1.	-
	Bit	Name		Value	
	0	Ready		0 = False, 1 = True	
	1	CRC mism	atch	0 = False, 1 = True	
	2	Running		0 = False, 1 = True	
	34	Pump prio	rity	0 = High, 1 = Normal, 2 = Low	
	5	In PFC cor	-	0 = False, 1 = True	
	6	In IPC con		0 = False, 1 = True	
	7	Master en	able	0 = False, 1 = True	
	8	Active mas	ster	0 = False, 1 = True	
	910	Reserved		,	
	11	Interlocked	1	0 = False, 1 = True	
	12	Local mod	e	0 = False, 1 = True	
	13	Pump cleaning		0 = False, 1 = True	
	14	Drive start	active	0 = False, 1 = True	
	15	Max statio	Max stationary time elapsed 0 = False, 1 = True		
	0000h.	FFFFh	Status of pump 1		1 = 1
76.12	Pump s	status 2	See parameter 70	6.11 Pump status 1.	-
76.13	Pump s	status 3	See parameter 70	6.11 Pump status 1.	-
76.14	Pump s	status 4	See parameter 70	6.11 Pump status 1.	-
76.15	Pump s	status 5	See parameter 70	6.11 Pump status 1.	-
76.16	Pump s	status 6	See parameter 70	6.11 Pump status 1.	-
76.17	Pump s	status 7	See parameter 76 Only for IPC.	6.11 Pump status 1.	-
76.18	Pump s	status 8	See parameter 76 Only for IPC.	6.11 Pump status 1.	-
76.21	Multipu configu		Selects the multi-	pump mode.	Off
	Off		Disabled.		0
	IPC		IPC enabled. See Intelligent pump control (IPC) on page 120.		1
	PFC		The remaining pu started and stopp The frequency (gr (group 22 Speed defined as PID fo	the pump at a time is controlled by the drive. Imps are direct-on-line pumps that are led by the drive logic. Imps 28 Frequency reference chain) / speed reference selection) reference must be the PFC functionality to work properly.  and fan control (PFC/SPFC) on page 132.	2

No.	Name/Value	Description	Def/FbEq16
76.27	Max number of motors allowed	Maximum number of motors running simultaneously.	1
	18	Maximum number of motors. For PFC 16, for IPC 18.	1 = 1
76.30	Start point 1	Defines the start speed, frequency or point (Hz/rpm/m) 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 PFC speed hold on. Certain pump types do not produce significant flow with low frequencies. The speed hold on time can be used to compensate the time needed to accelerate the second auxiliary motor to a speed where it produces flow. The start of the second auxiliary motor is not aborted if the speed of the first auxiliary motor decreases	Vector: 1300 rpm; Scalar 48 Hz; 58 Hz (95.20 b0) Level control: 24.00 m
	Speed	76.55 ———————————————————————————————————	Max. speed
	76.30		
	76.41	76.56	
	Min. speed	76.58 Tim	ne
	Stop/Start Stop/Start Stop/Start Stop/Start Stop/Start	Increasin flow	g
	OFF ——	Stop Decreasi	ng
	0.0032767.00 rpm/Hz/m	Speed/frequency/level	1 = 1 unit
76.31	Start point 2	Defines the start speed, frequency or point (Hz/rpm/m) for the second auxiliary motor. See parameter 76.31 Start point 1.	Vector: 1300 rpm; Scalar 48 Hz; 58 Hz (95.20 b0) Level control: 30.00 m

No.	Name/Value	Description	Def/FbEq16
76.32	Start point 3	Defines the start speed, frequency or point (Hz/rpm/m) for the third auxiliary motor. See parameter 76.31 Start point 1.	Vector: 1300 rpm; Scalar 48 Hz; 58 Hz (95.20 b0) Level control: 36.00 m
76.33	Start point 4	Defines the start speed, frequency or point (Hz/rpm/m) for the fourth follower pump/auxiliary motor. See parameter 76.30 Start point 1.	Vector: 1300 rpm; Scalar 48 Hz; 58 Hz (95.20 b0) Level control: 39.00 m
76.34	Start point 5	Defines the start speed, frequency or point (Hz/rpm/m) for the fifth follower pump/auxiliary motor. See parameter 76.30 Start point 1.	Vector: 1300 rpm; Scalar 48 Hz; 58 Hz (95.20 b0) Level control: 42.00 m
76.35	Start point 6	Defines the start speed, frequency or point (Hz/rpm/m) for the sixth follower pump/auxiliary motor. See parameter 76.30 Start point 1. For IPC only.	Vector: 1300 rpm; Scalar 48 Hz; 58 Hz (95.20 b0) Level control: 45.00 m
76.36	Start point 7	Defines the start speed, frequency or point (Hz/rpm/m) for the seventh follower pump/auxiliary motor. See parameter 76.30 Start point 1. For IPC only.	Vector: 1300 rpm; Scalar 48 Hz; 58 Hz (95.20 b0) Level control: 48.00 m
76.37	Start point 8	Defines the start point for the eighth follower pump/auxiliary motor. See parameter 76.30 Start point 1.  Note: This parameter is active only in the Level control only.	Level control: 51.00 m
76.41	Stop point 1	Defines the stop speed, frequency or point (Hz/rpm/m) for the first auxiliary motor. When the speed or frequency of the motor connected directly to the drive falls below this value and one auxiliary motor is running, the stop delay defined by parameter 76.56 Stop delay is started. If the speed is still at the same level or lower when the stop delay elapses, the first auxiliary motor stops.  The running speed of the drive is increased by [Start point 1-Stop point 1] after the auxiliary motor stops.	Vector: 800 rpm; Scalar 25 Hz; 30 Hz (95.20 b0) Level control: 18.00 m
	0.0032767.00 rpm/Hz/m	Speed/frequency/level	1 = 1 unit
76.42	Stop point 2	Defines the stop speed, frequency or point (Hz/rpm/m) for the second auxiliary motor. See parameter 76.41 Stop point 1.	Vector: 800 rpm; Scalar 25 Hz; 30 Hz (95.20 b0) Level control: 18.00 m

No.	Name/Value	Description	Def/FbEq16
76.43	Stop point 3	Defines the stop speed, frequency or point (Hz/rpm/m) for the third auxiliary motor. See parameter 76.41 Stop point 1.	Vector: 800 rpm; Scalar 25 Hz; 30 Hz (95.20 b0) Level control: 18.00 m
76.44	Stop point 4	Defines the stop speed, frequency or point (Hz/rpm/m) for the fourth follower pump/auxiliary motor. See parameter 76.41 Stop point 1.	Vector: 800 rpm; Scalar 25 Hz; 30 Hz (95.20 b0) Level control: 18.00 m
76.45	Stop point 5	Defines the stop speed, frequency or point (Hz/rpm/m) for the fifth follower pump/auxiliary motor. See parameter 76.41 Stop point 1.	Vector: 800 rpm; Scalar 25 Hz; 30 Hz (95.20 b0) Level control: 18.00 m
76.46	Stop point 6	Defines the stop speed, frequency or point (Hz/rpm/m) for the sixth follower pump/auxiliary motor. See parameter 76.41 Stop point 1. For IPC only	Vector: 800 rpm; Scalar 25 Hz; 30 Hz (95.20 b0) Level control: 18.00 m
76.47	Stop point 7	Defines the stop speed, frequency or point (Hz/rpm/m) for the seventh follower pump/auxiliary motor. See parameter 76.41 Stop point 1. For IPC only	Vector: 800 rpm; Scalar 25 Hz; 30 Hz (95.20 b0) Level control: 18.00 m
76.48	Stop point 8	Defines the stop point for the eighth follower pump/auxiliary motor. See parameter 76.41 Stop point 1.  Note: This parameter is active in Level control only.	Level control: 18.00 m
76.50	LC full speed point	Defines the level at which all the pumps will run at maximum speed/frequency defined with parameter 30.12 Maximum speed or 30.14 Maximum frequency.	Level control: 45.00 m
	0.0032767.00 m	Level control full speed level.	1 = 1 m
76.51	LC level source	Defines the source for level measurement.	Al2 scaled
	Al1 scaled	12.12 Al1 scaled value (see page 327).	1
	Al2 scaled	12.22 Al2 scaled value (see page 329).	2
	Al1 percent	12.101 Al1 percent value (see page 330).	8
	Al2 percent	12.102 Al2 percent value (see page 330).	9
76.52	LC level unit	Defines the unit for level control measurement (parameter 76.05 Measured level).	meters
	percent	Level control is measured in percent.	4
	feet	Level control is measured in feet.	27
	centimeters	Level control is measured in centimeter.	69

No.	Name/Value	Description	Def/FbEq16
	0.001800.00 s	Time.	1 = 1 s
76.62	IPC smooth acceleration time	Defines the ramp time of a new starting pump. A pump that is started by current master follows the speed until all the pumps rotate at the same speed and master role is changed. The smooth acceleration time must be longer than the time defined with parameter 40.33 Set 1 integration time.  Note: Quick ramp overrides the smooth ramp. See parameter group 82 Pump protections on page 536.	20.00 s
	3.001800.00 s	IPC smooth acceleration time in seconds.	1 = 1 s
76.63	IPC smooth deceleration time	Defines the ramp time that is used to stop the pump. A pump that is stopped by current master follows the speed until it is stopped completely. The smooth deceleration time must be longer than the time defined with parameter 40.33 Set 1 integration time.  Note: Quick ramps overrides the smooth ramp. See parameter group 82 Pump protections on page 536.	20.00 s
	3.001800.00 s	IPC smooth deceleration time in seconds.	1 = 1 s
76.64	Run permissive timeout	Defines the maximum time the drive waits between it receives a command to start and the condition defined in parameter 20.40 Run permissive to be satisfied.  The drive trips on fault D40C Multipump run permissive timeout if the timer expires before it receives the run permissive. The next pump is started if available.  Setting this parameter to 0 prevents a command to start without the run permissive satisfied (i.e. parameter 76.02 Multipump system status remains at Not ready while the permissive is not satisfied).	0.0 s
	0.00300.00 s	The maximum delay.	1 = 1 s
76.70	PFC Autochange	Defines the way the autochange is triggered. In all cases except <i>Even wear</i> , the start order is moved one step forward each time the autochange occurs. If the start order initially is 1-2-3-4, after the first autochange the order will be 2-3-4-1, etc.  For <i>Even wear</i> , the start order will be determined so that the running times of all motors remain within the defined limit. If IPC is used with values <i>Not selected</i> or <i>Selected</i> , the system will automatically select the <i>Even wear</i> value.  Note: Autochange only occurs when the speed of the drive is below the speed defined by parameter 76.73 Autochange level.  See also section <i>Autochange</i> on page 135.	Even wear (for IPC) Not selected (for PFC)
	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

DI6

No.

Name/Value

Timed function 1

Timed function 2

Timed function 3

Fixed interval

All stop

Even wear

Description

occurs.

(10.02 DI delayed status, bit 4).

(10.02 DI delayed status, bit 5).

Timed functions status (see page 436)).

Timed functions status (see page 436)).

Timed functions status (see page 436)).

when the process demand is low.

Autochange triggered by the rising edge of digital input DI5

Autochange triggered by the rising edge of digital input DI6

Autochange triggered by timed function 1 (bit 0 of 34.01

Autochange triggered by timed function 2 (bit 1 of 34.01)

Autochange triggered by timed function 3 (bit 2 of 34.01

Autochange is done when the interval determined in the

parameter76.71 PFC Autochange interval has elapsed.

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

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

Autochange is done when all the motors are stopped.

Def/FbEa16

6

R

g

10

11

12

13

hardware contactor connections and PFC1 must be defined

in one of the relay output source parameters.

No.	Name/Value	Description	Def/FbEq16
	Aux motors only	Only auxiliary (direct-on-line) motors are affected by the autochange function.  Note: PFC1 refers to the motor that is fixed to the drive and must not be selected in any of the relay output source parameters. Only the starting order of the auxiliary motors will be rotated.	1
76.76	Max stationary time	Defines the maximum time that a low priority pump can be stationary.  The IPC system uses pump priorities to start/stop the pumps. This parameter sets the upper limit for stationary time so that the pump blockage can be avoided.	0.0 h
	0.0214748368.0 h	Maximum stationary time in hours.	1 = 1 h
76.77	Pump priority	Selects the priority of the pump in an IPC system.  Note: Parameter 76.76 Max stationary time defines the maximum time that a low priority pump can be stationary.	Normal
	High	High priority pump. The IPC system prefers high priority pump.	1
	Normal	Normal priority pump.	3
	Low	Low priority pump.  The low priority pump runs as little as possible. It is started only when the demand requires full pumping capacity.	5
76.81	PFC 1 interlock	Defines if the PFC motor 1 can be started. An interlocked PFC motor cannot be started.  0 = Interlocked (not available)  1 = Available.	Available. PFC motor is available
	Interlocked. PFC motor is not in use	PFC motor is interlocked and not available.	0
	Available. PFC motor is available	PFC motor is available.	1
	DI1	Digital input DI1 (10.02 DI delayed status, bit 0).	2
	DI2	Digital input DI2 (10.02 DI delayed status, bit 1).	3
	DI3	Digital input DI3 (10.02 DI delayed status, bit 2).	4
	DI4	Digital input DI4 (10.02 DI delayed status, bit 3).	5
	DI5	Digital input DI5 (10.02 DI delayed status, bit 4).	6
	DI6	Digital input DI6 (10.02 DI delayed status, bit 5).	7
	Timed function 1	Bit 0 of 34.01 Timed functions status (see page 436).	8
	Timed function 2	Bit 1 of 34.01 Timed functions status (see page 436).	9
	Timed function 3	Bit 2 of 34.01 Timed functions status (see page 436).	10
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 290).	-
76.82	PFC 2 interlock	See parameter 76.81 PFC 1 interlock.	Available. PFC motor is available
76.83	PFC 3 interlock	See parameter 76.81 PFC 1 interlock.	Available. PFC motor is available
76.84	PFC 4 interlock	See parameter 76.81 PFC 1 interlock.	Available. PFC motor is available

No.	Name/Value	Description	Def/FbEq16
	Stop with warning	The drive behaves the same as the <i>Stop</i> option, but also generates warning <i>D509 Low level</i> which is maintained until the run command is canceled or if the other level sensor triggers a <i>Full speed</i> action.	4
	Full speed	The drive ramps the pump to the speed or frequency defined in either parameter 30.12 Maximum speed or 30.14 Maximum frequency, depending on whether the drive is operating in speed or frequency mode (see parameter 19.01 Actual operation mode). The follower pumps are also commanded to full speed. This state is maintained until the run command is canceled or if the other level sensor triggers a Stop action.	5
	Full speed with warning	The drive behaves as with the <i>Full speed</i> option, but also generates a <i>D509 Low level</i> warning which is maintained until the run command is canceled, or if the other level sensor triggers a <i>Stop</i> action.	6
76.93	LC high level action	Selects the action for drive to indicate when digital high level switch is activated.  See parameter 76.91 LC high level switch (page 524).	Warning
	No action	High level switch is disabled and does not generate any event.	0
	Warning	High level switch generates warning D508 High level.	1
	Fault	High level switch trips on fault D402 High level.	2
	Stop	The drive stops the connected pump and commands the other MPFC network drives to stop. This state is maintained until the run command is canceled or if the other level sensor triggers a <i>Full speed</i> action.	3
	Stop with warning	The drive behaves the same as the <i>Stop</i> option, but also generates warning <i>D508 High level</i> which is maintained until the run command is canceled or if the other level sensor triggers a <i>Full speed</i> action.	4
	Full speed	The drive ramps the pump to the speed or frequency defined in either parameter 30.12 Maximum speed or 30.14 Maximum frequency, depending on whether the drive is operating in speed or frequency mode (see parameter 19.01 Actual operation mode). The follower pumps are also commanded to full speed. This state is maintained until the run command is canceled or if the other level sensor triggers a Stop action.	5
	Full speed with warning	The drive behaves as with the <i>Full speed</i> option, but also generates a <i>D508 High level</i> warning which is maintained until the run command is canceled, or if the other level sensor triggers a <i>Stop</i> action.	6
76.95	Regulator bypass control	Defines if direct-on-line pumps are automatically started and stopped.  This setting can be used in applications with a low number of sensors and low accuracy requirements.	Disable
	Disable	Automatic starting and stopping is disabled.	0
	Enable	Automatic starting and stopping is enabled.	1
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 290).	-
76.101	IPC parameter synchronization	Defines parameter synchronization in IPC system.	Enable
	Disable	Parameter synchronization is disabled.	1
	Enable	Parameter synchronization is enabled.	2

No.	Name/Value	Description	Def/FbEq16
76.102	IPC synchronization settings	Selects the settings that are synchronized between drives in inverter-to-inverter communication bus. The process PID and IPC parameters are synchronized. Note: This parameter does not synchronize AI parameters.	0b0110

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

	0000hFFFFh	Synchronization settings	1 = 1
	000011111111	Cynonionization sciangs	1 - 1
76.105	IPC synchronization checksum	Displays the calculated parameter checksum (CRC) of the parameter groups selected with parameter 76.102 IPC synchronization settings. If the value of this parameter is same on all the drives, then the configuration is also synchronized correctly.	
	0000hFFFFh	Checksum.	1 = 1

77 Multipump maintenance and monitoring		PFC (Pump and fan control) and multipump maintenance and monitoring parameters.	
77.10	PFC runtime change	Enables the reset, or arbitrary setting, of 77.11 Pump 1 running time 77.18 Pump 8 running time.	Done
	Done	The parameter automatically reverts back to this value.	0
	Set any PFC run time	Enables the setting of 77.11 Pump 1 running time 77.18 Pump 8 running time.	1
	Reset PFC1 run time	Resets parameter 77.11 Pump 1 running time.	2
	Reset PFC2 run time	Resets parameter 77.12 Pump 2 running time.	3
	Reset PFC3 run time	Resets parameter 77.13 Pump 3 running time.	4
	Reset PFC4 run time	Resets parameter 77.14 Pump 4 running time.	4
	Reset PFC5 run time	Resets parameter 77.15 Pump 5 running time	
	Reset PFC6 run time	Resets parameter 77.16 Pump 6 running time.	7
77.11	Pump 1 running time	Running time counter of pump/fan 1. Can be set or reset by parameter 77.10 PFC runtime change.	0.00 h
	0.00 42949672.95 h	Time	1 = 1 h
77.12	Pump 2 running time	See parameter 77.11 Pump 1 running time.	0.00 h

No.	Name/Value		Description			Def/FbEq16
77.13	Pump 3 runnin time	g	See parameter 7	See parameter 77.11 Pump 1 running time.		
77.14	Pump 4 running time		See parameter 7	7.11 Pump 1	running time.	0.00 h
77.15	Pump 5 runnin time	g	See parameter 7	7.11 Pump 1	running time.	0.00 h
77.16	Pump 6 runnin time	g	See parameter 7	7.11 Pump 1	running time.	0.00 h
77.17	Pump 7 runnin time	g	Running time cou For IPC only.	unter of pum	p 7.	0.00 h
77.18	Pump 8 runnin time	g	Running time cou For IPC only.	unter of pum	p 8.	0.00 h
			see each other be	three pump ut drive 3 ca	eation.  system, drive 1 and drive 2 can nnot see other drives.  11b, Drive 3 = 0100b	
	Bit	Na	ime	De	scriptions	
	0	No	ode 1	Pu	mp 1 is online.	
	1	No	ode 2	Pu	mp 2 is online.	
	2	No	ode 3	Pu	mp 3 is online.	
	3	No	ode 4	Pu	mp 4 is online.	
	4	No	ode 5	Pu	mp 5 is online.	
	5	No	ode 6	Pu	mp 6 is online.	
	6	No	ode 7	Pu	mp 7 is online.	
	7	No	ode 8	Pu	mp 8 is online.	
	815	Re	eserved		<u> </u>	
	0000hFFFFh	า	Pump status			1 = 1

Total calculated volume.

0.00...

21474836.00 units

No.	Name/Value	Description	Def/FbEq16
80.04	Specific energy	Shows the ratio of pump flow rate and power input.  Note: By default the flow unit will be m³/kWh. However, the unit can be changed according to the parameter 81.21 Flow unit.	-
	0.00 32767.95 units	Specific energy of the pump.	1 = 1 units
80.05	Estimated pump head	Shows the estimated head produced by the pump.  Note: By default the unit will be m. However, the unit can be changed according to the parameter 81.22 Length unit.	-
	0.0032767.00 m	Estimated pump head.	1 = 1 m
80.08	Incremental volume	Shows the cumulative calculated volume that has been pumped since the last 80.30 Incremental volume reset.  Notes:  • By default, the volume unit will be m³. However, the unit will change according to the parameter 81.21 Flow unit.  • This value is scaled by 80.20 Volume unit multiplier. If 80.20 is set to 1000, the true volume is 1000 times greater than the value displayed.	-
	0.00 21474836.00 flow units	The cumulative incremental value.	-
80.11	Flow feedback 1 source	Selects the source for the flow feedback 1.	Not selected
	Not selected	Feedback not used.	0
	Al1 scaled	12.12 Al1 scaled value (see page 327).	1
	Al2 scaled	12.22 Al2 scaled value (see page 329).	2
	Freq in scaled	11.39 Freq in 1 scaled value (see page 324).	3
	Al1 percent	12.101 Al1 percent value (see page 330).	8
	Al2 percent	12.102 Al2 percent value (see page 330).	9
	Feedback data storage	40.91 Feedback data storage (see page 479).	10
	Reserved		1112
	Al3 scaled	15.52 Al3 scaled value (see page 349).	13
	Al4 scaled	15.62 Al4 scaled value (see page 351).	14
	Al5 scaled	15.72 Al5 scaled value (see page 353).	15
	Al3 percent	15.53 Al3 percent value (see page 349).	16
	Al4 percent	15.63 Al4 percent value (see page 351).	17
	Al5 percent	15.73 Al5 scaled value (see page 353).	18
	Other	Source selection (see <i>Terms and abbreviations</i> on page 290).	-
80.12	Flow feedback 2 source	Selects the source for the flow feedback 2. For the selections, see parameter 80.11 Flow feedback 1 source.	Not selected
80.13	Flow feedback function	Selects a function between the flow feedback sources selected by parameters 80.11 Flow feedback 1 source and 80.12 Flow feedback 2 source.  The result of the function (for any selection) is multiplied by parameter 80.14 Flow feedback multiplier.	In1

