ACS850

Firmware Manual
ACS850 Standard Control Program

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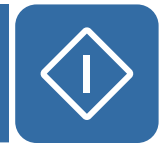

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About the manual

What this chapter contains

The chapter describes the contents of the manual. It also contains information on the compatibility, safety and intended audience.

Compatibility

The manual is compatible with ACS850 Standard Control program.

Safety instructions

Follow all safety instructions delivered with the drive.

- Read the **complete safety instructions** before you install, commission, or use the drive. The complete safety instructions are given at the beginning of the *Hardware Manual*.
- Read the **software function specific warnings and notes** before changing the default settings of the function. For each function, the warnings and notes are given in this manual in the section describing the related user-adjustable parameters.

Reader

The reader of the manual is expected to know the standard electrical wiring practices, electronic components, and electrical schematic symbols.

Contents

The manual consists of the following chapters:

- *Start-up* instructs in setting up the control program and how to control the drive through the I/O interface.
- *Control locations and operating modes* describes the control locations and operation modes of the drive.
- *Program features* contains descriptions of the features of the ACS850 Standard Control Program.
- *Application macros* contains a short description of each macro together with a connection diagram.
- *Parameters* describes the parameters of the drive.
- *Additional parameter data* contains further information on the parameters.
- *Fault tracing* lists the alarm (warning) and fault messages with possible causes and remedies.
- *Fieldbus control* describes the communication to and from a fieldbus network.
- *Control block diagrams* contains a graphical representation of the control program.

2

Start-up

What this chapter contains

This chapter describes the basic start-up procedure of the drive and instructs in how to control the drive through the I/O interface.

How to start up the drive

The drive can be operated:

- locally from control panel or DriveStudio PC tool.
- externally via I/O connections or fieldbus interface.

The start-up procedure presented uses the control panel. For detailed instructions for use of the panel, see *Control Panel for ACS850 and ACSM1 User's Guide* (3AUA0000020131 [English]).

For instructions on how to use DriveStudio, see *DriveStudio User Manual* (3AFE68749026 [English]).

The start-up procedure includes actions which need to be performed only when the drive is powered up for the first time (e.g. entering the motor data). After the first start-up, the drive can be powered up without using these start-up functions. The start-up procedure can be repeated later if start-up data needs to be changed.

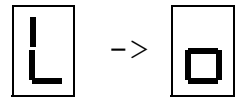
In addition to the commissioning and drive power-up, the start-up procedure includes the following steps:

- entering the motor data and performing the motor identification run
- setting up the encoder/resolver communication
- checking the emergency stop and Safe Torque Off circuits
- setting up the voltage control
- setting the drive limits

- setting up the motor overtemperature protection
- tuning the speed controller
- setting up the fieldbus control.

If an alarm or a fault is generated during the start-up, see chapter *Fault tracing* for the possible causes and remedies. If problems continue, disconnect the main power and wait 5 minutes for the intermediate circuit capacitors to discharge and check the drive and motor connections.