No.	Name/Value	Description	Def/FbEq16
	Low pulse flowmeter	A flowmeter is connected to 80.71 Low pulse flowmeter source and the pulses are used to calculate the flow using 80.72 Low pulse flowmeter scale.  Note: The minimum pulse width required is 2 ms (which gives a maximum frequency of 250 Hz). For flowmeters with a higher frequency, the Freq in scaled should be used.	102
	PQ and QH curves	The PQ curve is used for flow calculation. The calculated flow is then used in the QH curve to calculate the head.	103
80.14	Flow feedback multiplier	Defines the multiplier (k) used with the flow calculation The output value of 80.13 Flow feedback function is multiplied by this value.	1.00
	-200000.00 200000.00	Multiplier.	1 = 1
80.15	Maximum flow	Defines the nominal maximum flow of the system. This value is used to calculate the actual flow percentage value so that the value 100% for 80.02 corresponds to the value of this parameter.  Note: By default the flow unit will be m³/h. However, the unit can be changed according to the parameter 81.21 Flow unit.	1000.00 m <sup>3</sup> /h
	-200000.00 200000.00 m <sup>3</sup> /h	Limit for maximum flow protection.	1 = 1 m <sup>3</sup> /h
80.16	Minimum flow	Defines the nominal minimum flow of the system. <b>Note</b> : By default the flow unit will be m³/h. However, the unit can be changed according to the parameter 81.21 Flow unit.	1.00 m <sup>3</sup> /h
	-200000.00 200000.00 m <sup>3</sup> /h	Limit for minimum flow protection.	1 = 1 m <sup>3</sup> /h
80.17	Maximum flow protection	Selects the action for maximum flow protection function. See parameters 22.41 Speed ref safe and 28.41 Frequency ref safe.	No action
	No action	Maximum flow protection is disabled.	0
	Warning	Drive generates warning D50C Maximum flow protection.	1
	Fault	Drive trips on fault D406 Maximum flow protection.	2
	Speed ref safe	Speed reference safe is activated.	3
80.18	Minimum flow protection	Selects the action for minimum flow protection function. See parameters 22.41 Speed ref safe and 28.41 Frequency ref safe.	No action
	No action	Minimum flow protection is disabled.	0
	Warning	Drive generates warning D50D Minimum flow protection.	1
	Fault	Drive trips on fault D407 Minimum flow protection.	2
	Speed ref safe	Speed reference safe is activated.	3
80.19	Flow check delay	Defines the time after motor start when the flow protection is active.	5.00 s
	0.003600.00 s	Flow check delay.	1 = 1 s
80.20	Volume unit multiplier	The cumulative calculated volume is divided by this value before it is shown in 80.03 Total volume and 80.08 Incremental volume. This is useful for applications with a very large flow to ensure the limit of 21,474,836.00 is not reached.	1
	1 or 1000	The volume unit multiplier.	1 = 1

No.	Name/Value	Description	Def/FbEq16
80.31	Total volume reset date	Displays the date when signal 80.03 Total volume was reset to zero.	1/1/1980
	-	The total volume reset date.	-
80.32	Total volume reset time	Displays the time when signal 80.03 Total volume was reset to zero.	00:00:00
	-	The total volume reset time.	-
80.33	Incremental volume reset date	Displays the date when signal 80.08 Incremental volume was reset to zero.	1/1/1980
	-	The incremental volume reset date.	-
80.34	Incremental volume reset time	Displays the time when signal 80.08 Incremental volume was reset to zero.	00:00:00
	-	The incremental volume reset time.	-
80.40	H curve H1	Defines the head at point 1 of the HQ and QH performance curves.  Note: By default the unit will be m. However, the unit can be changed according to the parameter 81.22 Length unit.	0.00 length units
	0.0032767.00 length units	Head at point 1 of the HQ and QH curves.	1 = 1 length unit
80.41	H curve H2	Defines the head at point 2 of the H performance curve. See parameter 80.40 H curve H1 (page 533).	0.00 length units
80.42	H curve H3	Defines the head at point 3 of the H performance curve. See parameter 80.40 H curve H1 (page 533).	0.00 length units
80.43	H curve H4	Defines the head at point 4 of the H performance curve. See parameter 80.40 H curve H1 (page 533).	0.00 length units
80.44	H curve H5	Defines the head at point 5 of the H performance curve. See parameter 80.40 H curve H1 (page 533).	0.00 length units
80.45	H curve H6	Defines the head at point 6 of the H performance curve. See parameter 80.40 H curve H1 (page 533).	0.00 length units
80.46	H curve H7	Defines the head at point 7 of the H performance curve. See parameter 80.40 H curve H1 (page 533).	0.00 length units
80.47	H curve H8	Defines the head at point 8 of the H performance curve. See parameter 80.40 H curve H1 (page 533).	0.00 length units
80.48	H curve H9	Defines the head at point 9 of the H performance curve. See parameter 80.40 H curve H1 (page 533).	0.00 length units
80.49	H curve H10	Defines the head at point 10 of the H performance curve. See parameter 80.40 H curve H1 (page 533).	0.00 length units
80.50	P curve P1	Defines the power input of pump at point 1 on the P performance curve.  Note: By default the unit will be kW. However, the unit can be changed according to the parameter 96.16 Unit selection bit 00 Power unit.	0.00 kW
	0.0032767.00 kW or Hp	Power input of pump at point 1.	1 = 1 unit
80.51	P curve P2	Defines the power input of pump at point 2 on the PQ and HQ performance curves.  See parameter 80.50 P curve P1 (page 533).	0.00 kW
80.52	P curve P3	Defines the power input of pump at point 3 on the PQ and HQ performance curves.  See parameter 80.50 P curve P1 (page 533).	0.00 kW

Def/FbEq16

17

		The state of the s	-
80.69	Q value Q10	Defines the flow rate at point 10 on the PQ and HQ performance curves.  See parameter 80.60 Q value Q1 (page 534).	0.00 units
80.71	Low pulse flowmeter source	Selects the source for the pulse type flow meter.	DI4
	DI1	Digital input DI1 (10.02 DI delayed status, bit 0).	2
	DI2	Digital input DI1 (10.02 DI delayed status, bit 1).	3
	DI3	Digital input DI1 (10.02 DI delayed status, bit 2).	4
	DI4	Digital input DI1 (10.02 DI delayed status, bit 3).	5
	DI5	Digital input DI1 (10.02 DI delayed status, bit 4).	6
	DI6	Digital input DI1 (10.02 DI delayed status, bit 5).	7
	Other [bit]	Source selection (see <i>Terms and abbreviations</i> on page 290).	-
80.72	Low pulse flowmeter scale	Indicates the flow units per pulse of the flowmeter (e.g. 10.000 m³ per pulse).	1.000 flow units
	0.0001000.000 flow units	Flow units per pulse.	1000 = 1 flow unit
81 Se	nsor settings	Sensor settings for inlet and outlet pressure protection function.	
81.01	Actual inlet pressure	Shows the actual inlet pressure.  Note: By default the parameter unit will be bar. However, the unit can be changed according to the parameter 81.20  Pressure unit.	-
	0.0032767.00 pressure units	Actual inlet pressure.	1 = 1 pressure unit
81.02	Actual outlet pressure	Shows the actual outlet pressure.  Note: By default the parameter unit will be bar. However, the unit can be changed according to the parameter 81.20  Pressure unit.	-
	0.0032767.00 pressure units	Actual outlet pressure.	1 = 1 pressure unit
81.10	Inlet pressure source	Selects the primary source used for pump inlet pressure measurement.	Not selected
	Not selected	None.	0
	Al1 scaled	Parameter 12.12 Al1 scaled value.	1
	Al2 scaled	Parameter 12.22 Al2 scaled value.	2
	Freq in scaled	Parameter 11.39 Freq in 1 scaled value.	3
	Al1 percent	Parameter 12.101 Al1 percent value.	8
	Al2 percent	Parameter 12.102 Al2 percent value.	9
	Feedback data storage	Parameter 40.91 Feedback data storage.	10
	Reserved		1112
	Al3 scaled	15.52 Al3 scaled value (see page 349).	13
	Al4 scaled	15.62 Al4 scaled value (see page 351).	14
	Al5 scaled	15.72 Al5 scaled value (see page 353).	15
	Al3 percent	15.53 Al3 percent value (see page 349).	16
			†

15.63 Al4 percent value (see page 351).

No.

Name/Value

Al4 percent

Description

No.	Name/Value	Description	Def/FbEq16
	Al5 percent	15.73 Al5 scaled value (see page 353).	18
	Other	Source selection (see Terms and abbreviations on page 290).	-
81.11	Outlet pressure source	Selects the primary source used for pump outlet pressure measurement. For the available selections, see parameter 81.10 Inlet pressure source.	Not selected
81.12	Sensors height difference	Defines the height difference between inlet and outlet pressure sensors for flow calculation.  Note: By default the unit will be m. However, the unit can be changed according to the parameter 81.22 Length unit.	0.00 length units
	0.0032767.00 length units	Sensors height difference.	1 = 1 length unit
81.20	Pressure unit	Selects the unit of pressure.	bar
	bar	Pressure.	0
	kPa	Kilo pascal.	1
	psi	Pound per square inch.	2
	Pa	Pascal.	3
81.21	Flow unit	Selects the unit of flow. The selection also affects volume and specific energy units.	m3/h
	m <sup>3</sup> /h	Cubic meter per hour (volume unit is m <sup>3</sup> ).	0
	l/s	Liters per second (volume unit is I).	1
	gpm	US gallon per minute (volume unit is gal).	2
81.22	Length unit	Selects the unit of estimated head points, sensors height difference and pump inlet/outlet diameters.	meters
	centimeters	Length unit in centimeter.	69
	meters	Length unit in meter.	72
	Inches	Length unit in inch.	73
	feet	Length unit in feet.	27
81.23	Density unit	Selects the unit of density.	kg/m3
	kg/m <sup>3</sup>	Kilograms per cubic meter.	0
	kg/l	Kilograms per liter.	1
	lb/gal	Pounds per US gallon.	2

82 Pump protections	Settings for quick ramp functions as well as pump protection functions soft pipe fill and dry pump protection.  See sections Ramps – Quick ramps (page 127), Soft pipe fill (page 155) and Dry pump protection (page 158).	
82.01 Quick ramp accel. mode	Enables quick ramp mode for acceleration with quick ramp set 1 (in legacy mode or with updated functionality) and/or with quick ramp set 2 (in legacy mode or with updated functionality). Legacy mode is compatible with software versions before v2.12.  Quick ramp set 1 acceleration properties are configured with parameters 82.05 1st quick ramp accel. time and 82.06 Final quick ramp decel. time. Quick ramp 2 acceleration properties are configured with parameters 82.10 2nd quick ramp accel. time and 82.12 2nd quick ramp accel. limit.  For details, see section Ramps – Quick ramps (page 127).	Disabled
Disabled	Quick ramp mode is disabled.	0

No.	Name/Value	Description	Def/FbEq16
	Use 1 quick ramp (legacy)	Quick ramp set 1 is and set 2 are used (in legacy mode compatible with software versions before v2.12).	1
	Use 2 quick ramps (legacy)	Both quick ramp set 1 and set 2 are used (in legacy mode compatible with software versions before v2.12).	2
	Use 1 quick ramp	Quick ramp set 1 is used.	3
	Use 2 quick ramps	Both quick ramp set 1 and set 2 are used.	4
82.02	Quick ramp decel. mode	Enables quick ramp mode for deceleration with quick ramp set 1 (in legacy mode or with updated functionality) or with quick ramp set 2 (in legacy mode or with updated functionality).	Follow accel. limits
	Disabled	Quick ramp mode is disabled.	0
	Use 1 quick ramp (legacy)	Quick ramp set 1 is used (in legacy mode compatible with software versions before v2.12).	1
	Use 2 quick ramps (legacy)	Both quick ramp set 1 and set 2 are used (in legacy mode compatible with software versions before v2.12).	2
	Use 1 quick ramp	Quick ramp set 1 is used.	3
	Use 2 quick ramps	Both quick ramp set 1 and set 2 are used.	4
	Follow accel. limits	Use the same configuration (mode and limits) for deceleration that is used for acceleration.	5
82.05	1st quick ramp accel. time	Defines the quick ramp set 1 acceleration rate.	3.00 s
	0.101800.00 s	Time.	100 = 1 s
82.06	Final quick ramp decel. time	Defines the quick ramp set 1 deceleration rate. The deceleration rate is defined as the time to decelerate from the speed value defined by parameters 46.01 Speed scaling or 46.02 Frequency scaling to zero speed. This deceleration rate is effective from speed/frequency defined by parameter 82.07 1st quick ramp accel. limit to zero.	3.00 s
	0.101800.00 s	Time.	100 = 1 s
82.07	1st quick ramp accel. limit	Defines the acceleration limit for quick ramp 1. Above this speed/frequency, the drive uses either quick ramp 2 and normal ramp time or only normal ramp time depending on parameter 82.01 Quick ramp accel. mode.	30 unit
	0120 Hz / 03600 rpm	Frequency/Speed limit.	1 = 1 unit
82.08	Final quick ramp decel. limit	Defines the deceleration limit for quick ramp 2.	40 unit
	0120 Hz / 03600 rpm	Frequency/Speed limit.	1 = 1 unit
82.10	2nd quick ramp accel. time	Defines the quick ramp set 2 acceleration rate. The acceleration rate is defined as the time to accelerate from zero speed to the speed value defined by parameter 46.01 Speed scaling or 46.02 Frequency scaling. This acceleration rate is effective in speed/frequency range defined by parameters 82.07 1st quick ramp accel. limit and 82.12 2nd quick ramp accel. limit.	10.00 s
	0.101800.00 s	Time.	100 = 1 s

No.

82 11

Name/Value

decel time

2nd quick ramp

Description

Def/FbEa16

10 00 s

Defines the quick ramp set 2 deceleration rate.

The deceleration rate is defined as the time to decelerate from the speed value defined by parameters 46.01 Speed scaling or 46.02 Frequency scaling to zero speed.

No.	Name/Value	Description	Def/FbEq16
	Supervision 2	Activates dry run protection.	8
	Supervision 3	Activates dry run protection.	9
82.22	Flow switch protection	Selects the no flow protection mode.  The protection is activated only when the drive has been running for the time specified by 82.24 Flow switch check delay.	No action
	No action	No flow protection is disabled.	0
	Warning	No flow protection generates warning D5B2 No flow.	1
	Fault	No flow protection generates fault D4B2 No flow.	2
82.23	Flow switch source	Selects the source for the flow switch.	
	Not used	-	0
	Not used	-	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 290).	-
82.24	Flow switch check delay	Defines the delay time at which the flow switch supervision is inactive.  You can adjust the check delay to allow proper flow after starting the motor.	5.00 s
	0.03600.00 s	Flow switch check delay in seconds.	1 = 1 s
82.25	Soft pipe fill supervision	Selects the drive action in case the system does not reach the setpoint in time defined with parameter 82.26 Time-out limit.  The time is calculated with the last reference change in parameter 40.03 Process PID setpoint actual.  See section Soft pipe fill (page 155).	No action
	No action	Soft pipe fill time-out is disabled.	0
	Warning	Soft pipe fill supervision function generates warning D50B Pipe fill-timeout.	1
	Fault	Soft pipe fill supervision function generates fault D405 Pipe fill-timeout.	2
82.26	Time-out limit	Defines the delay time at which setpoint must be reached after last change in PID reference ramp output.	60.0 s
	0.01800.0 s	Time-out limit in seconds.	1 = 1 s
82.30	Outlet minimum pressure protection	Enables outlet minimum pressure protection function.	Disabled
	Disabled	Outlet minimum pressure protection function is disabled.	0
	Warning	Outlet minimum pressure protection function generates warning <i>D50E Outlet minimum pressure</i> when the outlet minimum pressure is below the level defined with parameter 82.31 Outlet minimum pressure warning level for a time set in 82.45 Pressure check delay.	1

No.	Name/Value	Description	Def/FbEq16
	Fault	Outlet minimum pressure protection function generates fault D408 Outlet minimum pressure when the outlet minimum pressure is below the level defined with parameter 82.32 Outlet minimum pressure fault level for a time set in parameter 82.45 Pressure check delay.	2
	Warning/Fault	Outlet minimum pressure protection function first generates a warning when the pressure is below the level defined with parameter 82.31 Outlet minimum pressure waming level for a time set in parameter 82.45 Pressure check delay. If the pressure continues to fall below the level defined with parameter 82.32 Outlet minimum pressure fault level, outlet minimum pressure fault is generated.	3
82.31	Outlet minimum pressure warning level	Defines the level at which drive should generate the outlet minimum pressure warning.  Note: By default the parameter unit will be bar. However, the unit can be changed according to the parameter 81.20  Pressure unit.	0.00 bar
	0.0032767.00 bar	Outlet minimum pressure warning level.	1 = 1 bar
82.32	Outlet minimum pressure fault level	Defines the level at which drive should generate the outlet minimum pressure fault. <b>Note:</b> By default the parameter unit will be bar. However, the unit can be changed according to the parameter 81.20 <i>Pressure unit.</i>	0.00 bar
	0.0032767.00 bar	Outlet minimum pressure fault level.	1 = 1 bar
82.35	Outlet maximum pressure protection	Enables outlet maximum pressure protection function.	Disabled
	Disabled	Outlet maximum pressure protection is disabled.	0
	Warning	Outlet maximum pressure protection function generates warning <i>D50F Outlet maximum pressure</i> when the pressure is above the level defined with parameter <i>82.37 Outlet maximum pressure warning level</i> for a time set in parameter <i>82.45 Pressure check delay</i> .	1
	Fault	Outlet maximum pressure protection function generates fault <i>D409 Outlet maximum pressure</i> when the pressure is above the level defined with parameter <i>82.38 Outlet maximum pressure fault level</i> for a time set in parameter <i>82.45 Pressure check delay</i> .	2
	Warning/Fault	Outlet maximum pressure protection function first generates a warning when the pressure is above the level defined with parameter 82.37 Outlet maximum pressure warning level for a time set in parameter 82.45 Pressure check delay. If the pressure raises above the level defined with parameter 82.38 Outlet maximum pressure fault level, outlet maximum pressure fault is generated.	3
82.37	Outlet maximum pressure warning level	Defines the level at which drive should generate the outlet maximum pressure warning.  Note: By default the parameter unit will be bar. However, the unit can be changed according to the parameter 81.20  Pressure unit.	0.00 bar
	0.0032767.00 bar	Outlet maximum pressure warning level.	1 = 1 bar

No.	Name/Value	Description	Def/FbEq16
82.38	Outlet maximum pressure fault level	Defines the level at which drive should generate the outlet maximum pressure fault.  Note: By default the parameter unit will be bar. However, the unit can be changed according to the parameter 81.20  Pressure unit.	0.00 bar
	0.0032767.00 bar	Outlet maximum pressure fault level.	1 = 1 bar
82.40	Inlet minimum pressure protection	Enables inlet minimum pressure protection function.	Disabled
	Disabled	Inlet minimum pressure protection is disabled.	0
	Warning	Inlet minimum pressure protection function generates warning <i>D510 Inlet minimum pressure</i> when the pressure is below the level defined with parameter <i>82.41 Inlet minimum pressure warning level</i> for a time set in <i>82.45 Pressure check delay</i> .	1
	Fault	Inlet minimum pressure protection function generates fault D40A Inlet minimum pressure when the pressure is below the level defined with parameter 82.42 Inlet minimum pressure fault level for a time set in 82.45 Pressure check delay.	2
	Warning/Fault	Inlet minimum pressure protection function first generates a warning when the pressure is below the level defined with parameter 82.41 Inlet minimum pressure warning level for a time set in 82.45 Pressure check delay. If the pressure continues to fall below the level defined with parameter 82.42 Inlet minimum pressure fault level, a fault is generated.	3
82.41	Inlet minimum pressure waming level	Defines the level at which drive should generate the inlet minimum pressure warning.  Note: By default the parameter unit will be bar. However, the unit can be changed according to the parameter 81.20  Pressure unit.	0.00 bar
	0.0032767.00 bar	Inlet minimum pressure warning level.	1 = 1 bar
82.42	Inlet minimum pressure fault level	Defines the level at which drive should generate the inlet minimum pressure fault.  Note: By default the parameter unit will be bar. However, the unit can be changed according to the parameter 81.20  Pressure unit.	0.00 bar
	0.0032767.00 bar	Inlet minimum pressure fault level.	1 = 1 bar
82.45	Pressure check delay	Defines the delay time at which the pressure supervisions are inactive. You can adjust check delay for a system in which the pressure does not increase immediately after starting the motor.	3.00 s
	0.003600.00 s	Pressure check delay time.	1 = 1 s
82.51	Pump autoreset selection	Selects pump protection 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 after 82.52 Pump autoreset delay time. 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.	0

83 Pump cleaning		Settings for the pump cleaning sequence. See section <i>Pump cleaning</i> (page 123).	
83.01	Pump cleaning status	Displays the status of pump cleaning.	-
	Disabled	Cleaning sequence is disabled.	0
	Pump clean	Cleaning sequence is active.	1
	No triggers configured	Triggers are not configured.	2
	Waiting for triggering	Waiting for triggering signal.	3
	Triggered	Cleaning sequence is triggered by parameter 83.11 specifies warning generation only.	4
83.02	Pump cleaning progress	Displays the pump cleaning progress.	-
	0100%	Percentage	10 = 1%
83.03	Total cleaning count	Displays the total cleaning count.	-
	04294967295	Total cleaning count.	
83.10	Pump cleaning action	Enables the pump cleaning action.	Cleaning
	Off	Pump cleaning is disabled.	0
	Cleaning	Pump cleaning is started based on triggers.	1
	Warning only	Generates warning message based on triggers.	2

No.	Name/	Value	Description		Def/FbEq16
83.11	Pump cleaning triggers		Enables/disables the pump cleaning sequence for the drive, and defines the triggering conditions.  Note: If DI1 remains On after cleaning is finished, no cleaning sequence is started. The drive starts cleaning on next start, if the trigger signal is On when motor is started.		0ь0000
	Bit	Name		Description	
	0	Reserved		1	
	1	Every start		Cleaning starts at every start.	
	2	Every stop		Cleaning starts at every stop.	
	3	Reserved			
	4	Overload d	etection	Cleaning sequence starts when overload situati detected. To set up the overload curve, see par group 37 User load curve.	
	5	Underload	detection	Cleaning sequence starts when underload situadetected. To set up the overload curve, see par group 37 User load curve.	
	6	Fixed time	interval	Time interval defined by parameter 83.15 Fixed	time interval.
	7	Combined	timer1	Combined timer 1 of timed functions starts clea Pump cleaning is triggered when Timer function See 34.01 Timed functions status (bit 0).	•
	89	Reserved Supervision 1			
	10			Cleaning sequence starts when Supervision 1 is	s high.
	11	Supervisio		Cleaning sequence starts when Supervision 2 is high.	
	12	Supervisio	n 3	Cleaning sequence starts when Supervision 3 is high.	
	13	DI4		Cleaning sequence starts when DI4 is high.	
	14	DI5		Cleaning sequence starts when DI5 is high.	
	15	DI6		Cleaning sequence starts when DI6 is high.	
	0000h.	FFFFh	Pump cleaning	ng triggers,	1 = 1
83.12	Manually force cleaning		Starts pump of	cleaning.	Not active
	Not act	ive	Pump cleanin	ng is not active.	0
	Start cl	eaning now	Starts pump of	cleaning immediately.	1
	DI4			cleaning when DI4 goes high.	2
	DI5			cleaning when DI5 goes high.	3
	DI6		Starts pump of	cleaning when DI6 goes high.	4
	Other [bit]		Source selection (see <i>Terms and abbreviations</i> on page 290).		-
83.15	Fixed to	ime interval		onstant time interval between cleaning cycles. er is used only when cleaning is triggered by	02 00:00
	00 00:0 45:12:1		Time interval	in format DD HH:MM (day hour:min).	-
83.16	Cycles prograi	in cleaning m		umber of cycles performed in cleaning program.  1 cycle = 1 forward + 1 reverse step.	3
	1655	i35	Value range.	<u> </u>	1 = 1

P 1		
ЫΙ	м	
-		
_		

86 Cavitation control		Settings for the detection and control of pump cavitation. See section <i>Parameter group 34 Timed functions (page 436)</i> . on page 133.	
86.01	Cavitation status word	Displays in which state the pump cavitation control is currently in.	0
	Disabled	Cavitation control is disabled.	0
	No cavitation detected	Cavitation control is enabled, the drive has not detected cavitation in the pump, and the drive is running normally.	1
	Cavitation detected (warning only)	The drive has detected cavitation in the pump; normal operation continues.	2
	Cavitation detected (controlling reference)	The drive has detected cavitation in the pump and the drive's speed (frequency) reference is being reduced in an attempt to eliminate the pump cavitation that has been detected.	3

No.	Name/Value	Description	Def/FbEq16
	Cavitation cleared (controlling reference)	The drive no longer has detected cavitation in the pump. The drive's speed (frequency) reference is being increased back to the value it was at prior to the initial pump cavitation detection.	4
	Cavitation detected (emptying well)	The drive has detected cavitation in the pump and the speed reference is at 86.12 Cavitation minimum speed (86.13 Cavitation minimum frequency) The drive will fault after 86.18 Cavitation empty well time.	5
	Cavitation detected (faulted)	The drive has detected cavitation in the pump and has faulted accordingly.	6
86.02	Cavitation value	The calculated ripple rms value of torque which is used in the cavitation algorithm	0.000
	0.000300.000	Calculated ripple rms value	1 = 1
86.11	Cavitation control	Selects the drive's reaction to a detection of pump cavitation. <b>Note</b> : Cavitation detection requires a pump curve; see <i>86.20</i> - <i>86.25</i> .	0
	Disabled	The pump cavitation detection algorithm is disabled. Bit 00 of 86.01 Cavitation minimum speed is set.	0
	Warning only	The drive enunciates a "Cavitation Detected" warning only, no corrective actions by the drive occurs. Bit 02 of 86.01 Cavitation status word is set when a cavitation in the pump is detected; otherwise, bit 01 is set.	1
	Control with events	The drive enunciates a "Cavitation Detected" warning and implements corrective actions until the detection is cleared or the actions fail to resolve the issue and the drive faults, at which point a <i>Cavitation Detected</i> fault is enunciated. Bit(s) 03 - 06 of 86.01 Cavitation status word are set when a cavitation in the pump is detected, depending on the situation; otherwise, bit 01 is set.	2
	Control without events	The drive does not enunciate a warning; however, it implements corrective actions until the detection is cleared or the actions fail to resolve the issue and drive faults, at which point a "Cavitation Detected" fault is enunciated. Bit(s) 03-06 of 86.01 Cavitation status word are set when a cavitation in the pump is detected, depending on the situation; otherwise, bit 01 is set.	3
	Fault only	The drive will enunciate a <i>Cavitation Detected</i> fault and stop the drive after 86.18 <i>Cavitation hold time</i> . Bit 06 of 86.01 <i>Cavitation status word</i> will be set when a cavitation in the pump is detected; otherwise, bit 01 is set.	4
86.12	Cavitation minimum speed	The minimum motor speed at which the cavitation control is enabled. This is the lowest speed the drive will adjust to while trying to resolve the detection of pump cavitation. The setting cannot be set lower than 30.11 Minimum speed  Note: This parameter is hidden when 99.04 Motor control mode is Scalar.	900 rpm
	030000 rpm	Minimum motor speed	1 = 1 rpm
86.13	Cavitation speed decrease	The speed step the drive will decrease the reference by when attempting to resolve a detected pump cavitation.  Note: This parameter is hidden when 99.04 Motor control mode is Scalar.	90 rpm
	030000 rpm	Speed step for decrease	1 = 1 rpm

Name/Value

Description

No.

Def/FbEa16

11

1 = 1 s

No.	Name/Value	Description	Def/FbEq16
	0.000300.000	Torque point	1 = 1
86.24	Cavitation curve p4	The fourth torque point in the base pump curve.	0.000
	0.000300.000	Torque point	1 = 1
86.25	Cavitation curve p5	The fifth torque point in the base pump curve.	0.000
	0.000300.000	Torque point	1 = 1
86.30	Cavitation normalization time	Tuning parameter used to calculate the RMS torque value.	10.0 s
	5.03000.0 s	Tuning parameter	10 = 1 s
86.31	Cavitation threshold	Tuning parameter used to determine the sensitivity of the cavitation detection. The higher this value is, the higher the intensity of the cavitation has to be before detecting it.	2
	1100	Tuning parameter	1 = 1
94 LS	U control	Control of the supply unit of the drive, such as DC voltage and reactive power reference.  (Only visible for ACQ580-31 and ACQ580-34).  Note that the references defined here must also be selected as the reference source in the supply control program to be effective.  See also section (page 118).	
94.01	LSU control	Enables/disables the internal INU-LSU state machine. When the state machine is enabled, the inverter unit (INU) controls the supply unit (LSU) and prevents the inverter unit from starting until the supply unit is ready. When the state machine is disabled, the status of the supply unit (LSU) is ignored by the inverter unit.	On
	Off	INU-LSU state machine disabled.	0
	On	INU-LSU state machine enabled.	1
94.02	LSU panel communication	Enables/disables control panel and PC tool access to the supply unit (line-side converter) via the inverter unit (motor-side converter).  Note: This feature is only supported by ACQ580-31 and ACQ580-34.	Disable
	Disable	Direct control panel and PC tool access to supply unit control board via inverter unit is disabled. Drive acts as single inverter on the panel bus.	0
	Enable	Direct control panel and PC tool access to supply unit control board via inverter unit is enabled. Drive unit shows as two separate units (inverter and supply unit) on the panel bus.	1
94.04	INU-LSU status word profile	Defines INU-LSU status word profile.  Note: This feature is only supported by ACQ580-31 and ACQ580-34.	ABB single drives standard SW
	ABB single drives standard SW	Drive indicates Ready run state in <i>06.11 Main status word</i> bit 1 when DC link is charged. This way the drive behaves in a similar way than -01 type drives.	0
	Backwards compatible SW	Drive indicates Ready run state in <i>06.11 Main status word</i> bit 1 after the main contactor is closed and LSU is running.	1
94.10	LSU max charging time	Defines the maximum time the supply unit (LSU) is allowed for charging before fault 7584 LSU charge failed is generated.	15 s
		laa	1

Maximum charging time.

time 0...65535 s

No.	Name/Value	Description	Def/FbEq16
95 HW	configuration	Various hardware-related settings.	
95.01	Supply voltage	Selects the supply voltage range. This parameter is used by the drive to determine the nominal voltage of the supply network. The parameter also affects the DC voltage control functions of the drive (see section DC voltage control on page 170).  WARNING! An incorrect setting may cause the motor to rush uncontrollably, or the brake chopper or resistor to overload.  Notes:  The selections shown depend on the hardware of the drive. If only one voltage range is valid for the drive in question, it is selected by default.  This parameter cannot be changed while the drive is running.	Automatic / not selected
	Automatic / not selected	If the drive supports only one voltage range, then this parameter is set to the supported value automatically:  • For voltage class -1 and -2 drives, this parameter is set to 208240 V.  • For voltage class -6, this parameter is set to 525600 V.  Automatic: In voltage class -4 drives, the supply voltage is automatically selected between 380415 V and 440480 V once after every CU boot. Supply voltage category 380415 V is internally used if 95.03 Estimated AC supply voltage is less than 415 V + 10%, otherwise category 440480 V is assumed. Note that category is internally selected without changing value of 95.01 from 0.  Note: The Automatic option applies to drive types -01, -04 (and -07).  Not selected: In voltage class -4 ULH drives, you have to select the supply voltage manually as the automatic selection is not supported by -31/34 types. Warning A6A6 Voltage category unselected appears and the drive will not start modulating before a category is selected.	0
	208240 V	208240 V	1
	380415 V	380415 V	2
	440480 V	440480 V	3
	525600 V	525600 V	5
95.02	Adaptive voltage limits	Enables adaptive voltage limits.  Adaptive voltage limits can be used if, for example, an IGBT supply unit is used to raise the DC voltage level. If the communication between the inverter and IGBT supply unit is active, the voltage limits are related to the DC voltage reference from the IGBT supply unit. Otherwise the limits are calculated based on the measured DC voltage at the end of the pre-charging sequence.  This function is also useful if the AC supply voltage to the drive is high, as the warning levels are raised accordingly.	Enable
	Disable	Adaptive voltage limits disabled.	0
	Enable	Adaptive voltage limits enabled.	1

No.	Name/Value	Description	Def/FbEq16
95.20	HW options word 1	Specifies hardware-related options that require differentiated parameter defaults.  This parameter is not affected by a parameter restore.  For motor disconnect in vector mode, make sure to:  1. set parameter 95.26 value to Disable  2. enable 31.12 bit 5. This is because when using output contactor in vector control mode, the drive may occasionally trip to Overspeed/Overfrequency fault.	-

Bit	Name	Value
0	Supply frequency 60 Hz	See section Differences in the default values between 50 Hz and 60 Hz supply frequency settings on page 577.  0 = 50 Hz.  1 = 60 Hz.
112	Reserved	
13	du/dt filter  activation  When active, an external du/dt filter is connected to the drive/inv output. The setting will limit the output switching frequency, and force the fan of the drive/inverter module to full speed.  0 = du/dt filter inactive.  1 = du/dt filter active.	
14	Reserved	
15	INU-LSU communication	*1 = IGBT supply unit control by inverter unit active. Makes several parameters visible in groups 01, 05, 06, 07, 30, 31, 60, 61, 62, 94 and 96.

<sup>\*</sup>See section (page 118).

0000hFFFFh	Hardware options configuration word.	1 = 1
95.21 HW options word 2	Specifies more hardware-related options that require differentiated parameter defaults. See parameter 95.20 HW options word 1.  WARNING! After switching any bits in this word, recheck the values of the affected parameters.	-

Bit	Name	Information
05	Reserved	
6	Cabinet drive	0 = Inactive, 1 = Active. Only for drive frames R6 or larger.
7	Cabinet fan	0 = Inactive, 1 = Active. Only for drive frames R6 or larger.
815	Reserved	

0000b0101b	Hardware options configuration word 2.	1 = 1
------------	--	-------

No.	Name/Value	Description	Def/FbEq16
95.26 Motor disconnect detection  Detects if motor is disconnected motor. We drive will do the following the follo		Detects if motor is disconnected and shows a warning of disconnected motor. When this parameter is enabled, the drive will do the following:  1. The drive detects if the motor is disconnected from the drive (all three phases).  2. When a motor disconnection is detected, the drive will stay running and waits for the motor to be connected again. The drive shows warning A784 Motor disconnect on the control panel.  3. When motor connection is again detected, the motor returns back to the last active reference before the disconnection was detected.  4. The warning message disappears from the panel. For motor disconnect in vector mode, make sure to:  1. set parameter 95.26 value to Disable  2. enable 31.12 bit 5. This is because when using output contactor in vector control mode, the drive may occasionally trip to Overspeed/Overfrequency fault.  Note: This feature is only available in scalar control mode. This parameter does not affect vector control mode behavior.	Disable
	Disable	Detecting of disconnecting motor disabled.	0
	Enable	Detecting of disconnecting motor enabled.	1
95.200	Cooling fan mode	Cooling fan operation mode.	Auto
	Auto	Fan runs normally: Fan on/off, fan speed reference can autochange according to the drive state.	0
	Always on	Fan always runs at 100% speed reference.	1

No.	Name/Value	Description		Def/FbEq16					
96 Sys	stem	Language selection; ac parameter save and re parameter sets; unit se calculation; user lock.	store; contro	l unit reboot;	user				
96.01	Language	Selects the language of displayed information v				English			
		divided in three firmwa Asian. The default package is languages marked with languages marked with	Drive supports multiple languages. The languages are divided in three firmware packages: Global, European and Asian.  The default package is Global package that supports anguages marked with X and G. European delta supports anguages marked with X and E. Asian delta supports anguages marked with X and A.						
		Language	Global package	European	Asian				
		English	Х	Х	Х	-			
		German	X	X	X	-			
		Spanish	X	X	X	-			
		Portuguese	X	X	X	1			
		French	X	X	X	1			
		Chinese (Simplified)	Х		Х	1			
		Italian	G						
		Finnish	G						
		Polish	G						
		Russian	G						
		Turkish	G						
		Dutch		E		1			
		Danish		Е		1			
		Swedish		E		1			
		Czech		E					
		Greek (Ellinika)		E					
		Hungarian (Magyar)		Е		1			
		Hebrew		(E)					
		Korean			Α	1			
		Japanese			Α	1			
		Thai			Α	1			
		X = Common langua G = Available in Glob E = Available in Euro (E) = Will be available A = Available in Asia	al package o pean packag later	only ge only	es				

No.	Name/Value	Description	Def/FbEq16
96.02	Pass code	Pass codes can be entered into this parameter to activate further access levels (see parameter 96.03 Access level status) or to configure the user lock.	
		Entering "358" toggles the parameter lock, which prevents the changing of all other parameters through the control panel or the Drive composer PC tool.	
		Entering the user pass code (by default, "10000000") enables parameters 96.10096.102, which can be used to define a new user pass code and to select the actions that are to be prevented.	
		Entering an invalid pass code will close the user lock if open, ie, hide parameters 96.10096.102. After entering the code, check that the parameters are in fact hidden. If they are not, enter another (random) pass code.	
		Note: You must change the default user pass code to maintain a high level of cybersecurity. Store the code in a safe place – ABB CANNOT UNLOCK THE DRIVE ONCE YOU CHANGE THE PASS CODE.	
		See also section <i>User lock</i> (page 233).	
	099999999	Pass code.	-
96.03	Access level status	Shows which access levels have been activated by pass codes entered into parameter 96.02 Pass code.	0001b

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

	0000hFFFFh	Active access levels.	1 = 1
96.04 Macro select		Selects the control macro. See chapter <i>Default I/O configuration</i> (page <i>101</i> ) for more information.  After a selection is made, the parameter reverts automatically to <i>Done</i> .	Done
	Done	Macro selection complete; normal operation.	0
	Water default	Factory default (page 84). For scalar motor control.	1
96.05	Macro active	Shows which control macro is currently selected. See chapter Default I/O configuration (page 101) for more information.  To change the macro, use parameter 96.04 Macro select.	Water default
	Water default	Factory default (page 84). For scalar motor control.	1
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

11

No.	Name/Value	Description	Def/FbEq16	
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).	No action	
		The value reverts to 0 automatically.		
	No action	1 = No action.		
	Reboot	1 = Reboot the control unit.	1	
96.10	User set status	Shows the status of the user parameter sets. This parameter is read-only. See also section <i>Data storage parameters</i> (page 232).	-	
	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	
	Reserved		819	
	User1 backup	User set 1 has been saved or loaded.	20	
	User2 backup	User set 2 has been saved or loaded.	21	
	User3 backup	User set 3 has been saved or loaded.	22	
	User4 backup	User set 4 has been saved or loaded.	23	
96.11	User set save/load	Enables the saving and restoring of up to four custom sets of parameter settings. See section <i>User parameter sets</i> (page 226).  The set that was in use before powering down the drive is in use after the next power-up.  Notes:  Hardware configuration settings, such as I/O extension module and fieldbus configuration parameters (groups 1416, 47, 5158 and 9293, and parameter 50.01 FBA A enable), and forced input/output values (such as 10.03 DI force selection and 10.04 DI forced data) 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.  If no sets have been saved, attempting to load a set will create all sets from the currently active parameter settings.  Switching between sets is only possible with the drive stopped.	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	

No.	Name/V	alue	Description	Def/FbEq16
96.16	Unit sele	ection	Selects the unit of parameters indicating power, and torque.	temperature 0000b
	Bit	Name	Information	
	0	Power unit	0 = kW	
			1 = hp	
	1	Reserved	I	
	2	Temperatu unit	0 = °C 1 = °F	
	3	Reserved	I = F	
	4	Torque uni	0 = Nm (N·m)	
		'	1 = lbft (lb·ft)	
	515	Reserved		
	<u>-</u>	-		
	0000h	.FFFFh	Jnit selection word.	1 = 1
96.20	Time syl	nc primary	Defines the first priority external source for synch he drive's time and date. The date and time can also be directly set into p 26.2496.26, in which case this parameter is ic	parameters FB
	Reserve	ed .		12
	Fieldbus A		Fieldbus interface A, FENA/FPNO can get the ti SNTP server and set it as time for the drive.	me from 3
	Reserve	d		45
	Embedd	led FB	Embedded fieldbus interface. The embedded fienterface has no function on ACQ drives.	eldbus 6
	Reserve	:d		7
	Panel lir	nk	Control panel, or Drive composer PC tool connectontrol panel. You can set the time using the cora PC tool connected to the panel link.	
	Ethernet tool link		Drive composer PC tool through a FENA module he time manually using DCP over Ethernet. The set in the same way when you do it with USB ar	e time can be
96.24	96.24 Full days since 1st Jan 1980		The number of full days passed since beginning 1980. This parameter, together with 96.25 Time within 24h and 96.26 Time in ms within one min bossible to set the date and time in the drive via parameter interface from a fieldbus or application this may be necessary if the fieldbus protocol disupport time synchronization.	in minutes ute makes it the on program.
	15999	99 days	Days since beginning of 1980.	1 = 1 day
96.25	Time in within 24		The number of full minutes passed since midnig example, the value 860 corresponds to 2:20 pm parameter <u>96.24 Full days since 1st Jan 1980</u> .	
	11439	) min	Minutes since midnight.	1 = 1 min
96.26	Time in one min	ms within ute	The number of milliseconds passed since the pr ninute. See parameter <u>96.24 Full days since 1s</u>	
	05999	99 ms	Number of milliseconds since last minute.	1 = 1 ms
96.39	Event co	onfiguration	Selects the events that will be logged in the eve	nt logger. 1111 1111b

No.	Name/Value De		Des	scription	Def/FbEq16	
	Bit Name			Information		
	0	Power app	liod	1 = Enabled = Event <i>B5A2</i> will be logged		
	ľ			0 = Disabled = Event will not be logged		
	1	Hand mode		1 = Enabled = Event <i>B681</i> will be logged		
	1	selected		0 = Disabled = Event will not be logged		
	2	Off mode		1 = Enabled = Event <i>B682</i> will be logged		
		selected		0 = Disabled = Event will not be logged		
	3	Auto mode		1 = Enabled = Event <i>B683</i> will be logged		
		selected		0 = Disabled = Event will not be logged		
	4	Auto start		1 = Enabled = Event B687 will be logged		
		command		0 = Disabled = Event will not be logged		
	5	Auto stop		1 = Enabled = Event <i>B688</i> will be logged		
		command		0 = Disabled = Event will not be logged		
	6	Modulating		1 = Enabled = Event <i>B689</i> will be logged		
		started		0 = Disabled = Event will not be logged		
	7	Modulating		1 = Enabled = Event <i>B68A</i> will be logged		
		stopped		0 = Disabled = Event will not be logged		
	05999	9	Bitn	nask of logged events.	1 = 1	
96.51	Clear fau			ars all events from the drive's fault and event logs. See tion <i>Warning/fault history</i> on page 238.	Done	
	Done		0 =	No action	0	
	Reset		1 =	Clear the loggers.	1	
96.54	• 1		• M	ects how the drive reacts when 96.55 Checksum control word, bit 8 = 1 (Approved thecksum A): if the parameter checksum 96.68 Actual thecksum A does not match 96.71 Approved checksum A, and/or when 96.55 Checksum control word, bit 9 = 1 (Approved thecksum B): if the parameter checksum 96.69 Actual thecksum B does not match 96.72 Approved checksum B.	No action	
	No action	n	No	action taken. (The checksum feature is not in use.)	0	
	Pure eve	ent		re generates an event log entry <i>B686 Checksum</i> match.	1	
	Warning		Driv	re generates warning A686 Checksum mismatch.	2	
	Warning prevent			re generates warning <i>A686 Checksum mismatch</i> . Starting drive is prevented.	3	
	Fault		Driv	re trips on fault 6200 Checksum mismatch.	4	

No.	Name/Value	Description	Def/FbEq16
96.55	Checksum control word	Bits 89 select which comparison(s) are made:  • Bit 8 = 1 (Approved checksum A): 96.68 Actual checksum A is compared to 96.71 Approved checksum A, and/or  • Bit 9 = 1 (Approved checksum A): if 96.69 Actual checksum B is compared to 96.72 Approved checksum B.  Bits 1213 select approved (reference) checksum parameter(s) into which the actual checksum(s) from parameter(s) are copied:  • Bit 12 = 1 (Set approved checksum A): Value of 96.68 Actual checksum A is copied into 96.71 Approved checksum A, and/or  • Bit 13 = 1 (Set approved checksum B): Value of 96.69 Actual checksum B copied into 96.72 Approved checksum B.	0000h

Bit	Name	Description
07	Reserved	
8	Approved checksum A	1 = Enabled: Checksum A (96.71) is observed. 0 = Disabled.
9	Approved checksum B	1 = Enabled: Checksum B (96.72) is observed. 0 = Disabled.
1011	Reserved	
12	Set approved checksum A	1 = Set: Copy value of 96.68 into 96.71. 0 = Done (copy has been made).
13	Set approved checksum B	1 = Set: Copy value of 96.69 into 96.72. 0 = Done (copy has been made).
1415	Reserved	•

			1
	0000hFFFFh	Checksum control word.	1 = 1
96.68	Actual checksum A	Displays the actual parameter configuration checksum. Checksum A calculation does not include • fieldbus settings.  The parameters included in the calculation are user editable parameters in parameter groups 1013, 15, 1925, 28, 3032, 3437, 4041, 43, 4546, 7074, 76, 80, 9499.  See also section Parameter checksum calculation (page 232).	-
	00000000h FFFFFFFh	Actual checksum.	-
96.69	Actual checksum B	Displays the actual parameter configuration checksum B. Checksum B calculation does not include  • fieldbus settings  • motor data settings  • energy data settings.  The parameters included in the calculation are user editable parameters in parameter groups 1013, 15, 1925, 28, 3032, 34, 3537, 4041, 43, 46, 7074, 76, 80, 9497. See also section <i>Parameter checksum calculation</i> (page 232).	-
	00000000h FFFFFFFh	Actual checksum.	-

No.	Name/Value	Description	Def/FbEq16
96.70	Disable adaptive program	Enables/disables the adaptive program (if present). See also section <i>Adaptive programming</i> (page <i>113</i> ).	Yes
	No	Adaptive program enabled.	0
	Yes	Adaptive program disabled.	1
96.71	Approved checksum A	Approved (reference) checksum A.	0h
	00000000h FFFFFFFh	Approved checksum A.	-
96.72	Approved checksum B	Approved (reference) checksum B.	0h
	00000000h FFFFFFFh	Approved checksum B.	-
96.78	Legacy Modbus mapping	This parameter enables ACx550 Modbus register mapping on ACx580 drives, for registers currently supported. Enabling this parameter will change the drive's Modbus register mapping to match that of the ACx550.  This parameter is typically used in situations where an ACx580 drive is replacing an ACx550 drive that had been communicating via Modbus to an external controller. Activation of this parameter allows the ACx580 drive to emulate the ACx550 drive for certain Modbus registers and eliminates the need to adjust the external controller's code for those Modbus registers.  This sets parameter 58.33 Addressing mode value to Mode 0.	
	Disable	The ACx580 drive will use the Modbus register mapping defined for the ACx580 drive.	0
	Enable	The ACx580 drive will use the Modbus register mapping defined for the ACx550 drive (for the currently supported registers).	1
	Enabled, DCU profile only	Using legacy control profile enabled. For use with some external option modules, for example, FDNA-01.	2
96.79	Legacy control profile	This parameter enables ACx550 control profiles on ACx580 drives. Note that if the parameter selection changes, also parameter 58.25 Control profile changes to a matching selection and the parameter is locked.  This feature is useful when replacing an existing ACx550 drive with a new ACx580 drive when it is not easy to change the control program.  This parameter is typically used in situations where an ACx580 drive is replacing an ACx550 drive that had been communicating with an external controller via Modbus. This parameter allows the ACx580 drive to use the same control profiles as the ACx550 drive and eliminates the need to adjust the external controller's code for drive control.	Not selected
	Not selected	The ACx580 drive will use whichever profile is selected by parameter 58.25 Control profile.	0
	DCU profile	The ACx580 drive will use the DCU profile from the ACx550 application. Parameter 58.25 Control profile value will be set to DCU Profile.	1
	ABB drives full	This selection is the same as setting parameter 58.25 Control profile value to ABB Drives.	2

	,
ы	и

		Description	Def/FbEq16	
		The ACx580 drive will use the ABB drives limited profile from the ACx550 application. Parameter 58.25 Control profile value is set to ABB Drives.	3	
96.100	(Visible when user lock is open)  To change the current user pass code, enter a new code  To change the current user pass code, enter a new code this parameter as well as 96.101 Confirm user pass code warning will be active until the new pass code is confired to cancel changing the pass code, close the user lock confirming. To close the lock, enter an invalid pass code parameter 96.02 Pass code, activate parameter 96.0 Control board boot, or cycle the power.  See also section Parameter checksum calculation (page 232).		1000000	
	10000000 99999999	New user pass code.	-	
96.101	Confirm user pass code	(Visible when user lock is open) Confirms the new user pass code entered in 96.100 Change user pass code.		
	10000000 99999999	Confirmation of new user pass code.	-	

No.	Name/Value	Description	Def/FbEq16
96.102	User lock functionality	(Visible when user lock is open) Selects the actions or functionalities to be prevented by the user lock. Note that the changes made will take effect only when the user lock is closed. See parameter 96.02 Pass code.  Note: We recommend you select all the actions and functionalities unless otherwise required by the application.	1000Ь

Bit	Name	Information	
0	Disable ABB access levels	1 = ABB access levels (service, advanced programmer, etc.; see 96.03) disabled	
1	Freeze parameter lock state	1 = Changing the parameter lock state prevented, ie, pass code 358 has no effect	
2	Disable file download	= Loading of files to drive prevented. This applies to     firmware upgrades     parameter restore     loading an adaptive program     changing home view of control panel     editing drive texts     editing the favorite parameters list on control panel     configuration settings made through control panel such as time/date formats and enabling/disabling clock display.	
3	Reserved		
4	Disable backups	0 = Backups are enabled. 1 = Backups are disabled.	
5	Reserved		
6	Protect application	1 = Creating a backup and restoring from a backup prevented.	
7	Disable panel Bluetooth	Bluetooth disabled on ACH-AP-W control panel. If the drive is part of a panel bus, Bluetooth is disabled on all control panels.	
8	Protect AP	backup operation is allowed and AP will be part of the backup file.     1 = backup operation is allowed but AP is protected and will not be part of the backup file.  Note: Access to AP is prevented when this bit is set.	
910	Reserved		
11	Disable OEM access level 1	s 1 = OEM access level 1 disabled	
12	Disable OEM access level 2	1 = OEM access level 2 disabled	

	0000hFFFFh	Selection of actions to be prevented by user lock.	1 = 1
96.108	LSU control board boot	(Only visible for ACQ580-31 and ACQ580-34). Changing the value of this parameter to 1 reboots the supply control unit (without requiring a power off/on cycle of the drive system). The value reverts to 0 automatically.	0
	01	1 = Reboot the supply control unit.	1 = 1

No.	Name/Value	Description	Def/FbEq16
97 Mo	tor control	Switching frequency; slip gain; voltage reserve; flux braking; anti-cogging (signal injection); IR compensation.	
97.01	Switching frequency reference	Defines the switching frequency of the drive that is used as long as the drive stays below the thermal limit. See section Switching frequency on page 200.  Higher switching frequency results in lower acoustic motor noise. Lower switching frequency generates less switching losses and reduce EMC emissions.  Notes:  If you have a multimotor system, contact your local ABB representative.  With the CPTC-02 ATEX-certified thermistor protection module, follow the instructions given in the CPTC-02 ATEX-certified thermistor protection module, Ex II (2) GD (+L537+Q971) user's manual (3AXD50000030058 [English]).  With an ABB EX motor, follow the instructions given in the ABB EX motor documentation.	4 kHz
	2 kHz	2 kHz.	2
	4 kHz	4 kHz.	4
	8 kHz	8 kHz.	8
	12 kHz	12 kHz.	12
97.02	Minimum switching frequency	Lowest switching frequency value that is allowed. Depends on the frame size.  When drive is reaching the thermal limit, it will automatically start to reduce the switching frequency until the minimum allowed value is reached. Once the minimum has been reached, the drive will automatically start limiting the output current to keep the temperature below the thermal limit. Inverter temperature is shown by parameter 05.11 Inverter temperature.  Notes:  With the CPTC-02 ATEX-certified thermistor protection module, follow the instructions given in the CPTC-02 ATEX-certified thermistor protection module, Ex II (2) GD (+L537+Q971) user's manual (3AXD50000030058 [English]).  With an ABB EX motor, follow the instructions given in the ABB EX motor documentation.	2 kHz
	1.5 kHz	1.5 kHz. Not for all frame sizes.	1
	2 kHz	2 kHz.	2
	4 kHz	4 kHz.	4
	8 kHz	8 kHz.	8
	12 kHz	12 kHz.	12

No.	Name/Value	Description	Def/FbEq16
97.03	Slip gain	Defines the slip gain which is used to improve the estimated motor slip. 100% means full slip gain; 0% means no slip gain. The default value is 100%. Other values can be used if a static speed error is detected despite having the setting at full slip gain.  Example (with nominal load and nominal slip of 40 rpm): A 1000 rpm constant speed reference is given to the drive. Despite having full slip gain (= 100%), a manual tachometer measurement from the motor axis gives a speed value of 998 rpm. The static speed error is 1000 rpm - 998 rpm = 2 rpm. To compensate the error, the slip gain should be increased to 105% (2 rpm / 40 rpm = 5%).	100%
	0200%	Slip gain.	1 = 1%
97.04	Voltage reserve	Defines the minimum allowed voltage reserve. When the voltage reserve has decreased to the set value, the drive enters the field weakening area.   Note: This is an expert level parameter and should not be adjusted without appropriate skill.   If the intermediate circuit DC voltage $U_{\rm dc}$ = 550 V and the voltage reserve is 5%, the RMS value of the maximum output voltage in steady-state operation is $0.95 \times 550 \text{ V}$ / 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.   Warning: Decreasing the voltage reserve parameter to -5% to get higher voltage leads to higher harmonics in output current, typically 8-10% as the drive is operating in overmodulation region.	-2%
	-550%	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
97.08	Optimizer minimum torque	This parameter can be used to improve the control dynamics of a synchronous reluctance motor or a salient permanent magnet synchronous motor.  As a rule of thumb, define a level to which the output torque must rise with minimum delay. This will increase the motor current and improve the torque response at low speeds.	0.0%
	0.0 1600.0%	Optimizer torque limit.	10 = 1%

No.	Name/Value	Description	Def/FbEq16
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.  For ACQ580-01 frames R6R9 as well as ACQ580-31 and ACQ580-34 drives.	Disabled
	Disabled	Anti-cogging disabled.	0
	Enabled (5%)	Anti-cogging enabled with amplitude level of 5%.	1
	Enabled (10%)	Anti-cogging enabled with amplitude level of 10%.	2
	Enabled (15%)	Anti-cogging enabled with amplitude level of 15%.	3
	Enabled (20%)	Anti-cogging enabled with amplitude level of 20%.	4
97.11	TR tuning	Rotor time constant tuning. This parameter can be used to improve torque accuracy in closed-loop control of an induction motor. Normally, the motor identification run provides sufficient torque accuracy, but manual fine-tuning can be applied in exceptionally demanding applications to achieve optimal performance.  Note: This is an expert level parameter and should not be adjusted without appropriate skill.	100%
	25400%	Rotor time constant tuning.	1 = 1%

	~
ΣıΙ	Ea II
-	

No.	Name/Value	Description	Def/FbEq16
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.  Notes:  The <i>Ulf</i> function cannot be used with energy optimization; if 45.11 Energy optimizer is set to Enable, parameter 97.20 <i>U/F ratio</i> is ignored.  With the CPTC-02 ATEX-certified thermistor protection module, follow the instructions given in the <i>CPTC-02 ATEX-certified thermistor protection module, Ex II (2) GD (+L537+Q971) user's manual</i> (3AXD50000030058 [English]).	Squared
	Linear	Linear ratio for constant torque applications.	0
	Squared	Squared ratio for centrifugal pump and fan applications. With squared U/f ratio the noise level is lower for most operating frequencies. Not recommended for permanent magnet motors.	1
97.48	UDC stabilizer	Enables or disables the DC bus voltage stabilizer.	Disabled
	Disabled	DC bus voltage stabilizer disabled.	0
	Enabled min	DC bus voltage stabilizer enabled, minimum stabilization.	50
	Enabled mild	DC bus voltage stabilizer enabled, mild stabilization.	100
	Enabled medium	DC bus voltage stabilizer enabled, medium stabilization.	300
	Enabled strong	DC bus voltage stabilizer enabled, strong stabilization.	500
	Enabled max	DC bus voltage stabilizer enabled, maximum stabilization.	800
97.49	Slip gain for scalar	Sets gain for slip compensation in percent when the drive is operating in scalar control mode.  A squirrel-cage motor slips under load. Increasing the frequency as the motor torque increases compensates for the slip.  Note: This parameter is only effective in scalar motor control mode (parameter 99.04 Motor control mode is set to Scalar).	0%
	0200%	0% = No slip compensation. 0200% = Increasing slip compensation. 100% means full slip compensation according to parameter 99.08 Motor nominal frequency and 99.09 Motor nominal speed.	1 = 1%
97.94	IR comp max frequency	Sets the frequency at which IR compensation set by parameter 97.13 IR compensation reaches 0 V. Unit is percent of the motor nominal frequency.	50.0%
	1.0200.0%	Frequency.	1 = 1%
97.135	UDC ripple	Calculates ripple voltage.	-
_	0.0200.0 V	Voltage	1 = 1 V

ш

No.	Name/Value	Description	Def/FbEq16
98.08	PM flux user	Defines the permanent magnet flux.  Note: This parameter is valid only for permanent magnet motors.	0.00000 p.u.
	0.00000 2.00000 p.u	Permanent magnet flux in per unit.	
98.09	Rs user SI	Defines the stator resistance $R_S$ of the motor model.	0.00000 ohm
	0.00000100.000 00 ohm	Stator resistance.	100 = 1 ohm
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
	0.00000100.000 00 ohm	Rotor resistance.	100 = 1 ohm
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 = 1 mH
98.12	SigmaL user SI	Defines the leakage inductance $\sigma \mathcal{L}_S$ . <b>Note:</b> This parameter is valid only for asynchronous motors.	0.00 mH
	0.00100000.00 mH	Leakage inductance.	1 = 1 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 = 1 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 = 1 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
	SynRM	Synchronous reluctance motor. Three-phase AC synchronous motor with salient pole rotor without permanent magnets. With synchronous reluctance motors you must use vector control.	2
	PMaSynRM	Permanent Magnet Assisted Synchronous Reluctance Motor	3
	•	1 , , , , , , , , , , , , , , , , , , ,	L

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, for example, 60 V per 1000 rpm, the voltage for a nominal speed of 3000 rpm is 3 × 60 V = 180 V.  • The stress on the motor insulation is always dependent on the drive supply voltage. This also applies to the case where the motor voltage rating is lower than that of the drive and the supply.  • This parameter cannot be changed while the drive is	0.0 ∨
	0.0960.0 V	running.  Nominal voltage of the motor.	10 = 1 V
99.08	Motor nominal frequency	Defines the nominal motor frequency. This setting must match the value on the rating plate of the motor.  Note: This parameter cannot be changed while the drive is running.	50.00 Hz
	0.00500.00 Hz	Nominal frequency of the motor.	10 = 1 Hz
99.09	Motor nominal speed	Defines the nominal motor speed. The setting must match the value on the rating plate of the motor.  Note: This parameter cannot be changed while the drive is running.	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.  For 16-bit scaling, see parameter 46.04 Power scaling.	0.00 kW or hp
	0.00 10000.00 kW or 0.00 13404.83 hp	Nominal power of the motor.	1 = 1 unit
99.11	Motor nominal cos ?	Defines the cosphi of the motor for a more accurate motor model. The value is not obligatory, but is useful with an asynchronous motor, especially when performing a standstill identification run. With a permanent magnet or synchronous reluctance motor, this value is not needed.  Notes:  Do not enter an estimated value. If you do not know the exact value, leave the parameter at zero.  This parameter cannot be changed while the drive is running.	0.00
	0.001.00	Cosphi of the motor.	100 = 1

No.

Name/Value

Description

Def/FbEa16

11

ĽΠ	ra III
ш.	
-	-

No. Na	me/Value	Description	Def/FbEq16
No	ormal	Normal ID run. Guarantees good control accuracy for all cases. The ID run takes about 90 seconds. This mode should be selected whenever it is possible.  Notes:  If the load torque will be higher than 20% of motor nominal torque, or if the machinery is not able to withstand the nominal torque transient during the ID run, then the driven machinery must be de-coupled from the motor during a Normal ID run.  Check the direction of rotation of the motor before starting the ID run. During the run, the motor will rotate in the forward direction.  WARNING! The motor will run at up to approximately 50100% of the nominal speed during the ID run. ENSURE THAT IT IS SAFE TO RUN THE MOTOR BEFORE PERFORMING THE ID RUN!	1
Re	educed	Reduced ID run. This mode should be selected instead of the Normal or Advanced ID run if  • mechanical losses are higher than 20% (ie. the motor cannot be de-coupled from the driven equipment), or if  • flux reduction is not allowed while the motor is running (ie. in case of a motor with an integrated brake supplied from the motor terminals).  With this ID run mode, the resultant motor control in the field weakening area or at high torques is not necessarily as accurate as motor control following a Normal ID run. Reduced ID run is completed faster than the Normal ID run (< 90 seconds).  Note: Check the direction of rotation of the motor before starting the ID run. During the run, the motor will rotate in the forward direction.  WARNING! The motor will run at up to approximately 50100% of the nominal speed during the ID run. ENSURE THAT IT IS SAFE TO RUN THE MOTOR BEFORE PERFORMING THE ID RUN!	2
Sta	andstill	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 (for example, with lift or crane applications).	3
Re	eserved		4
me	ırrent easurement libration	Current offset and gain measurement calibration is set to calibrate the control loops. The calibration will be performed at the next start. Only for frames R6R11.	5

Name/Value

Advanced

Description

across the whole operating area.

Def/FbEa16

No.

Advanced ID run. 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

**Note:** The driven machinery must be de-coupled from the motor because of high torque and speed transients that are

### 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	50.000	60.000		
13.18	AO1 source max	50.0	60.0		
22.26	Constant speed 1	300.00 rpm	360.00 rpm		
22.27	Constant speed 2	600.00 rpm	720.00 rpm		
22.28	Constant speed 3	900 .00 rpm	1080.00 rpm		
22.29	Constant speed 4	1200.00 rpm	1440.00 rpm		
22.30	Constant speed 5	1500.00 rpm	1800.00 rpm		
22.31	Constant speed 6	2400.00 rpm	2880.00 rpm		
22.32	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>
30.12	Maximum speed	1500.00 rpm	1800.00 rpm
30.14	Maximum frequency	50.00 Hz	60.00 Hz
31.26	Stall speed limit	150.00 rpm	180.00 rpm
31.27	Stall frequency limit	15.00 Hz	18.00 Hz
31.30	Overspeed trip margin	500.00 rpm	500.00 rpm
46.01	Speed scaling	1500.00 rpm	1800.00 rpm
46.02	Frequency scaling	50.00 Hz	60.00 Hz
46.31	Above speed limit	1500.00 rpm	1800.00 rpm
46.32	Above frequency limit	50.00 Hz	60.00 Hz

#### Parameters supported by Modbus legacy compatibility

Legacy compatibility mode is a way to communicate with a legacy drive in such a way that it looks like the legacy drive over Modbus RTU or Modbus TCP. This mode can be enabled by changing parameter 96.78 Legacy Modbus mapping to Enable.

In the legacy compatibility mode all supported parameters can be read as if the drive were a legacy drive. Some parameters are read only and do not support writes. See the table below to see which parameters support writes.

Legacy parameter	Name	Read/Write		
01.01	SPEED & DIR	Read only		
01.02	SPEED	Read only		
01.03	OUTPUT FREQ	Read only		
01.04	CURRENT	Read only		
01.05	TORQUE	Read only		
01.06	POWER	Read only		
01.07	DC BUS VOLTAGE	Read only		
01.09	OUTPUT VOLTAGE	Read only		
01.10	DRIVE TEMP	Read only		
01.11	EXTERNAL REF 1	Read only		
01.13	CTRL LOCATION	Read only		
01.14	RUN TIME	Read only		
01.15	KWH COUNTER	Read only		
01.18	DI 1-3 STATUS	Read only		
01.19	DI 4-6 STATUS	Read only		
01.20	Al 1	Read only		
01.21	Al 2	Read only		
01.22	RO 1-3 STATUS	Read only		
01.23	RO 4-6 STATUS	Read only		
01.24	AO 1	Read only		
01.25	AO 2	Read only		
01.26	PID 1 OUTPUT	Read only		
01.27	PID 2 OUTPUT	Read only		
01.28	PID 1 SETPNT	Read only		
01.29	PID 2 SETPNT	Read only		
01.30	PID 1 FBK	Read only		
01.31	PID 2 FBK	Read only		
01.32	PID 1 DEVIATION Read only			
01.33	PID 2 DEVIATION	Read only		

Legacy parameter	Name	Read/Write
01.34	COMM RO WORD	Read only
01.35	COMM VALUE 1	Read only
01.36	COMM VALUE 2	Read only
01.41	MWH COUNTER	Read only
01.43	DRIVE ON TIME	Read only
01.45	MOTOR TEMP	Read only
01.50	CB TEMP	Read only
01.74	SAVED KWH	Read only
01.75	SAVED MWH	Read only
01.77	SAVED AMOUNT 2	Read only
01.78	SAVED CO2	Read only
03.01	FB CMD WORD 1	Read only
03.02	FB CMD WORD 2	Read only
03.03	FB STS WORD 1	Read only
03.04	FB STS WORD 2	Read only
03.05	FAULT WORD 1	Read only
03.06	FAULT WORD 2	Read only
03.07	FAULT WORD 3	Read only
03.08	ALARM WORD 1	Read only
03.09	ALARM WORD 2	Read only
04.01	LAST FAULT	Read only
04.12	PREVIOUS FAULT 1	Read only
04.13	PREVIOUS FAULT 2	Read only
10.01	EXT1 COMMANDS Read/V	
10.02	EXT2 COMMANDS	Read/Write
10.03	DIRECTION	Read/Write
10.04	JOGGING SEL	Read/Write
11.02	EXT1/EXT2 SEL	Read/Write
11.03	REF1 SELECT	Read/Write

Legacy	Name	Read/Write
parameter		.001:1
11.04	REF1 MIN	Read/Write
11.05	REF1 MAX	Read/Write
11.06	REF2 SEL	Read/Write
11.07	REF2 MIN	Read/Write
11.08	REF2 MAX	Read/Write
12.01	CONST SPEED SEL	Read/Write
12.02	CONST SPEED 1	Read/Write
12.03	CONST SPEED 2	Read/Write
12.04	CONST SPEED 3	Read/Write
12.05	CONST SPEED 4	Read/Write
12.06	CONST SPEED 5	Read/Write
12.07	CONST SPEED 6	Read/Write
15.02	CONST SPEED 7	Read/Write
15.03	AO1 CONTENT MAX	Read/Write
15.04	MINIMUM AO1	Read/Write
15.05	MAXIMUM AO1	Read/Write
15.08	AO2 CONTENT MIN	Read/Write
15.09	AO2 CONTENT MAX	Read/Write
15.10	MINIMUM AO2	Read/Write
15.11	MAXIMUM AO2	Read/Write
16.01	RUN ENABLE	Read/Write
16.02	PARAMETER LOCK	Read/Write
16.03	PASS CODE	Read/Write
16.08	START ENABLE 1	Read/Write
16.09	START ENABLE 2	Read/Write
20.01	MINIMUM SPEED	Read/Write
20.02	MAXIMUM SPEED	Read/Write
20.03	MAX CURRENT	Read/Write
20.06	UNDERVOLT CRTL	Read/Write
20.07	MINIMUM FREQ	Read/Write
20.08	MAXIMUM FREQ	Read/Write
20.13	MIN TORQUE SEL	Read/Write
20.14	MAX TORQUE SEL	Read/Write
20.15	MIN TORQUE 1	Read/Write
20.16	MIN TORQUE 2	Read/Write
20.17	MAX TORQUE 1	Read/Write
20.18	MAX TORQUE 2	Read/Write
21.02	STOP FUNCTION	Read/Write
21.03	DC MAGN TIME	Read/Write
	1	1

	_	_	
Legacy parameter	Name	Read/Write	
21.05	DC HOLD SPEED	Read/Write	
21.06	DC CURR REF	Read/Write	
21.09	EMERG STOP SEL	Read/Write	
21.12	ZERO SPEED DELAY	Read/Write	
21.13	START DELAY	Read/Write	
22.02	ACCELER TIME 1	Read/Write	
22.03	DECELER TIME 1	Read/Write	
22.04	RAMP SHAPE 1	Read/Write	
22.05	ACCELER TIME 2	Read/Write	
22.06	DECELER TIME 2	Read/Write	
22.07	RAMP SHAPE 2	Read/Write	
22.08	EMERG DEC TIME	Read/Write	
23.01	PROP GAIN	Read/Write	
23.02	INTEGRATION TIME	Read/Write	
23.03	DERIVATION TIME	Read/Write	
23.04	ACC COMPENSATION	Read/Write	
30.02	PANEL COMM ERR	Read/Write	
30.03	EXTERNAL REF 1	Read/Write	
30.04	EXTERNAL REF 2	Read/Write	
30.05	MOT THERM POT	Read/Write	
30.06	MOT THERM TIME	Read/Write	
30.07	MOT LOAD CURVE	Read/Write	
30.08	ZERO SPEED LOAD	Read/Write	
30.09	BREAK POINT FREQ	Read/Write	
30.10	STALL FUNCTION	Read/Write	
30.11	STALL FREQUENCY	Read/Write	
30.12	STALL TIME	Read/Write	
30.17	EARTH FAULT	Read/Write	
30.18	COMM FAULT FUNC	Read/Write	
30.19	COMM FAULT TIME	Read/Write	
30.22	AI2 FAULT LIMIT	Read/Write	
30.23	WIRING FAULT	Read/Write	
33.01	FIRMWARE	Read only	
33.02	LOADING PACKAGE Read or		
33.03	TEST DATE	Read only	
33.04	DRIVE RATING	Read only	
40.01	GAIN	Read/Write	
40.02	INTEGRATION TIME	Read/Write	
40.03	DERIVATION TIME	Read/Write	

Legacy parameter	Name	Read/Write
40.04	PID DERIV FILTER	Read/Write
40.08	0% VALUE	Read/Write
40.09	100% VALUE	Read/Write
40.10	SET POINT SEL	Read/Write
40.11	INTERNAL SETPNT	Read/Write
40.12	SETPOINT MIN	Read/Write
40.13	SETPOINT MAX	Read/Write
40.14	FBK SEL	Read/Write
40.15	FBK MULTIPLIER	Read/Write
40.16	ACT 1 INPUT	Read/Write
40.17	ACT 2 INPUT	Read/Write
40.24	PID SLEEP DELAY	Read/Write
40.25	WAKE-UP DEV	Read/Write
40.26	WAKE-UP DELAY	Read/Write
40.27	PID 1 PARAM SET	Read/Write
41.01	GAIN	Read/Write
41.02	INTEGRATION TIME	Read/Write
41.03	DERIVATION TIME	Read/Write
41.04	PID DERIV FILTER	Read/Write
41.08	0% VALUE	Read/Write
41.09	100% VALUE	Read/Write
41.10	SET POINT SEL	Read/Write

Legacy parameter	Name	Read/Write
41.11	INTERNAL SETPNT	Read/Write
41.12	SETPOINT MIN	Read/Write
41.13	SETPOINT MAX	Read/Write
41.14	FBK SEL	Read/Write
41.15	FBK MULTIPLIER	Read/Write
41.16	ACT 1 INPUT	Read/Write
41.17	ACT 2 INPUT	Read/Write
41.24	PID SLEEP DELAY	Read/Write
41.25	WAKE-UP DEV	Read/Write
41.26	WAKE-UP DELAY	Read/Write
42.11	INTERNAL SETPNT	Read/Write
53.05	EFB CTRL PROFILE	Read/Write
99.01	LANGUAGE	Read/Write
99.04	MOTOR CTRL MODE	Read/Write
99.05	MOTOR NOM VOLT	Read/Write
99.06	MOTOR NOM CURR	Read/Write
99.07	MOTOR NOM FREQ	Read/Write
99.08	MOTOR NOM SPEED	Read/Write
99.09	MOTOR NOM POWER	Read/Write
99.10	ID RUN	Read/Write
99.15	MOTOR COS PHI	Read/Write



# 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 289).

#### 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 control 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 289).
List	Selection list.

Term	Definition
No.	Parameter number.
РВ	Packed Boolean (bit list).
Real	Real number.
Туре	Parameter type. See Analog src, Binary src, List, PB, Real.

## Fieldbus addresses

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

# Parameter groups 1...9

No.	Name	Туре	Range	Unit	FbEq32
01 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	100 = 1 kW
01.15	Output power % of motor 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
01.31	Ambient temperature	Real	-40.0120.0	°C or °F	10 = 1 unit
01.50	Current hour kWh	Real	0.001000000.00	kWh	100 = 1 kWh
01.51	Previous hour kWh	Real	0.001000000.00	kWh	100 = 1 kWh
01.52	Current day kWh	Real	0.001000000.00	kWh	100 = 1 kWh
01.53	Previous day kWh	Real	0.001000000.00	kWh	100 = 1 kWh
01.54	Cumulative inverter energy	Real	-200000000.0 200000000.0	kWh	1 = 1 kWh
01.55	Inverter GWh counter (resettable)	Real	065535	GWh	1 = 1 GWh
01.56	Inverter MWh counter (resettable)	Real	01000	MWh	1 = 1 MWh
01.57	Inverter kWh counter (resettable)	Real	01000	kWh	1 = 1 kWh
01.58	Cumulative inverter energy (resettable)	Real	-200000000.0 200000000.0	kWh	1 = 1 kWh
01.61	Abs motor speed used	Real	0.0030000.00	rpm	100 = 1 rpm
01.62	Abs motor speed %	Real	0.001000.00%	%	100 = 1%
01.63	Abs output frequency	Real	0.00500.00 Hz	Hz	100 = 1 Hz
01.64	Abs motor torque	Real	0.01600.0	%	10 = 1%
01.65	Abs output power	Real	0.0032767.00	kW	100 = 1 kW
01.66	Abs output power % motor nom	Real	0.00300.00	%	100 = 1%
01.68	Abs motor shaft power	Real	0.0032767.00	kW or hp	100 = 1 unit

No.	Name	Type	Range	Unit	FbEq32
01.72	U-phase RMS current	Real	0.0030000.00	Α	100 = 1 A
01.73	V-phase RMS current	Real	0.0030000.00	Α	100 = 1 A
01.74	W-phase RMS current	Real	0.0030000.00	Α	100 = 1 A
	(Parameters 01.10201.164 only visible for ACQ580-31 and ACQ580-34).				
01.102	Line current	Real	0.0030000.00	Α	100 = 1 A
01.104	Active current	Real	0.0030000.00	Α	100 = 1 A
01.106	Reactive current	Real	0.0030000.00	Α	100 = 1 A
01.108	Grid frequency	Real	0.00100.00	Hz	100 = 1 Hz
01.109	Grid voltage	Real	0.002000.00	V	100 = 1 V
01.110	Grid apparent power	Real	-30000.0030000.00	kVA	100 = 1 kVA
01.112	Grid power	Real	-30000.0030000.00	kW	100 = 1 kW
01.114	Grid reactive power	Real	-30000.0030000.00	kvar	100 = 1 kvar
01.116	LSU cos Phi	Real	-1.001.00	-	100 = 1
01.164	LSU nominal power	Real	030000	kW	1 = 1 kW
03 Input	references				
03.01	Panel reference	Real	-100000.00100000.00	-	100 = 1
03.02	Panel reference remote	Real	-100000.00100000.00	-	100 = 1
03.05	FB A reference 1	Real	-100000.00100000.00	-	100 = 1
03.06	FB A reference 2	Real	-100000.00100000.00	-	100 = 1
03.09	EFB reference 1	Real	-30000.0030000.00	-	100 = 1
03.10	EFB reference 2	Real	-30000.0030000.00	-	100 = 1
04 Warn	ings and faults	•			
04.01	Tripping fault	Data	0000hFFFFh	-	1 = 1
04.02	Active fault 2	Data	0000hFFFFh	-	1 = 1
04.03	Active fault 3	Data	0000hFFFFh	-	1 = 1
04.06	Active warning 1	Data	0000hFFFFh	-	1 = 1
04.07	Active warning 2	Data	0000hFFFFh	-	1 = 1
04.08	Active warning 3	Data	0000hFFFFh	-	1 = 1
04.11	Latest fault	Data	0000hFFFFh	-	1 = 1
04.12	2nd latest fault	Data	0000hFFFFh	-	1 = 1
04.13	3rd latest fault	Data	0000hFFFFh	-	1 = 1
04.16	Latest warning	Data	0000hFFFFh	-	1 = 1
04.17	2nd latest warning	Data	0000hFFFFh	-	1 = 1
04.18	3rd latest warning	Data	0000hFFFFh	-	1 = 1
04.40	Event word 1	PB	0000hFFFFh	-	1 = 1
04.41	Event word 1 bit 0 code	Data	0000hFFFFh	-	1 = 1
04.43	Event word 1 bit 1 code	Data	0000hFFFFh	-	1 = 1
04.45, 04.47, 04.49,					
04.71	Event word 1 bit 15 code	Data	0000hFFFFh	-	1 = 1

No.	Name	Type	Range	Unit	FbEq32			
05 Diagnostics								
05.01	On-time counter	Real	065535	d	1 = 1 d			
05.02	Run-time counter	Real	065535	d	1 = 1 d			
05.03	Hours run	Real	0.0429496729.5	h	10 = 1 h			
05.04	Fan on-time counter	Real	065535	d	1 = 1 d			
05.08	Cabinet temperature	Real	-40120	°C or °F	10 = 1 unit			
05.10	Control board temperature	Real	-100300	°C or °F	10 = 1 unit			
05.11	Inverter temperature	Real	-40.0160.0	%	10 = 1%			
05.20	Diagnostic word 1	PB	0000hFFFFh	-	1 = 1			
05.21	Diagnostic word 2	PB	0000hFFFFh	-	1 = 1			
05.22	Diagnostic word 3	PB	0000hFFFFh	-	1 = 1			
05.80	Motor speed at fault	Real	-3000030000.00	rpm	100 = 1 rpm			
05.81	Output frequency at fault	Real	-500.00500.00	Hz	100 = 1 Hz			
05.82	DC voltage at fault	Real	0.002000.00	V	100 = 1 V			
05.83	Motor current at fault	Real	0.0030000.00	Α	100 = 1 A			
05.84	Motor torque at fault	Real	-1600.01600.0	%	10 = 1%			
05.85	Main status word at fault	PB	0000hFFFFh	-	1 = 1			
05.86	DI delayed status at fault	PB	0000hFFFFh	-	1 = 1			
05.87	Inverter temperature at fault	Real	-40.0160.0	%	10 = 1%			
05.88	Reference used at fault	Real	-500.00500.00 or -30000.0030000.00	Hz or rpm	100 = 1 unit			
05.89	Hand-off-auto status word at fault	PB	0000hFFFFh	-	1 = 1			
	(Parameters 05.1110	5.121 only	visible for ACQ580-31 and A	CQ580-34)				
05.111	Line converter temperature	Real	-40.0160.0	%	10 = 1%			
05.121	MCB closing counter	Real	04294967295	%	1 = 1			
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			
06.22	Hand-off-auto status word	PB	0000hFFFFh	-	1 = 1			
06.29	MSW bit 10 selection	Binary src	-	-	1 = 1			
06.30	MSW bit 11 selection	Binary src	-	-	1 = 1			
06.31	MSW bit 12 selection	Binary src	-	-	1 = 1			

4	6
	~

No.	Name	Type	Range	Unit	FbEq32
06.32	MSW bit 13 selection	Binary src	-	-	1 = 1
06.33	MSW bit 14 selection	Binary src	-	-	1 = 1
	(Parameters 06.3606	5.118 only v	risible for ACQ580-31 and AC	Q580-34)	
06.36	LSU Status word	PB	0000hFFFFh	-	1 = 1
06.39	Internal state machine LSU CW	PB	0000hFFFFh	-	1 = 1
06.116	LSU drive status word 1	PB	0000hFFFFh	-	1 = 1
06.118	LSU start inhibit status word	PB	0000hFFFFh	-	1 = 1
07 Syste	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
07.06	Loading package name	List	-	-	1 = 1
07.07	Loading package version	Data	-	-	1 = 1
07.10	Language file set	List	13	-	1 = 1
07.11	Cpu usage	Real	0100	%	1 = 1%
07.25	Customization package name	Data	-	-	1 = 1
07.26	Customization package version	Data	-	-	1 = 1
07.30	Adaptive program status	PB	0000hFFFFh	-	1 = 1
07.31	AP sequence state	Data	020	-	1 = 1
07.35	Drive configuration	PB	0000hFFFFh	-	1 = 1
07.36	Drive configuration 2	PB	0000hFFFFh	-	1 = 1
	(Parameters 07.1060	7.107 only	visible for ACQ580-31 and AC	CQ580-34)	
07.106	LSU loading package name	List	-	-	1 = 1
07.107	LSU loading package version	Data	-	-	1 = 1

# Parameter groups 10...99

No.	Name	Type	Range	Unit	FbEq32		
10 Standard DI, RO							
10.01	DI status	PB	0000hFFFFh	-	1 = 1		
10.02	DI delayed status	PB	0000hFFFFh	-	1 = 1		
10.03	DI force selection	PB	0000hFFFFh	-	1 = 1		
10.04	DI forced data	PB	0000hFFFFh	-	1 = 1		
10.05	DI1 ON delay	Real	0.03000.0	s	10 = 1 s		
10.06	DI1 OFF delay	Real	0.03000.0	s	10 = 1 s		
10.07	DI2 ON delay	Real	0.03000.0	S	10 = 1 s		
10.08	DI2 OFF delay	Real	0.03000.0	S	10 = 1 s		
10.09	DI3 ON delay	Real	0.03000.0	S	10 = 1 s		
10.10	DI3 OFF delay	Real	0.03000.0	S	10 = 1 s		
10.11	DI4 ON delay	Real	0.03000.0	S	10 = 1 s		
10.12	DI4 OFF delay	Real	0.03000.0	s	10 = 1 s		
10.13	DI5 ON delay	Real	0.03000.0	S	10 = 1 s		
10.14	DI5 OFF delay	Real	0.03000.0	S	10 = 1 s		
10.15	DI6 ON delay	Real	0.03000.0	S	10 = 1 s		
10.16	DI6 OFF delay	Real	0.03000.0	S	10 = 1 s		
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 Standard DIO, FI, FO							
11.21	DI5 configuration	List	01	-	1 = 1		
11.38	Freq in 1 actual value	Real	016000	Hz	1 = 1 Hz		
11.39	Freq in 1 scaled value	Real	-32768.00032767.000	-	1000 = 1		

No.	Name	Туре	Range	Unit	FbEq32
13.13	AO1 forced value	Real	0.00022.000 mA or 0.00011000 V	mA or V	1000 = 1 unit
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 or 0.00011000 V	mA or V	1000 = 1 unit
13.20	AO1 out at AO1 src max	Real	0.00022.000 mA or 0.00011000 V	mA or V	1000 = 1 unit
13.21	AO2 actual value	Real	0.00022.000	mA	1000 = 1 mA
13.22	AO2 source	Analog src	-	-	1 = 1
13.23	AO2 forced value	Real	0.00022.000	mA	1000 = 1 mA
13.26	AO2 filter time	Real	0.00030.000	S	1000 = 1 s
13.27	AO2 source min	Real	-32768.032767.0	-	10 = 1
13.28	AO2 source max	Real	-32768.032767.0	-	10 = 1
13.29	AO2 out at AO2 src min	Real	0.00022.000	mA	1000 = 1 mA
13.30	AO2 out at AO2 src max	Real	0.00022.000	mA	1000 = 1 mA
13.91	AO1 data storage	Real	-327.68327.67	-	100 = 1
13.92	AO2 data storage	Real	-327.68327.67	-	100 = 1
15 I/O e	xtension module				
15.01	Extension module type	List	04	-	1 = 1
15.02	Detected extension module	List	04	-	1 = 1
15.03	DI status	PB	0000hFFFFh	-	1 = 1
15.04	RO/DO status	PB	0000hFFFFh	-	1 = 1
15.05	RO/DO force selection	PB	0000hFFFFh	-	1 = 1
15.06	RO/DO forced data	PB	0000hFFFFh	-	1 = 1
15.07	RO4 source	Binary src	-	-	1 = 1
15.08	RO4 ON delay	Real	0.03000.0	s	10 = 1 s
15.09	RO4 OFF delay	Real	0.03000.0	s	10 = 1 s
15.10	RO5 source	Binary src	-	-	1 = 1
15.11	RO5 ON delay	Real	0.03000.0	s	10 = 1 s
15.12	RO5 OFF delay	Real	0.03000.0	s	10 = 1 s
15.13	RO6 source	Binary src	-	-	1 = 1
15.14	RO6 ON delay	Real	0.03000.0	S	10 = 1 s
15.15	RO6 OFF delay	Real	0.03000.0	s	10 = 1 s
15.16	RO7 source	Binary src	-	-	1 = 1
15.17	RO7 ON delay	Real	0.03000.0	s	10 = 1 s
15.18	RO7 OFF delay	Real	0.03000.0	S	10 = 1 s

No.	Name	Туре	Range	Unit	FbEq32
15.22	DO1 configuration	List	0, 2	-	1 = 1
15.23	DO1 source	Binary src	-	-	1 = 1
15.24	DO1 ON delay	Real	0.03000.0	s	10 = 1 s
15.25	DO1 OFF delay	Real	0.03000.0	S	10 = 1 s
15.32	Freq out 1 actual value	Real	016000	Hz	1 = 1 Hz
15.33	Freq out 1 source	Analog src	-	-	1 = 1
15.34	Freq out 1 src min	Real	-32768.032767.0	-	1000 = 1
15.35	Freq out 1 src max	Real	-32768.032767.0	-	1000 = 1
15.36	Freq out 1 at src min	Real	016000	Hz	1 = 1 Hz
15.37	Freq out 1 at src max	Real	016000	Hz	1 = 1 Hz
15.40	Al force selection	Real	0000hFFFFh	-	1 = 1
15.41	Al supervision function	List	04	-	1 = 1
15.42	Al supervision selection	Real	0000hFFFFh	-	1 = 1
15.43	Al supervision force selection	Real	0000hFFFFh	-	1 = 1
15.44	Al dead band	Real	0.00100.00	-	1000 = 1
15.45	AO force selection	Real	0000hFFFFh	-	1 = 1
15.51	Al3 actual value	Real	-11.000 V / -22.000 mA 11.000 V / 22.000 mA	mA or V	1000 = 1 unit
15.52	Al3 scaled value	Real	-3276832767	-	1 = 1
15.53	Al3 percent value	Real	0110	%	1 = 1%
15.54	Al3 forced value	Real	-11.000 V / -22.000 mA 11.000 V / 22.000 mA	mA or V	1000 = 1 unit
15.55	AI3 unit selection	List	-	-	1 = 1
15.56	AI3 filter time	Real	0.00030.000	s	1000 = 1 s
15.57	Al3 min	Real	-11.000 V / -22.000 mA 11.000 V / 22.000 mA	mA or V	1000 = 1 unit
15.58	Al3 max	Real	-11.000 V / -22.000 mA 11.000 V / 22.000 mA	mA or V	1000 = 1 unit
15.59	AI3 scaled at AI3 min	Real	-3276832767	-	1 = 1
15.60	Al3 scaled at Al3 max	Real	-3276832767	-	1 = 1
15.61	Al4 actual value	Real	-11.000 V / -22.000 mA 11.000 V / 22.000 mA	mA or V	1000 = 1 unit

No.	Name	Туре	Range	Unit	FbEq32
15.62	Al4 scaled value	Real	-3276832767	-	1 = 1
15.63	Al4 percent value	Real	0110	%	1 = 1%
15.64	Al4 forced value	Real	-11.000 V / -22.000 mA 11.000 V / 22.000 mA	mA or V	1000 = 1 unit
15.65	Al4 unit selection	Binary src	-	-	1 = 1
15.66	Al4 filter time	Real	0.00030.000	s	1000 = 1 s
15.67	Al4 min	Real	-11.000 V / -22.000 mA 11.000 V / 22.000 mA	mA or V	1000 = 1 unit
15.68	Al4 max	Real	-11.000 V / -22.000 mA 11.000 V / 22.000 mA	mA or V	1000 = 1 unit
15.69	Al4 scaled at Al4 min	Real	-3276832767	-	1 = 1
15.70	Al4 scaled at Al4 max	Real	-3276832767	-	1 = 1
15.71	Al5 actual value	Real	-11.000 V / -22.000 mA 11.000 V / 22.000 mA	mA or V	1000 = 1 unit
15.72	Al5 scaled value	Real	-3276832767	-	1 = 1
15.73	Al5 percent value	Real	0110	%	1 = 1%
15.74	Al5 forced value	Real	-11.000 V / -22.000 mA 11.000 V / 22.000 mA	mA or V	1000 = 1 unit
15.75	Al5 unit selection	Binary src	-	-	1 = 1
15.76	Al5 filter time	Real	0.00030.000	s	1000 = 1 s
15.77	Al5 min	Real	-11.000 V / -22.000 mA 11.000 V / 22.000 mA	mA or V	1000 = 1 unit
15.78	Al5 max	Real	-11.000 V / -22.000 mA 11.000 V / 22.000 mA	mA or V	1000 = 1 unit
15.79	Al5 scaled at Al5 min	Real	-3276832767	-	1 = 1
15.80	Al5 scaled at Al5 max	Real	-3276832767	-	1 = 1
15.81	AO3 actual value	Real	0.000mA / 0.000V22.000mA / 11.000V	mA or V	1000 = 1 unit

No.	Name	Туре	Range	Unit	FbEq32
19.11	Ext1/Ext2 selection	Binary src	-	-	1 = 1
19.18	HAND/OFF disable source	Binary src	-	-	1 = 1
19.19	HAND/OFF disable action	List	02	-	1 = 1
20 Start	/stop/direction				
20.01	Ext1 commands	List	06, 1112, 14	-	1 = 1
20.02	Ext1 start trigger type	List	01	-	1 = 1
20.03	Ext1 in1 source	Binary src	-	-	1 = 1
20.04	Ext1 in2 source	Binary src	-	-	1 = 1
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
20.21	Direction	List	02	-	1 = 1
20.30	Enable signal warning function	PB	0000hFFFFh	ı	1 = 1
20.40	Run permissive	Binary src	-	-	1 = 1
20.41	Start interlock 1	Binary src	-	-	1 = 1
20.42	Start interlock 2	Binary src	-	-	1 = 1
20.43	Start interlock 3	Binary src	-	-	1 = 1
20.44	Start interlock 4	Binary src	-	-	1 = 1
20.45	Start interlock stop mode	List	02	-	1 = 1
20.46	Run permissive text	List	03, 5	-	1 = 1
20.47	Start interlock 1 text	List	01, 45, 89, 1112, 1415	-	1 = 1
20.48	Start interlock 2 text	List	01, 45, 89, 1112, 1415	-	1 = 1
20.49	Start interlock 3 text	List	01, 45, 89, 1112, 1415	-	1 = 1
20.50	Start interlock 4 text	List	01, 45, 89, 1112, 1415	-	1 = 1
20.51	Start interlock condition	List	01	-	1 = 1
21 Start	/stop mode				
21.01	Start mode	List	02	-	1 = 1

Magnetization time

Stop mode

Name

No.

21 02

21 03

21 04

Type

Real

List

Range

0 10000

0 2

Unit

ms

FbEa32

 $1 = 1 \, \text{ms}$ 

1 = 1

1 = 1

No.	Name	Type	Range	Unit	FbEq32
22.25	Constant speed sel4	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
22.46	Constant speed sel5	Binary src	-	-	1 = 1
22.47	Constant speed sel6	Binary src	-	-	1 = 1
22.51	Critical speed function	PB	00b11b	-	1 = 1
22.52	Critical speed 1 low	Real	-30000.0030000.00	rpm	100 = 1 rpm
22.53	Critical speed 1 high	Real	-30000.0030000.00	rpm	100 = 1 rpm
22.54	Critical speed 2 low	Real	-30000.0030000.00	rpm	100 = 1 rpm
22.55	Critical speed 2 high	Real	-30000.0030000.00	rpm	100 = 1 rpm
22.56	Critical speed 3 low	Real	-30000.0030000.00	rpm	100 = 1 rpm
22.57	Critical speed 3 high	Real	-30000.0030000.00	rpm	100 = 1 rpm
22.70	Motor potentiometer reference enable	List	02	-	1 = 1
22.71	Motor potentiometer function	List	04	-	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 Spec	ed reference ramp				
23.01	Speed ref ramp input	Real	-30000.0030000.00	rpm	100 = 1 rpm
23.02	Speed ref ramp output	Real	-30000.0030000.00	rpm	100 = 1 rpm
23.12	Acceleration time 1	Real	0.0001800.000	s	1000 = 1 s
23.13	Deceleration time 1	Real	0.0001800.000	s	1000 = 1 s
23.23	Emergency stop time	Real	0.0001800.000	s	1000 = 1 s
23.32	Shape time 1	Real	0.0001800.000	s	1000 = 1 s

No.	Name	Type	Range	Unit	FbEq32
24 Spec	ed reference conditioning			I	ı
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 Spec	ed control				•
25.01	Torque reference speed control	Real	-1600.01600.0	%	10 = 1%
25.02	Speed proportional gain	Real	0.00250.00	-	100 = 1
25.03	Speed integration time	Real	0.001000.00	s	100 = 1 s
25.04	Speed derivation time	Real	0.00010.000	s	1000 = 1 s
25.05	Derivation filter time	Real	010000	ms	1 = 1 ms
25.15	Proportional gain em stop	Real	1.00250.00	-	100 = 1
25.30	Flux adaptation enable	Real	0.251,00	-	100 = 1
25.33	Speed controller auto tune	List	01	-	1 = 1
25.34	Auto tune control preset	List	02	-	1 = 1
25.37	Mechanical time constant	Real	0.001000.00	s	100 = 1 s
25.38	Auto tune torque step	Real	0.0020.00	%	100 = 1%
25.39	Auto tune speed step	Real	0.0020.00	%	100 = 1%
25.40	Auto tune repeat times	Real	010	-	1 = 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%
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
28.15	Ext2 frequency ref1	Analog src	-	-	1 = 1
28.21	Constant frequency function	PB	00b11b	-	1 = 1
28.22	Constant frequency sel1	Binary src	-	-	1 = 1
28.23	Constant frequency sel2	Binary src	-	-	1 = 1
28.24	Constant frequency sel3	Binary src	-	-	1 = 1
28.25	Constant frequency sel4	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

No.	Name	Туре	Range	Unit	FbEq32
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
28.46	Constant frequency sel5	Binary src	-	-	1 = 1
28.47	Constant frequency sel6	Binary src	-	-	1 = 1
28.51	Critical frequency function	PB	00b11b	-	1 = 1
28.52	Critical frequency 1 low	Real	-500.00500.00	Hz	100 = 1 Hz
28.53	Critical frequency 1 high	Real	-500.00500.00	Hz	100 = 1 Hz
28.54	Critical frequency 2 low	Real	-500.00500.00	Hz	100 = 1 Hz
28.55	Critical frequency 2 high	Real	-500.00500.00	Hz	100 = 1 Hz
28.56	Critical frequency 3 low	Real	-500.00500.00	Hz	100 = 1 Hz
28.57	Critical frequency 3 high	Real	-500.00500.00	Hz	100 = 1 Hz
28.72	Freq acceleration time 1	Real	0.0001800.000	s	1000 = 1 s
28.73	Freq deceleration time 1	Real	0.0001800.000	s	1000 = 1 s
28.76	Freq ramp in zero source	Binary src	-	-	1 = 1
28.82	Shape time 1	Real	0.0001800.000	s	1000 = 1 s
28.92	Frequency ref act 3	Real	-500.00500.00	Hz	100 = 1 Hz
28.96	Frequency ref act 7	Real	-500.00500.00	Hz	100 = 1 Hz
28.97	Frequency ref unlimited	Real	-500.00500.00	Hz	100 = 1 Hz
30 Limit	s				
30.01	Limit word 1	PB	0000hFFFFh	-	1 = 1
30.02	Torque limit status	PB	0000hFFFFh	-	1 = 1
30.11	Minimum speed	Real	-30000.0030000.00	rpm	100 = 1 rpm
30.12	Maximum speed	Real	-30000.0030000.00	rpm	100 = 1 rpm
30.13	Minimum frequency	Real	-500.00500.00	Hz	100 = 1 Hz
30.14	Maximum frequency	Real	-500.00500.00	Hz	100 = 1 Hz
30.17	Maximum current	Real	0.0030000.00	Α	100 = 1 A
30.19	Minimum torque 1	Real	-1600.00.0	%	10 = 1%
30.20	Maximum torque 1	Real	0.01600.0	%	10 = 1%
30.26	Power motoring limit	Real	0.00600.00	%	100 = 1%
30.27	Power generating limit	Real	-600.000.00	%	100 = 1%
30.30	Overvoltage control	List	01	-	1 = 1
30.31	Undervoltage control	List	01	-	1 = 1
30.35	Thermal current limitation	List	01	-	1 = 1
30.36	Speed limit selection	Binary src	-	-	1 = 1

No.	Name	Туре	Range	Unit	FbEq32
30.37	Minimum speed source	Analog src	-	-	1 = 1
30.38	Maximum speed source	Analog src	-	-	1 = 1
	(Parameters 30.101	30.149 only v	isible for ACQ580-31 and A	CQ580-34)	
30.101	LSU limit word 1	PB	0000hFFFFh	-	1 = 1
30.102	LSU limit word 2	PB	0000hFFFFh	-	1 = 1
30.103	LSU limit word 3	PB	0000hFFFFh	-	1 = 1
30.104	LSU limit word 4	PB	0000hFFFFh	-	1 = 1
30.149	LSU maximum power limit	Real	0.0200.0	%	10 = 1%
31 Fault	functions				
31.01	External event 1 source	Binary src	-	-	1 = 1
31.02	External event 1 type	List	01	-	1 = 1
31.03	External event 2 source	Binary src	-	-	1 = 1
31.04	External event 2 type	List	01	-	1 = 1
31.05	External event 3 source	Binary src	-	-	1 = 1
31.06	External event 3 type	List	01	-	1 = 1
31.07	External event 4 source	Binary src	-	-	1 = 1
31.08	External event 4 type	List	01	-	1 = 1
31.09	External event 5 source	Binary src	-	-	1 = 1
31.10	External event 5 type	List	01	-	1 = 1
31.11	Fault reset selection	Binary src	-	-	1 = 1
31.12	Autoreset selection	PB	0000hFFFFh	-	1 = 1
31.13	Selectable fault	Real	0000hFFFFh	-	1 = 1
31.14	Number of trials	Real	05	-	1 = 1
31.15	Total trials time	Real	1.0600.0	S	10 = 1 s
31.16	Delay time	Real	0.0120.0	s	10 = 1 s
31.19	Motor phase loss	List	01	-	1 = 1
31.20	Earth fault	List	02	-	1 = 1
31.21	Supply phase loss	List	01	-	1 = 1
31.22	STO indication run/stop	List	05	-	1 = 1
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

No.	Name	Type	Range	Unit	FbEq32
31.31	Frequency trip margin	Real	0.0010000.00	Hz	100 = 1 Hz
31.32	Emergency ramp supervision	Real	0300	%	1 = 1%
31.33	Emergency ramp supervision delay	Real	0100	s	1 = 1 s
31.35	Main fan fault function	List	02	-	1 = 1
31.36	Aux fan fault function	List	01	-	1 = 1
31.40	Disable warning messages	PB	0000hFFFFh	-	1 = 1
	(Parameters 3	31.5031.5	only visible for ACQ580-07	)	
31.50	Cabinet temp warning limit	Real		°C	1 = 1 °C
31.51	Cabinet temp fault limit	Real		°C	1 = 1 °C
31.54	Fault action	List	01	-	1 = 1
	(Parameters 31.1203	1.121 only	visible for ACQ580-31 and AC	CQ580-34)	
31.120	LSU earth fault	List	01	-	1 = 1
31.121	LSU supply phase loss	List	01	-	1 = 1
32 Supe	ervision				
32.01	Supervision status	PB	0000hFFFFh	-	1 = 1
32.05	Supervision 1 function	List	07	-	1 = 1
32.06	Supervision 1 action	List	03	-	1 = 1
32.07	Supervision 1 signal	Analog src	-	-	1 = 1
32.08	Supervision 1 filter time	Real	0.00030.000	s	1000 = 1 s
32.09	Supervision 1 low	Real	-21474836.00 21474836.00	-	100 = 1
32.10	Supervision 1 high	Real	-21474836.00 21474836.00	-	100 = 1
32.11	Supervision 1 hysteresis	Real	0.00100000.00	-	100 = 1
32.12	Supervision 1 enable	List	07	-	1 = 1
32.13	Supervision 1 ON delay	Real	0.003000.00	s	10 = 1
32.14	Supervision 1 OFF delay	Real	0.003000.00	s	10 = 1
32.15	Supervision 2 function	List	07	-	1 = 1
32.16	Supervision 2 action	List	03	-	1 = 1
32.17	Supervision 2 signal	Analog src	-	-	1 = 1
32.18	Supervision 2 filter time	Real	0.00030.000	s	1000 = 1 s
32.19	Supervision 2 low	Real	-21474836.00 21474836.00	-	100 = 1
32.20	Supervision 2 high	Real	-21474836.00 21474836.00	-	100 = 1
32.21	Supervision 2 hysteresis	Real	0.00100000.00	-	100 = 1
32.22	Supervision 2 enable	List	07	-	1 = 1
32.23	Supervision 2 ON delay	Real	0.003000.00	s	10 = 1
32.24	Supervision 2 OFF delay	Real	0.003000.00	s	10 = 1
32.25	Supervision 3 function	List	07	-	1 = 1

No.	Name	Type	Range	Unit	FbEq32
32.26	Supervision 3 action	List	03	-	1 = 1
32.27	Supervision 3 signal	Analog	-		1 = 1
02.21	ouper vision o signar	src			
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
32.32	Supervision 3 enable	List	07	-	1 = 1
32.33	Supervision 3 ON delay	Real	0.003000.00	s	10 = 1
32.34	Supervision 3 OFF delay	Real	0.003000.00	S	10 = 1
32.35	Supervision 4 function	List	07	-	1 = 1
32.36	Supervision 4 action	List	03	-	1 = 1
32.37	Supervision 4 signal	Analog src	-	-	1 = 1
32.38	Supervision 4 filter time	Real	0.00030.000	S	1000 = 1 s
32.39	Supervision 4 low	Real	-21474836.00 21474836.00	-	100 = 1
32.40	Supervision 4 high	Real	-21474836.00 21474836.00	-	100 = 1
32.41	Supervision 4 hysteresis	Real	0.00100000.00	-	100 = 1
32.42	Supervision 4 enable	List	07	-	1 = 1
32.43	Supervision 4 ON delay	Real	0.003000.00	s	10 = 1
32.44	Supervision 4 OFF delay	Real	0.003000.00	S	10 = 1
32.45	Supervision 5 function	List	07	-	1 = 1
32.46	Supervision 5 action	List	03	-	1 = 1
32.47	Supervision 5 signal	Analog src	-	-	1 = 1
32.48	Supervision 5 filter time	Real	0.00030.000	S	1000 = 1 s
32.49	Supervision 5 low	Real	-21474836.00 21474836.00	-	100 = 1
32.50	Supervision 5 high	Real	-21474836.00 21474836.00	-	100 = 1
32.51	Supervision 5 hysteresis	Real	0.00100000.00	-	100 = 1
32.52	Supervision 5 enable	List	07	-	1 = 1
32.53	Supervision 5 ON delay	Real	0.003000.00	S	10 = 1
32.54	Supervision 5 OFF delay	Real	0.003000.00	S	10 = 1
32.55	Supervision 6 function	List	07	-	1 = 1
32.56	Supervision 6 action	List	03	-	1 = 1
32.57	Supervision 6 signal	Analog src	-	-	1 = 1
32.58	Supervision 6 filter time	Real	0.00030.000	s	1000 = 1 s
32.59	Supervision 6 low	Real	-21474836.00 21474836.00	-	100 = 1

No.	Name	Туре	Range	Unit	FbEq32
32.60	Supervision 6 high	Real	-21474836.00 21474836.00	-	100 = 1
32.61	Supervision 6 hysteresis	Real	0.00100000.00	-	100 = 1
32.62	Supervision 6 enable	List	07	-	1 = 1
32.63	Supervision 6 ON delay	Real	0.003000.00	S	10 = 1
32.64	Supervision 6 OFF delay	Real	0.003000.00	S	10 = 1
34 Time	d functions	1			
34.01	Timed functions status	PB	0000hFFFFh	-	1 = 1
34.02	Timer status	PB	0000hFFFFh	-	1 = 1
34.04	Season/exception day status	PB	0000hFFFFh	-	1 = 1
34.10	Timed functions enable	Binary src	-	-	1 = 1
34.11	Timer 1 configuration	PB	0000hFFFFh	-	1 = 1
34.12	Timer 1 start time	Time	00:00:0023:59:59	-	-
34.13	Timer 1 duration	Duration	00 00:0007 00:00	-	-
34.14	Timer 2 configuration	PB	0000hFFFFh	-	1 = 1
34.15	Timer 2 start time	Time	00:00:0023:59:59	-	-
34.16	Timer 2 duration	Duration	00 00:0007 00:00	-	-
34.17	Timer 3 configuration	PB	0000hFFFFh	-	1 = 1
34.18	Timer 3 start time	Time	00:00:0023:59:59	-	-
34.19	Timer 3 duration	Duration	00 00:0007 00:00	-	-
34.20	Timer 4 configuration	PB	0000hFFFFh	-	1 = 1
34.21	Timer 4 start time	Time	00:00:0023:59:59	-	-
34.22	Timer 4 duration	Duration	00 00:0007 00:00	-	-
34.23	Timer 5 configuration	PB	0000hFFFFh	-	1 = 1
34.24	Timer 5 start time	Time	00:00:0023:59:59	-	-
34.25	Timer 5 duration	Duration	00 00:0007 00:00	-	-
34.26	Timer 6 configuration	PB	0000hFFFFh	-	1 = 1
34.27	Timer 6 start time	Time	00:00:0023:59:59	-	-
34.28	Timer 6 duration	Duration	00 00:0007 00:00	-	-
34.29	Timer 7 configuration	PB	0000hFFFFh	-	1 = 1
34.30	Timer 7 start time	Time	00:00:0023:59:59	-	-
34.31	Timer 7 duration	Duration	00 00:0007 00:00	-	-
34.32	Timer 8 configuration	PB	0000hFFFFh	-	1 = 1
34.33	Timer 8 start time	Time	00:00:0023:59:59	-	-
34.34	Timer 8 duration	Duration	00 00:0007 00:00	-	-
34.35	Timer 9 configuration	PB	0000hFFFFh	-	1 = 1
34.36	Timer 9 start time	Time	00:00:0023:59:59	-	-
34.37	Timer 9 duration	Duration	00 00:0007 00:00	-	-
34.38	Timer 10 configuration	PB	0000hFFFFh	-	1 = 1
34.39	Timer 10 start time	Time	00:00:0023:59:59	-	•
34.40	Timer 10 duration	Duration	00 00:0007 00:00	-	-

34.41   Timer 11 configuration   PB	No.	Name	Туре	Range	Unit	FbEq32
34.43   Timer 11 duration	34.41	Timer 11 configuration	PB	0000hFFFFh	-	1 = 1
34.44   Timer 12 configuration   PB   0000hFFFFh   - 1 = 1	34.42	Timer 11 start time	Time	00:00:0023:59:59	-	-
34.45   Timer 12 start time   Time   00:00:0023:59:59   -   -	34.43	Timer 11 duration	Duration	00 00:0007 00:00	-	-
34.46   Timer 12 duration	34.44	Timer 12 configuration	PB	0000hFFFFh	-	1 = 1
34.60   Season 1 start date   Date   01/0131/12   -   -	34.45	Timer 12 start time	Time	00:00:0023:59:59	-	-
34.61   Season 2 start date   Date   01/0131/12   -   -	34.46	Timer 12 duration	Duration	00 00:0007 00:00	-	-
34.62         Season 3 start date         Date         01/0131/12         -         -           34.63         Season 4 start date         Date         01/0131/12         -         -           34.70         Number of active exceptions         Real         016         -         1 = 1           34.71         Exception types         PB         0000hFFFFh         -         1 = 1           34.71         Exception 1 start         Date         01/0131/12         -         -           34.73         Exception 2 start         Date         01/0131/12         -         -           34.74         Exception 2 length         Real         060         d         1 = 1 d           34.75         Exception 2 length         Real         060         d         1 = 1 d           34.75         Exception 3 start         Date         01/0131/12         -         -           34.77         Exception 3 start         Date         01/0131/12         -         -           34.79         Exception day 4         Date         01/0131/12         -         -           34.80         Exception day 5         Date         01/0131/12         -         - <td< td=""><td>34.60</td><td>Season 1 start date</td><td>Date</td><td>01/0131/12</td><td>-</td><td>-</td></td<>	34.60	Season 1 start date	Date	01/0131/12	-	-
34.63         Season 4 start date         Date         01/0131/12         -         -           34.70         Number of active exceptions         Real         016         -         1 = 1           34.71         Exception types         PB         0000hFFFFh         -         1 = 1           34.71         Exception 1 start         Date         01/0131/12         -         -           34.73         Exception 2 start         Date         01/0131/12         -         -           34.75         Exception 2 length         Real         060         d         1 = 1 d           34.76         Exception 3 start         Date         01/0131/12         -         -           34.77         Exception day 4         Date         01/0131/12         -         -           34.77         Exception day 4         Date         01/0131/12         -         -           34.79         Exception day 5         Date         01/0131/12         -         -           34.80         Exception day 6         Date         01/01	34.61	Season 2 start date	Date	01/0131/12	-	-
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         -         -           34.73         Exception 1 length         Real         060         d         1 = 1 d           34.74         Exception 2 length         Real         060         d         1 = 1 d           34.75         Exception 3 length         Real         060         d         1 = 1 d           34.76         Exception 3 length         Real         060         d         1 = 1 d           34.77         Exception 3 length         Real         060         d         1 = 1 d           34.77         Exception day 4         Date         01/0131/12         -         -           34.78         Exception day 5         Date         01/0131/12         -         -           34.80         Exception day 6         Date         01/0131/12         -         -           34.81         Exception day 8         Date         01/0131/12         -         -           34.82 <td>34.62</td> <td>Season 3 start date</td> <td>Date</td> <td>01/0131/12</td> <td>-</td> <td>-</td>	34.62	Season 3 start date	Date	01/0131/12	-	-
34.71   Exception types   PB	34.63	Season 4 start date	Date	01/0131/12	-	-
34.72         Exception 1 start         Date         01/0131/12         -         -           34.73         Exception 1 length         Real         060         d         1 = 1 d           34.74         Exception 2 start         Date         01/0131/12         -         -           34.75         Exception 2 length         Real         060         d         1 = 1 d           34.76         Exception 3 length         Real         060         d         1 = 1 d           34.77         Exception 3 length         Real         060         d         1 = 1 d           34.78         Exception day 4         Date         01/0131/12         -         -           34.79         Exception day 5         Date         01/0131/12         -         -           34.80         Exception day 6         Date         01/0131/12         -         -           34.81         Exception day 7         Date         01/0131/12         -         -           34.82         Exception day 8         Date         01/0131/12         -         -           34.83         Exception day 9         Date         01/0131/12         -         -           34.84	34.70	Number of active exceptions	Real	016	-	1 = 1
34.73         Exception 1 length         Real         060         d         1 = 1 d           34.74         Exception 2 start         Date         01/0131/12         -         -           34.75         Exception 2 length         Real         060         d         1 = 1 d           34.76         Exception 3 start         Date         01/0131/12         -         -           34.77         Exception 3 length         Real         060         d         1 = 1 d           34.77         Exception day 4         Date         01/0131/12         -         -           34.78         Exception day 5         Date         01/0131/12         -         -           34.80         Exception day 6         Date         01/0131/12         -         -           34.81         Exception day 7         Date         01/0131/12         -         -           34.82         Exception day 8         Date         01/0131/12         -         -           34.83         Exception day 10         Date         01/0131/12         -         -           34.85         Exception day 11         Date         01/0131/12         -         -           34.86	34.71	Exception types	PB	0000hFFFFh	-	1 = 1
34.74         Exception 2 start         Date         01/0131/12         -         -           34.75         Exception 2 length         Real         060         d         1 = 1 d           34.76         Exception 3 start         Date         01/0131/12         -         -           34.77         Exception 3 length         Real         060         d         1 = 1 d           34.77         Exception day 4         Date         01/0131/12         -         -           34.78         Exception day 5         Date         01/0131/12         -         -           34.80         Exception day 6         Date         01/0131/12         -         -           34.81         Exception day 7         Date         01/0131/12         -         -           34.82         Exception day 8         Date         01/0131/12         -         -           34.83         Exception day 9         Date         01/0131/12         -         -           34.84         Exception day 10         Date         01/0131/12         -         -           34.85         Exception day 12         Date         01/0131/12         -         -           34.87 <t< td=""><td>34.72</td><td>Exception 1 start</td><td>Date</td><td>01/0131/12</td><td>-</td><td>-</td></t<>	34.72	Exception 1 start	Date	01/0131/12	-	-
34.75         Exception 2 length         Real         060         d         1 = 1 d           34.76         Exception 3 start         Date         01/0131/12         -         -           34.77         Exception 3 length         Real         060         d         1 = 1 d           34.79         Exception day 4         Date         01/0131/12         -         -           34.79         Exception day 5         Date         01/0131/12         -         -           34.80         Exception day 6         Date         01/0131/12         -         -           34.81         Exception day 7         Date         01/0131/12         -         -           34.82         Exception day 8         Date         01/0131/12         -         -           34.82         Exception day 9         Date         01/0131/12         -         -           34.84         Exception day 10         Date         01/0131/12         -         -           34.85         Exception day 11         Date         01/0131/12         -         -           34.87         Exception day 13         Date         01/0131/12         -         -           34.89 <td< td=""><td>34.73</td><td>Exception 1 length</td><td>Real</td><td>060</td><td>d</td><td>1 = 1 d</td></td<>	34.73	Exception 1 length	Real	060	d	1 = 1 d
34.76 Exception 3 start Date 01/0131/12	34.74	Exception 2 start	Date	01/0131/12	-	-
34.77         Exception 3 length         Real         060         d         1 = 1 d           34.78         Exception day 4         Date         01/0131/12         -         -           34.79         Exception day 5         Date         01/0131/12         -         -           34.80         Exception day 6         Date         01/0131/12         -         -           34.81         Exception day 7         Date         01/0131/12         -         -           34.82         Exception day 8         Date         01/0131/12         -         -           34.83         Exception day 9         Date         01/0131/12         -         -           34.84         Exception day 10         Date         01/0131/12         -         -           34.85         Exception day 11         Date         01/0131/12         -         -           34.86         Exception day 12         Date         01/0131/12         -         -           34.87         Exception day 13         Date         01/0131/12         -         -           34.89         Exception day 15         Date         01/0131/12         -         -           34.100	34.75	Exception 2 length	Real	060	d	1 = 1 d
34.78 Exception day 4 Date 01/0131/12	34.76	Exception 3 start	Date	01/0131/12	-	-
34.79         Exception day 5         Date         01/0131/12         -         -           34.80         Exception day 6         Date         01/0131/12         -         -           34.81         Exception day 7         Date         01/0131/12         -         -           34.82         Exception day 8         Date         01/0131/12         -         -           34.83         Exception day 9         Date         01/0131/12         -         -           34.84         Exception day 10         Date         01/0131/12         -         -           34.85         Exception day 11         Date         01/0131/12         -         -           34.86         Exception day 12         Date         01/0131/12         -         -           34.87         Exception day 13         Date         01/0131/12         -         -           34.89         Exception day 15         Date         01/0131/12         -         -           34.90         Exception day 16         Date         01/0131/12         -         -           34.100         Timed function 1         PB         0000hFFFFh         -         1 = 1           34.110         <	34.77	Exception 3 length	Real	060	d	1 = 1 d
34.80         Exception day 6         Date         01/0131/12         -         -           34.81         Exception day 7         Date         01/0131/12         -         -           34.82         Exception day 8         Date         01/0131/12         -         -           34.83         Exception day 9         Date         01/0131/12         -         -           34.84         Exception day 10         Date         01/0131/12         -         -           34.85         Exception day 11         Date         01/0131/12         -         -           34.86         Exception day 12         Date         01/0131/12         -         -           34.87         Exception day 13         Date         01/0131/12         -         -           34.89         Exception day 14         Date         01/0131/12         -         -           34.90         Exception day 16         Date         01/0131/12         -         -           34.100         Timed function 1         PB         0000hFFFFh         -         1 = 1           34.110         Boost time function         PB         0000hFFFFh         -         1 = 1           34.112	34.78	Exception day 4	Date	01/0131/12	-	-
34.81         Exception day 7         Date         01/0131/12         -         -           34.82         Exception day 8         Date         01/0131/12         -         -           34.83         Exception day 9         Date         01/0131/12         -         -           34.84         Exception day 10         Date         01/0131/12         -         -           34.85         Exception day 11         Date         01/0131/12         -         -           34.86         Exception day 12         Date         01/0131/12         -         -           34.87         Exception day 13         Date         01/0131/12         -         -           34.88         Exception day 14         Date         01/0131/12         -         -           34.89         Exception day 15         Date         01/0131/12         -         -           34.90         Exception day 16         Date         01/0131/12         -         -           34.100         Timed function 1         PB         0000hFFFFh         -         1 = 1           34.101         Timed function 3         PB         0000hFFFFh         -         1 = 1           34.111	34.79	Exception day 5	Date	01/0131/12	-	-
34.82         Exception day 8         Date         01/0131/12         -         -           34.83         Exception day 9         Date         01/0131/12         -         -           34.84         Exception day 10         Date         01/0131/12         -         -           34.85         Exception day 11         Date         01/0131/12         -         -           34.86         Exception day 12         Date         01/0131/12         -         -           34.87         Exception day 13         Date         01/0131/12         -         -           34.89         Exception day 14         Date         01/0131/12         -         -           34.90         Exception day 15         Date         01/0131/12         -         -           34.100         Timed function 1         PB         0000hFFFFh         -         1 = 1           34.101         Timed function 2         PB         0000hFFFFh         -         1 = 1           34.110         Boost time function         PB         0000hFFFFh         -         1 = 1           34.112         Boost time duration         Duration         00 00:0007 00:00         -         -	34.80	Exception day 6	Date	01/0131/12	-	-
34.83         Exception day 9         Date         01/0131/12         -         -           34.84         Exception day 10         Date         01/0131/12         -         -           34.85         Exception day 11         Date         01/0131/12         -         -           34.86         Exception day 12         Date         01/0131/12         -         -           34.87         Exception day 13         Date         01/0131/12         -         -           34.88         Exception day 14         Date         01/0131/12         -         -           34.90         Exception day 15         Date         01/0131/12         -         -           34.100         Timed function 1         PB         0000hFFFFh         -         1 = 1           34.101         Timed function 2         PB         0000hFFFFh         -         1 = 1           34.110         Boost time function         PB         0000hFFFFh         -         1 = 1           34.112         Boost time activation source         Binary src         -         -         1 = 1           35         Motor thermal protection	34.81	Exception day 7	Date	01/0131/12	-	-
34.84         Exception day 10         Date         01/0131/12         -         -           34.85         Exception day 11         Date         01/0131/12         -         -           34.86         Exception day 12         Date         01/0131/12         -         -           34.87         Exception day 13         Date         01/0131/12         -         -           34.88         Exception day 14         Date         01/0131/12         -         -           34.90         Exception day 15         Date         01/0131/12         -         -           34.100         Timed function 1         PB         0000hFFFFh         -         1 = 1           34.101         Timed function 2         PB         0000hFFFFh         -         1 = 1           34.110         Boost time function         PB         0000hFFFFh         -         1 = 1           34.111         Boost time activation source         Binary src         -         -         1 = 1           34.112         Boost time duration         Duration         00 00:0007 00:00         -         -           35 Motor thermal protection	34.82	Exception day 8	Date	01/0131/12	-	-
34.85         Exception day 11         Date         01/0131/12         -         -           34.86         Exception day 12         Date         01/0131/12         -         -           34.87         Exception day 13         Date         01/0131/12         -         -           34.88         Exception day 14         Date         01/0131/12         -         -           34.89         Exception day 15         Date         01/0131/12         -         -           34.90         Exception day 16         Date         01/0131/12         -         -           34.100         Timed function 1         PB         0000hFFFFh         -         1 = 1           34.101         Timed function 2         PB         0000hFFFFh         -         1 = 1           34.110         Boost time function         PB         0000hFFFFh         -         1 = 1           34.111         Boost time activation source         Binary src         -         -         1 = 1           34.112         Boost time duration         Duration         00 00:0007 00:00         -         -           35 Motor thermal protection	34.83	Exception day 9	Date	01/0131/12	-	-
34.86         Exception day 12         Date         01/0131/12         -         -           34.87         Exception day 13         Date         01/0131/12         -         -           34.88         Exception day 14         Date         01/0131/12         -         -           34.89         Exception day 15         Date         01/0131/12         -         -           34.90         Exception day 16         Date         01/0131/12         -         -           34.100         Timed function 1         PB         0000hFFFFh         -         1 = 1           34.101         Timed function 2         PB         0000hFFFFh         -         1 = 1           34.102         Timed function 3         PB         0000hFFFFh         -         1 = 1           34.110         Boost time function         PB         0000hFFFFh         -         1 = 1           34.111         Boost time activation source         Binary src         -         -         1 = 1           34.112         Boost time duration         Duration         00 00:0007 00:00         -         -           35 Motor thermal protection	34.84	Exception day 10	Date	01/0131/12	-	-
34.87         Exception day 13         Date         01/0131/12         -         -           34.88         Exception day 14         Date         01/0131/12         -         -           34.89         Exception day 15         Date         01/0131/12         -         -           34.90         Exception day 16         Date         01/0131/12         -         -           34.100         Timed function 1         PB         0000hFFFFh         -         1 = 1           34.101         Timed function 2         PB         0000hFFFFh         -         1 = 1           34.102         Timed function 3         PB         0000hFFFFh         -         1 = 1           34.110         Boost time function         PB         0000hFFFFh         -         1 = 1           34.111         Boost time activation source         Binary src         -         -         1 = 1           34.112         Boost time duration         Duration         00 00:0007 00:00         -         -           35 Motor thermal protection	34.85	Exception day 11	Date	01/0131/12	-	-
34.88         Exception day 14         Date         01/0131/12         -         -           34.89         Exception day 15         Date         01/0131/12         -         -           34.90         Exception day 16         Date         01/0131/12         -         -           34.100         Timed function 1         PB         0000hFFFFh         -         1 = 1           34.101         Timed function 2         PB         0000hFFFFh         -         1 = 1           34.102         Timed function 3         PB         0000hFFFFh         -         1 = 1           34.110         Boost time function         PB         0000hFFFFh         -         1 = 1           34.111         Boost time activation source         Binary src         -         -         1 = 1           34.112         Boost time duration         Duration         00 00:0007 00:00         -         -           35 Motor thermal protection         Date         01/0131/12         -         -         -	34.86	Exception day 12	Date	01/0131/12	-	-
34.89         Exception day 15         Date         01/0131/12         -         -           34.90         Exception day 16         Date         01/0131/12         -         -           34.100         Timed function 1         PB         0000hFFFFh         -         1 = 1           34.101         Timed function 2         PB         0000hFFFFh         -         1 = 1           34.102         Timed function 3         PB         0000hFFFFh         -         1 = 1           34.110         Boost time function         PB         0000hFFFFh         -         1 = 1           34.111         Boost time activation source         Binary src         -         1 = 1           34.112         Boost time duration         Duration         00 00:0007 00:00         -         -           35 Motor thermal protection	34.87	Exception day 13	Date	01/0131/12	-	-
34.90         Exception day 16         Date         01/0131/12         -         -           34.100         Timed function 1         PB         0000hFFFFh         -         1 = 1           34.101         Timed function 2         PB         0000hFFFFh         -         1 = 1           34.102         Timed function 3         PB         0000hFFFFh         -         1 = 1           34.110         Boost time function         PB         0000hFFFFh         -         1 = 1           34.111         Boost time activation source         Binary src         -         -         1 = 1           34.112         Boost time duration         Duration         00 00:0007 00:00         -         -           35 Motor thermal protection	34.88	Exception day 14	Date	01/0131/12	-	-
34.100         Timed function 1         PB         0000hFFFFh         -         1 = 1           34.101         Timed function 2         PB         0000hFFFFh         -         1 = 1           34.102         Timed function 3         PB         0000hFFFFh         -         1 = 1           34.110         Boost time function         PB         0000hFFFFh         -         1 = 1           34.111         Boost time activation source         Binary src         -         -         1 = 1           34.112         Boost time duration         Duration         00 00:0007 00:00         -         -           35 Motor thermal protection	34.89	Exception day 15	Date	01/0131/12	-	-
34.101         Timed function 2         PB         0000hFFFFh         -         1 = 1           34.102         Timed function 3         PB         0000hFFFFh         -         1 = 1           34.110         Boost time function         PB         0000hFFFFh         -         1 = 1           34.111         Boost time activation source         Binary src         -         -         1 = 1           34.112         Boost time duration         Duration         00 00:0007 00:00         -         -           35 Motor thermal protection	34.90	Exception day 16	Date	01/0131/12	-	-
34.102         Timed function 3         PB         0000hFFFFh         -         1 = 1           34.110         Boost time function         PB         0000hFFFFh         -         1 = 1           34.111         Boost time activation source         Binary src         -         -         1 = 1           34.112         Boost time duration         Duration         00 00:0007 00:00         -         -           35 Motor thermal protection	34.100	Timed function 1	PB	0000hFFFFh	-	1 = 1
34.110         Boost time function         PB         0000hFFFFh         -         1 = 1           34.111         Boost time activation source         Binary src         -         -         1 = 1           34.112         Boost time duration         Duration         00 00:0007 00:00         -         -           35 Motor thermal protection	34.101	Timed function 2	PB	0000hFFFFh	-	1 = 1
34.111         Boost time activation source         Binary src         -         -         1 = 1           34.112         Boost time duration         Duration         00 00:0007 00:00         -         -           35 Motor thermal protection	34.102	Timed function 3	PB	0000hFFFFh	-	1 = 1
	34.110	Boost time function	PB	0000hFFFFh	-	1 = 1
35 Motor thermal protection	34.111	Boost time activation source		-	-	1 = 1
	34.112	Boost time duration	Duration	00 00:0007 00:00	-	
35.01 Motor estimated temperature Real -601000 °C or °C or °F 1 = 1 unit	35 Moto	r thermal protection				
-761832 °F	35.01	Motor estimated temperature	Real	-601000 °C or -761832 °F	°C or °F	1 = 1 unit

No.	Name	Туре	Range	Unit	FbEq32
35.02	Measured temperature 1	Real	-605000 °C or -769032 °F, 0 ohm or [35.12] ohm	°C, °F or ohm	1 = 1 unit
35.03	Measured temperature 2	Real	-605000 °C or -769032 °F, 0 ohm or [35.12] ohm	°C, °F or ohm	1 = 1 unit
35.05	Motor overload level	Real	0.0100.0%	%	100 = 1%
35.11	Temperature 1 source	List	02, 58, 1116, 1920, 2123	-	1 = 1
35.12	Temperature 1 fault limit	Real	-605000 °C or -769032 °F or 05000 ohm	°C, °F or ohm	1 = 1 unit
35.13	Temperature 1 warning limit	Real	-605000 °C or -769032 °F or 05000 ohm	°C, °F or ohm	1 = 1 unit
35.14	Temperature 1 Al source	Analog src	-	-	1 = 1
35.21	Temperature 2 source	List	02, 58, 1116, 1920, 2123	-	1 = 1
35.22	Temperature 2 fault limit	Real	-605000 °C or -769032 °F or 05000 ohm	°C, °F or ohm	1 = 1 unit
35.23	Temperature 2 warning limit	Real	-605000 °C or -769032 °F or 05000 ohm	°C, °F or ohm	1 = 1 unit
35.24	Temperature 2 Al source	Analog src	-	-	1 = 1
35.31	Safe motor temperature enable	List	01	-	1 = 1
35.50	Motor ambient temperature	Real	-60100 °C or -76 212 °F	°C or °F	1 = 1 unit
35.51	Motor load curve	Real	50150	%	1 = 1%
35.52	Zero speed load	Real	25150	%	1 = 1%
35.53	Break point	Real	1.00 500.00	Hz	100 = 1 Hz
35.54	Motor nominal temperature rise	Real	0300 °C or 32572 °F	°C or °F	1 = 1 unit
35.55	Motor thermal time constant	Real	10010000	S	1 = 1 s
35.56	Motor overload action	List	02	-	1 = 1
35.57	Motor overload class	List	05	-	1 = 1
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

PVL peak value

PVL peak date

PVL peak time

PVL current at peak

PVL speed at peak

PVL reset date

PVL reset time

PVL DC voltage at peak

Name

Type

Real

Data

Data

Real

Real

Real

Data

Data

Range

-32768.00...32767.00

-32768.00...32767.00

0.00...2000.00 -30000.00... 30000.00 Unit

Α

V

rpm

FbEa32

100 = 1

100 = 1 A

100 = 1 V

100 = 1 rpm

No.

36 10

36 11

36.12

36 13

36.14

36.15

36.16

36.17

No.	Name	Туре	Range	Unit	FbEq32
37.16	ULC frequency table point 1	Real	-500.0500.0	Hz	10 = 1 Hz
37.17	ULC frequency table point 2	Real	-500.0500.0	Hz	10 = 1 Hz
37.18	ULC frequency table point 3	Real	-500.0500.0	Hz	10 = 1 Hz
37.19	ULC frequency table point 4	Real	-500.0500.0	Hz	10 = 1 Hz
37.20	ULC frequency table point 5	Real	-500.0500.0	Hz	10 = 1 Hz
37.21	ULC underload point 1	Real	-1600.01600.0	%	10 = 1%
37.22	ULC underload point 2	Real	-1600.01600.0	%	10 = 1%
37.23	ULC underload point 3	Real	-1600.01600.0	%	10 = 1%
37.24	ULC underload point 4	Real	-1600.01600.0	%	10 = 1%
37.25	ULC underload point 5	Real	-1600.01600.0	%	10 = 1%
37.31	ULC overload point 1	Real	-1600.01600.0	%	10 = 1%
37.32	ULC overload point 2	Real	-1600.01600.0	%	10 = 1%
37.33	ULC overload point 3	Real	-1600.01600.0	%	10 = 1%
37.34	ULC overload point 4	Real	-1600.01600.0	%	10 = 1%
37.35	ULC overload point 5	Real	-1600.01600.0	%	10 = 1%
37.41	ULC overload timer	Real	0.010000.0	S	10 = 1 s
37.42	ULC underload timer	Real	0.010000.0	s	10 = 1 s
40 Proc	ess PID set 1				
40.01	Process PID output actual	Real	-200000.00200000.00	%	100 = 1 %
40.02	Process PID feedback actual	Real	-200000.00200000.00	PID unit 1	100 = 1 PID unit 1
40.03	Process PID setpoint actual	Real	-200000200000	PID unit 1	100 = 1 PID unit 1
40.04	Process PID deviation actual	Real	-200000.00200000.00	PID unit 1	100 = 1 PID unit 1
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	013	-	1 = 1
40.11	Set 1 feedback filter time	Real	0.00030.000	s	1000 = 1 s
40.14	Set 1 setpoint scaling	Real	-200000.00200000.00	-	100 = 1
40.15	Set 1 output scaling	Real	-200000.00200000.00	-	100 = 1
40.16	Set 1 setpoint 1 source	Analog src	-	-	1 = 1
40.17	Set 1 setpoint 2 source	Analog src	-	-	1 = 1
40.18	Set 1 setpoint function	List	013	-	1 = 1
40.19	Set 1 internal setpoint sel1	Binary src	-	-	1 = 1
40.20	Set 1 internal setpoint sel2	Binary src	-	-	1 = 1

No.	Name	Туре	Range	Unit	FbEq32
40.21	Set 1 internal setpoint 1	Real	-200000.00200000.00	PID unit	100 = 1 PID unit 1
40.22	Set 1 internal setpoint 2	Real	-200000.00200000.00	PID unit	100 = 1 PID unit 1
40.23	Set 1 internal setpoint 3	Real	-200000.00200000.00	PID unit	100 = 1 PID unit 1
40.24	Set 1 internal setpoint 0	Real	-200000.00200000.00	PID unit 1	100 = 1 PID unit 1
40.26	Set 1 setpoint min	Real	-200000.00200000.00	PID unit 1	100 = 1 PID unit 1
40.27	Set 1 setpoint max	Real	-200000.00200000.00	PID unit 1	100 = 1 PID unit 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	-200000.00200000.00	-	100 = 1
40.37	Set 1 output max	Real	-200000.00200000.00	-	100 = 1
40.38	Set 1 output freeze enable	Binary src	-	-	1 = 1
40.39	Set 1 deadband range	Real	0.00200000.00	-	100 = 1
40.40	Set 1 deadband delay	Real	0.03600.0	s	10 = 1 s
40.41	Set 1 sleep mode	List	02	-	1 = 1
40.42	Set 1 sleep enable	List	01	-	1 = 1
40.43	Set 1 sleep level	Real	0.0200000.0	-	10 = 1
40.44	Set 1 sleep delay	Real	0.03600.0	s	10 = 1 s
40.45	Set 1 sleep boost time	Real	0.03600.0	s	10 = 1 s
40.46	Set 1 sleep boost step	Real	0.00200000.00	PID unit 1	100 = 1 PID unit 1
40.47	Set 1 wake-up deviation	Real	-200000.00200000.00	PID unit 1	100 = 1 PID unit 1
40.48	Set 1 wake-up delay	Real	0.0060.00	s	100 = 1 s
40.49	Set 1 tracking mode	Binary src	-	-	1 = 1
40.50	Set 1 tracking ref selection	Analog src	-	-	1 = 1
40.57	PID set1/set2 selection	Binary src	-	-	1 = 1
40.58	Set 1 increase prevention	Binary src	-	-	1 = 1

No.	Name	Type	Range	Unit	FbEq32
40.59	Set 1 decrease prevention	Binary src	-	-	1 = 1
40.60	Set 1 PID activation source	Binary src	-	-	1 = 1
40.61	Setpoint scaling actual	Real	-200000.00200000.00	-	100 = 1
40.62	PID internal setpoint actual	Real	-200000.00200000.00	PID unit 1	100 = 1 PID unit 1
40.70	Compensated setpoint	Real	-21474836.48 21474835.20	PID unit 1	100 = 1 PID unit 1
40.71	Set 1 compensation input source	List	0, 24, 8, 1012, 1516, 1920, 24	-	1 = 1
40.72	Set 1 compensation input 1	Real	-200000.00200000.00	-	100 = 1
40.73	Set 1 compensated output 1	Real	-200000.00200000.00	-	100 = 1
40.74	Set 1 compensation input 2	Real	-200000.00200000.00	-	100 = 1
40.75	Set 1 compensated output 2	Real	-200000.00200000.00	-	100 = 1
40.76	Set 1 compensation non- linearity	Real	0100	%	1= 1%
40.79	Set 1 units	List	0, 4, 21, 26, 29, 34, 3738, 40, 44, 4748, 5052, 5859, 65, 7480, 88, 94, 125126, 131, 150151	-	1 = 1
40.80	Set 1 PID output min source	List	01	-	1 = 1
40.81	Set 1 PID output max source	List	01	-	1 = 1
40.89	Set 1 setpoint multiplier	Real	-200000.00200000.00	-	100 = 1
40.90	Set 1 feedback multiplier	Real	-200000.00200000.00	-	100 = 1
40.91	Feedback data storage	Real	-327.68327.67	-	100 = 1
40.92	Setpoint data storage	Real	-327.68327.67	-	100 = 1
40.96	Process PID output %	Real	-100.00100.00	%	100 = 1%
40.97	Process PID feedback %	Real	-100.00100.00	%	100 = 1%
40.98	Process PID setpoint %	Real	-100.00100.00	%	100 = 1%
40.99	Process PID deviation %	Real	-100.00100.00	%	100 = 1%
41 Proc	ess PID set 2				
41.08	Set 2 feedback 1 source	Analog src	-	-	1 = 1
41.09	Set 2 feedback 2 source	Analog src	-	-	1 = 1
41.10	Set 2 feedback function	List	013	-	1 = 1
41.11	Set 2 feedback filter time	Real	0.00030.000	s	1000 = 1 s
41.14	Set 2 setpoint scaling	Real	-200000.00200000.00	-	100 = 1
41.15	Set 2 output scaling	Real	-200000.00200000.00	-	100 = 1
41.16	Set 2 setpoint 1 source	Analog src	-	-	1 = 1
41.17	Set 2 setpoint 2 source	Analog src	-	-	1 = 1
41.18	Set 2 setpoint function	List	013	-	1 = 1

Name

Set 2 internal setpoint sel1

Type

Binary

src

Range

Unit

FbEa32

1 = 1

No.

41 19

No.	Name	Туре	Range	Unit	FbEq32
41.58	Set 2 increase prevention	Binary src	-	-	1 = 1
41.59	Set 2 decrease prevention	Binary src	-	-	1 = 1
41.60	Set 2 PID activation source	Binary src	-	-	1 = 1
41.71	Set 2 compensation input source	List	0, 24, 8, 1012, 1516, 1920, 24	-	1 = 1
41.72	Set 2 compensation input 1	Real	-200000.00200000.00	-	100 = 1
41.73	Set 2 compensated output 1	Real	-200000.00200000.00	-	100 = 1
41.74	Set 2 compensation input 2	Real	-200000.00200000.00	-	100 = 1
41.75	Set 2 compensated output 2	Real	-200000.00200000.00	-	100 = 1
41.76	Set 2 compensation non- linearity	Real	0100	%	1= 1%
41.79	Set 2 units	List	0, 4, 21, 26, 29, 34, 3738, 40, 44, 4748, 5052, 5859, 65, 7480, 88, 94, 125126, 131, 150151	-	1 = 1
41.80	Set 2 PID output min source	List	01	-	1 = 1
41.81	Set 2 PID output max source	List	01	-	1 = 1
41.89	Set 2 setpoint multiplier	Real	-200000.00200000.00	-	100 = 1
41.90	Set 2 feedback multiplier	Real	-200000.00200000.00	-	100 = 1
43 Brak	e chopper				
43.01	Braking resistor temperature	Real	0.0120.0	%	10 = 1%
43.06	Brake chopper function	List	03	-	1 = 1
43.07	Brake chopper run enable	Binary src	-	-	1 = 1
43.08	Brake resistor thermal to	Real	010000	s	1 = 1 s
43.09	Brake resistor Pmax cont	Real	0.0010000.00	kW	100 = 1 kW
43.10	Brake resistance	Real	0.01000.0	ohm	10 = 1 ohm
43.11	Brake resistor fault limit	Real	0150	%	1 = 1%
43.12	Brake resistor warning limit	Real	0150	%	1 = 1%
45 Ener	gy efficiency				
45.01	Saved GW hours	Real	065535	GWh	1 = 1 GWh
45.02	Saved MW hours	Real	0999	MWh	1 = 1 MWh
45.03	Saved kW hours	Real	0.0999.9	kWh	10 = 1 kWh
45.04	Saved energy	Real	0.0214748364.0	kWh	10 = 1 kWh
45.05	Saved money x1000	Real	04294967295 thousands	(defina- ble)	1 = 1 currency unit
45.06	Saved money	Real	0.00999.99	(defina- ble)	100 = 1 currency unit
45.07	Saved amount	Real	0.0021474830.08	(defina- ble)	100 = 1 currency unit

No.	Name	Type	Range	Unit	FbEq32
46.12	Filter time output frequency	Real	220000	ms	1 = 1 ms
46.13	Filter time motor torque	Real	220000	ms	1 = 1 ms
46.14	Filter time power	Real	220000	ms	1 = 1 ms
46.21	At speed hysteresis	Real	0.0030000.00	rpm	100 = 1 rpm
46.22	At frequency hysteresis	Real	0.001000.00	Hz	100 = 1 Hz
46.31	Above speed limit	Real	0.0030000.00	rpm	100 = 1 rpm
46.32	Above frequency limit	Real	0.001000.00	Hz	100 = 1 Hz
46.41	kWh pulse scaling	Real	0.0011000.000	kWh	1000 = 1 kWh
46.43	Power decimals	Real	03	-	1 = 1
46.44	Current decimals	Real	03	-	1 = 1
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
47.05	Data storage 5 real32	Real	-2147483.000 2147483.000	-	1000 = 1
47.06	Data storage 6 real32	Real	-2147483.000 2147483.000	-	1000 = 1
47.07	Data storage 7 real32	Real	-2147483.000 2147483.000	-	1000 = 1
47.08	Data storage 8 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
47.15	Data storage 5 int32	Real	-2147483648 2147483647	-	1 = 1
47.16	Data storage 6 int32	Real	-2147483648 2147483647	-	1 = 1
47.17	Data storage 7 int32	Real	-2147483648 2147483647	-	1 = 1
47.18	Data storage 8 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

No.	Name	Туре	Range	Unit	FbEq32
51.28	FBA A par table ver	Data	-	-	1 = 1
51.29	FBA A drive type code	Real	065535	-	1 = 1
51.30	FBA A mapping file ver	Real	065535	-	1 = 1
51.31	D2FBA A comm status	List	06	-	1 = 1
51.32	FBA A comm SW ver	Data	-	-	1 = 1
51.33	FBA A appl SW ver	Data	-	-	1 = 1
52 FBA	A data in				
52.01	FBA A data in1	Analog src	-	-	1 = 1
52.12	FBA A data in12	Analog src	-	-	1 = 1
53 FBA	A data out				
53.01	FBA A data out1	Analog src	-	-	1 = 1
53.12	FBA A data out12	Analog src	-	-	1 = 1
58 Emb	edded fieldbus	1			L
58.01	Protocol enable	List	01, 4	-	1 = 1
58.02	Protocol ID	Real	0000hFFFFh	-	1 = 1
58.03	Node address	Real	0255	-	1 = 1
58.04	Baud rate	List	07	-	1 = 1
58.05	Parity	List	03	-	1 = 1
58.06	Communication control	List	02	-	1 = 1
58.07	Communication diagnostics	PB	0000hFFFFh	-	1 = 1
58.08	Received packets	Real	04294967295	-	1 = 1
58.09	Transmitted packets	Real	04294967295	-	1 = 1
58.10	All packets	Real	04294967295	-	1 = 1
58.11	UART errors	Real	04294967295	-	1 = 1
58.12	CRC errors	Real	04294967295	-	1 = 1
58.14	Communication loss action	List	05	-	1 = 1
58.15	Communication loss mode	List	12	-	1 = 1
58.16	Communication loss time	Real	0.06000.0	s	10 = 1 s
58.17	Transmit delay	Real	065535	ms	1 = 1 ms
58.18	EFB control word	PB	00000000hFFFFFFFh	-	1 = 1
58.19	EFB status word	PB	00000000hFFFFFFFh	-	1 = 1
58.25	Control profile	List	0, 5	-	1 = 1
58.26	EFB ref1 type	List	02, 45	-	1 = 1
58.27	EFB ref2 type	List	02, 45	-	1 = 1
58.28	EFB act1 type	List	02, 45	-	1 = 1
58.29	EFB act2 type	List	02, 45	-	1 = 1

No.	Name	Туре	Range	Unit	FbEq32		
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		
60 DDC	S communication						
	(Parameters 60.786	0.79 only vi	isible for ACQ580-31 and AC	Q580-34)			
60.78	INU-LSU comm loss timeout	Real	065535	ms	1 = 1 ms		
60.79	INU-LSU comm loss function	Binary src	-	-	1 = 1		
61 D2D	and DDCS transmit data						
	(Parameters 61.2016	1.203 only	visible for ACQ580-31 and A	CQ580-34)			
61.201	INU-LSU data set 10 data 1 value	Real	065535	-	1 = 1		
61.202	INU-LSU data set 10 data 2 value	Real	065535	-	1 = 1		
61.203	INU-LSU data set 10 data 3 value	Real	065535	-	1 = 1		
62 D2D	and DDCS receive data						
	(Parameter 62.201	only visible	e for ACQ580-31 and ACQ58	0-34)			
62.201	INU-LSU data set 11 data 1 value	Real	065535	-	1 = 1		
71 External PID1							
71.01	External PID act value	Real	-200000.00200000.00	%	100 = 1%		
71.02	Feedback act value	Real	-200000.00200000.00	PID unit 1	100 = 1 PID unit 1		
71.03	Setpoint act value	Real	-200000.00200000.00	PID unit 1	100 = 1 PID unit 1		

No.	Name	Туре	Range	Unit	FbEq32
71.04	Deviation act value	Real	-200000.00200000.00	PID unit 1	100 = 1 PID unit 1
71.06	PID status word	PB	0000hFFFFh	-	1 = 1
71.07	PID operation mode	List	02	-	1 = 1
71.08	Feedback 1 source	Analog src	-	-	1 = 1
71.11	Feedback filter time	Real	0.00030.000	S	1000 = 1 s
71.14	Setpoint scaling	Real	-200000.00200000.00	-	100 = 1
71.15	Output scaling	Real	-200000.00200000.00	-	100 = 1
71.16	Setpoint 1 source	Analog src	-	-	1 = 1
71.19	Internal setpoint sel1	Binary src	-	1	1 = 1
71.20	Internal setpoint sel2	Binary src	-	1	1 = 1
71.21	Internal setpoint 1	Real	-200000.00200000.00	PID unit 1	100 = 1 PID unit 1
71.22	Internal setpoint 2	Real	-200000.00200000.00	PID unit 1	100 = 1 PID unit 1
71.23	Internal setpoint 3	Real	-200000.00200000.00	PID unit 1	100 = 1 PID unit 1
71.26	Setpoint min	Real	-200000.00200000.00	-	100 = 1
71.27	Setpoint max	Real	-200000.00200000.00	-	100 = 1
71.31	Deviation inversion	Binary src	-	-	1 = 1
71.32	Gain	Real	0.10100.00	-	100 = 1
71.33	Integration time	Real	0.09999.0	s	10 = 1 s
71.34	Derivation time	Real	0.00010.000	s	1000 = 1 s
71.35	Derivation filter time	Real	0.010.0	s	10 = 1 s
71.36	Output min	Real	-200000.00200000.00	-	10 = 1
71.37	Output max	Real	-200000.00200000.00	-	10 = 1
71.38	Output freeze enable	Binary src	-	-	1 = 1
71.39	Deadband range	Real	0.0200000.0	-	10 = 1
71.40	Deadband delay	Real	0.03600.0	S	10 = 1 s
71.58	Increase prevention	Binary src	-	-	1 = 1
71.59	Decrease prevention	Binary src	-	-	1 = 1
71.62	Internal setpoint actual	Real	-200000.00200000.00	PID unit 1	100 = 1 PID unit 1
71.79	External PID units	List	0, 4, 21, 26, 29, 34, 3738, 40, 44, 4748, 5052, 5859, 65, 7480, 88, 94, 125126, 131, 150151	-	1 = 1

No.	Name	Type	Range	Unit	FbEq32
76.53	LC efficient speed	Real	-30000.0030000.00	rpm/Hz	100 = 1 unit
76.54	LC max time at level	Real	0.01800.0	h	100 = 1 h
76.55	Start delay	Real	0.0012600.00	s	100 = 1 s
76.56	Stop delay	Real	0.0012600.00	s	100 = 1 s
76.57	PFC speed hold on	Real	0.001000.00	s	100 = 1 s
76.58	PFC speed hold off	Real	0.001000.00	s	100 = 1 s
76.59	PFC contactor delay	Real	0.20600.00	s	100 = 1 s
76.60	PFC ramp acceleration time	Real	0.001800.00	s	100 = 1 s
76.61	PFC ramp deceleration time	Real	0.001800.00	s	100 = 1 s
76.62	IPC smooth acceleration time	Real	3.001800.00	s	100 = 1 s
76.63	IPC smooth deceleration time	Real	3.001800.00	s	100 = 1 s
76.64	Run permissive timeout	Real	0.00300.00	s	100 = 1 s
76.70	PFC Autochange	Binary src	-	-	1 = 1
76.71	PFC Autochange interval	Real	0.00100000.00	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
76.76	Max stationary time	Real	0.0214748368.0	h	10 = 1 h
76.77	Pump priority	List	1, 3, 5	-	1 = 1
76.81	PFC 1 interlock	Binary src	-	-	1 = 1
76.82	PFC 2 interlock	Binary src	-	-	1 = 1
76.83	PFC 3 interlock	Binary src	-	-	1 = 1
76.84	PFC 4 interlock	Binary src	-	-	1 = 1
76.85	PFC 5 interlock	Binary src	-	-	1 = 1
76.86	PFC 6 interlock	Binary src	-	-	1 = 1
76.90	LC low level switch	Binary src	-	-	1 = 1
76.91	LC high level switch	Binary src	-	-	1 = 1
76.92	LC low level action	List	02	-	1 = 1
76.93	LC high level action	List	02	-	1 = 1
76.95	Regulator bypass control	Binary src	-	-	1 = 1
76.101	IPC parameter synchronization	List	12	-	1 = 1
76.102	IPC synchronization settings	PB	0000hFFFFh	-	1 = 1
76.105	IPC synchronization checksum	PB	0000hFFFFh	-	1 = 1

No.	Name	Type	Range	Unit	FbEq32
77 Mult	ipump maintenance and moni	toring			
77.10	PFC runtime change	List	07	-	1 = 1
77.11	Pump 1 running time	Real	0.0042949672.95	h	100 = 1 h
77.12	Pump 2 running time	Real	0.0042949672.95	h	100 = 1 h
77.13	Pump 3 running time	Real	0.0042949672.95	h	100 = 1 h
77.14	Pump 4 running time	Real	0.0042949672.95	h	100 = 1 h
77.15	Pump 5 running time	Real	0.0042949672.95	h	100 = 1 h
77.16	Pump 6 running time	Real	0.0042949672.95	h	100 = 1 h
77.17	Pump 7 running time	Real	0.0042949672.95	h	100 = 1 h
77.18	Pump 8 running time	Real	0.0042949672.95	h	100 = 1 h
77.20	IPC online pumps	PB	0000hFFFFh	-	1 = 1
77.21	IPC comm loss status	PB	0000hFFFFh	-	1 = 1
80 Flow	calculation				
80.01	Actual flow	Real	-200000.00200000.00	flow unit	100 = 1 flow unit
80.02	Actual flow percentage	Real	-100.00100.00	%	100 = 1%
80.03	Total volume	Real	0.0021474836.00	based on flow unit	100 = 1 unit
80.04	Specific energy	Real	0.0032767.95	based on flow unit	100 = 1 unit
80.05	Estimated pump head	Real	0.0032767.00	length unit	100 = 1 length unit
80.08	Incremental volume	Real	0.0021474835.20	based on flow unit	100 = 1 unit
80.11	Flow feedback 1 source	Analog src	-	-	1 = 1
80.12	Flow feedback 2 source	Analog src	-	-	1 = 1
80.13	Flow feedback function	List	01, 89, 100101	-	1 = 1
80.14	Flow feedback multiplier	Real	-200000.00200000.00	-	100 = 1
80.15	Maximum flow	Real	-200000.00200000.00	flow unit	100 = 1 flow unit
80.16	Minimum flow	Real	-200000.00200000.00	flow unit	100 = 1 flow unit
80.17	Maximum flow protection	List	03	-	1 = 1
80.18	Minimum flow protection	List	03	-	1 = 1
80.19	Flow check delay	Real	0.003600.00	s	100 = 1 s
80.20	Volume unit multiplier	Real	1 or 1000	-	1 = 1
80.21	Flow pump nominal speed	Real	0.030000.0	rpm	1 = 1 rpm
80.22	Pump inlet diameter	Real	0.01032767.000	length unit	1000 = 1 length unit
80.23	Pump outlet diameter	Real	0.01032767.000	length unit	1000 = 1 length unit
80.26	Calculation minimum speed	Real	0.0032767.00	rpm/Hz	100 = 1 unit

No.	Name	Туре	Range	Unit	FbEq32
80.28	Density	Real	0.0032767.00	density	100 = 1
				unit	density unit
80.29	Total volume reset	List	-	-	1 = 1
80.30	Incremental volume reset	List	01	-	1 = 1
80.31	Total volume reset date	Real	-	-	-
80.32	Total volume reset time	Real	-	-	-
80.33	Incremental volume reset date	Real	-	-	-
80.34	Incremental volume reset time	Real	-	-	-
80.40	H curve H1	Real	0.0032767.00	length unit	100 = 1 length unit
80.41	H curve H2	Real	0.0032767.00	length unit	100 = 1 length unit
80.42	H curve H3	Real	0.0032767.00	length unit	100 = 1 length unit
80.43	H curve H4	Real	0.0032767.00	length unit	100 = 1 length unit
80.44	H curve H5	Real	0.0032767.00	length unit	100 = 1 length unit
80.45	H curve H6	Real	0.0032767.00	length unit	100 = 1 length unit
80.46	H curve H7	Real	0.0032767.00	length unit	100 = 1 length unit
80.47	H curve H8	Real	0.0032767.00	length unit	100 = 1 length unit
80.48	H curve H9	Real	0.0032767.00	length unit	100 = 1 length unit
80.49	H curve H10	Real	0.0032767.00	length unit	100 = 1 length unit
80.50	P curve P1	Real	0.0032767.00	kW or Hp	100 = 1 unit
80.51	P curve P2	Real	0.0032767.00	kW or Hp	100 = 1 unit
80.52	P curve P3	Real	0.0032767.00	kW or Hp	100 = 1 unit
80.53	P curve P4	Real	0.0032767.00	kW or Hp	100 = 1 unit
80.54	P curve P5	Real	0.0032767.00	kW or Hp	100 = 1 unit
80.55	P curve P6	Real	0.0032767.00	kW or Hp	100 = 1 unit
80.56	P curve P7	Real	0.0032767.00	kW or Hp	100 = 1 unit
80.57	P curve P8	Real	0.0032767.00	kW or Hp	100 = 1 unit
80.58	P curve P9	Real	0.0032767.00	kW or Hp	100 = 1 unit
80.59	P curve P10	Real	0.0032767.00	kW or Hp	100 = 1 unit
80.60	Q value Q1	Real	0.00200000.00	flow unit	100 = 1 flow unit
80.61	Q value Q2	Real	0.00200000.00	flow unit	100 = 1 flow unit
80.62	Q value Q3	Real	0.00200000.00	flow unit	100 = 1 flow unit
80.63	Q value Q4	Real	0.00200000.00	flow unit	100 = 1 flow unit

Q value Q5

Name

Type

Real

Range

0.00 200000.00

No.

80 64

Unit

flow unit

FbEq32 100 = 1

No.	Name	Туре	Range	Unit	FbEq32
82.15	Oper. quick ramp decel. time (1st)	Real	0.101800.00	s	1 = 1 s
82.20	Dry run protection	List	03	-	1 = 1
82.21	Dry run source	List	09	-	1 = 1
82.22	Flow switch protection	List	02	-	1 = 1
82.23	Flow switch source	List	27	-	1 = 1
82.24	Flow switch check delay	Real	0.003600.00	S	1 = 1
82.25	Soft pipe fill supervision	List	02	-	1 = 1
82.26	Time-out limit	Real	0.01800.0	s	10 = 1 s
82.30	Outlet minimum pressure protection	List	03	-	1 = 1
82.31	Outlet minimum pressure warning level	Real	0.0032767.00	pressure unit	100 = 1 pressure unit
82.32	Outlet minimum pressure fault level	Real	0.0032767.00	pressure unit	100 = 1 pressure unit
82.35	Outlet maximum pressure protection	List	03	-	1 = 1
82.37	Outlet maximum pressure warning level	Real	0.0032767.00	pressure unit	100 = 1 pressure unit
82.38	Outlet maximum pressure fault level	Real	0.0032767.00	pressure unit	100 = 1 pressure unit
82.40	Inlet minimum pressure protection	List	03	-	1 = 1
82.41	Inlet minimum pressure warning level	Real	0.0032767.00	pressure unit	100 = 1 pressure unit
82.42	Inlet minimum pressure fault level	Real	0.0032767.00	pressure unit	100 = 1 pressure unit
82.45	Pressure check delay	Real	0.003600.00	s	100 = 1 s
82.51	Pump autoreset selection	Real	065535	-	1 = 1
82.52	Pump autoreset delay time	Real	0.032767.0	min	10 = 1 min
83 Pum	p cleaning				
83.01	Pump cleaning status	Binary src	-	-	1 = 1
83.02	Pump cleaning progress	Real	0.0100.0	%	1 = 1 %
83.03	Total cleaning count	Real	01000000	-	1 = 1
83.10	Pump cleaning action	List	02	-	1 = 1
83.11	Pump cleaning triggers	PB	0000hFFFFh	-	1 = 1
83.12	Manually force cleaning	Binary src	-	-	1 = 1
83.15	Fixed time interval	Time	00:00:0045:12:15	-	-
83.16	Cycles in cleaning program	Real	165535	-	1 = 1
83.20	Cleaning speed step	Real	0100	%	1 = 1 %
83.25	Time to cleaning speed	Real	0.00060.000	s	1 = 1 s
83.26	Time to zero-speed	Real	0.00060.000	s	1 = 1 s
83.27	Cleaning on time	Real	0.0001000.000	S	1 = 1 s

No.	Name	Type	Range	Unit	FbEq32
95.15	Special HW settings	PB	00000000hFFFFFFFh	-	1 = 1
95.20	HW options word 1	PB	0000hFFFFh	-	1 = 1
95.21	HW options word 2	PB	0000hFFFFh	-	1 = 1
95.26	Motor disconnect detection	List	01	-	1 = 1
95.200	Cooling fan mode	List	01	-	1 = 1
96 Syst	em				
96.01	Language	List	-	-	1 = 1
96.02	Pass code	Data	099999999	-	1 = 1
96.03	Access level status	PB	00000000hFFFFFFFh	-	1 = 1
96.04	Macro select	List	01	-	1 = 1
96.05	Macro active	List	1	-	1 = 1
96.06	Parameter restore	List	0, 2, 8, 32, 62, 512, 1024, 34560	-	1 = 1
96.07	Parameter save manually	List	01	-	1 = 1
96.08	Control board boot	List	01	-	1 = 1
96.10	User set status	List	07, 2023	-	1 = 1
96.11	User set save/load	List	05, 1821	-	1 = 1
96.12	User set I/O mode in1	Binary src	-	-	1 = 1
96.13	User set I/O mode in2	Binary src	-	-	1 = 1
96.16	Unit selection	PB	0000hFFFFh		1 = 1
96.20	Time sync primary source	List	0, 3, 6, 8, 9	-	1 = 1
96.24	Full days since 1st Jan 1980	Real	159999	d	1 = 1 d
96.25	Time in minutes within 24h	Real	11439	min	1 = 1 min
96.26	Time in ms within one minute	Real	059999	ms	1 = 1 ms
96.39	Event configuration	Real	059999	-	1 = 1
96.51	Clear fault and event logger	Real	01	-	1 = 1
96.54	Checksum action	List	04	-	1 = 1
96.55	Checksum control word	PB	0000hFFFFh	-	1 = 1
96.68	Actual checksum A	PB	00000000hFFFFFFFh	-	1 = 1
96.69	Actual checksum B	PB	00000000hFFFFFFFh	-	1 = 1
96.70	Disable adaptive program	List	01	-	1 = 1
96.71	Approved checksum A	PB	00000000hFFFFFFFh	-	1 = 1
96.72	Approved checksum B	PB	00000000hFFFFFFFh	-	1 = 1
96.78	Legacy Modbus mapping	List	01	-	1 = 1
96.79	Legacy control profile	List	03	-	1 = 1
96.100	Change user pass code	Data	1000000099999999	-	1 = 1
96.101	Confirm user pass code	Data	1000000099999999	-	1 = 1
96.102	User lock functionality	PB	0000hFFFFh	-	1 = 1
	(Parameter 96.108	only visibl	e for ACQ580-31 and ACQ58	0-34)	•
96.108	LSU control board boot	Real	01	-	1 = 1

No.	Name	Туре	Range	Unit	FbEq32
97 Moto	or control				
97.01	Switching frequency reference	List	2, 4, 8, 12	kHz	1 = 1 kHz
97.02	Minimum switching frequency	List	1, 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
97.08	Optimizer minimum torque	Real	0.01600.0	%	10 = 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
97.48	UDC stabilizer	List	0, 50, 100, 300, 500, 800	-	1 = 1
97.49	Slip gain for scalar	Real	0200	%	1 = 1%
97.94	IR comp max frequency	Real	1.0200.0	%	1 = 1%
97.135	UDC ripple	Real	0.0200.0	V	10 = 1V
98 User	motor parameters				
98.01	User motor model mode	List	01	-	1 = 1
98.02	Rs user	Real	0.00000.50000	p.u.	100000 = 1 p.u.
98.03	Rr user	Real	0.00000.50000	p.u.	100000 = 1 p.u.
98.04	Lm user	Real	0.0000010.00000	p.u.	100000 = 1 p.u.
98.05	SigmaL user	Real	0.000001.00000	p.u.	100000 = 1 p.u.
98.06	Ld user	Real	0.0000010.00000	p.u.	100000 = 1 p.u.
98.07	Lq user	Real	0.0000010.00000	p.u.	100000 = 1 p.u.
98.08	PM flux user	Real	0.000002.00000	p.u.	100000 = 1 p.u.
98.09	Rs user SI	Real	0.00000100.00000	ohm	100000 = 1 ohm
98.10	Rr user SI	Real	0.00000100.00000	ohm	100000 = 1 ohm
98.11	Lm user SI	Real	0.00100000.00	mH	100 = 1 mH
98.12	SigmaL user SI	Real	0.00100000.00	mH	100 = 1 mH
98.13	Ld user SI	Real	0.00100000.00	mH	100 = 1 mH
98.14	Lq user SI	Real	0.00100000.00	mH	100 = 1 mH

No.	Name	Туре	Range	Unit	FbEq32				
99 Moto	99 Motor data								
99.03	Motor type	List	02	-	1 = 1				
99.04	Motor control mode	List	01	-	1 = 1				
99.06	Motor nominal current	Real	0.06400.0	Α	10 = 1 A				
99.07	Motor nominal voltage	Real	0.0960.0	V	10 = 1 V				
99.08	Motor nominal frequency	Real	0.00 500.00	Hz	100 = 1 Hz				
99.09	Motor nominal speed	Real	0 30000	rpm	1 = 1 rpm				
99.10	Motor nominal power	Real	0.0010000.00 kW or 0.00 13404.83 hp	kW or hp	100 = 1 unit				
99.11	Motor nominal cos Φ	Real	0.00 1.00	-	100 = 1				
99.12	Motor nominal torque	Real	0.0004000000.000 N·m or 0.0002950248.597 lb·ft	N·m or lb·ft	1000 = 1 unit				
99.13	ID run requested	List	03, 56, 8	-	1 = 1				
99.14	Last ID run performed	List	03, 56, 8	-	1 = 1				
99.15	Motor polepairs calculated	Real	01000	-	1 = 1				
99.16	Motor phase order	List	01	-	1 = 1				

# 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://new.abb.com/channel-partners/search">https://new.abb.com/channel-partners/search</a>.

### Product training

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

#### Providing feedback on ABB Drives manuals

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

## Document library on the Internet

You can find manuals and other product documents in PDF format on the Internet at <a href="https://library.abb.com/">https://library.abb.com/</a>.



abb.com/drives



3AXD50000035867G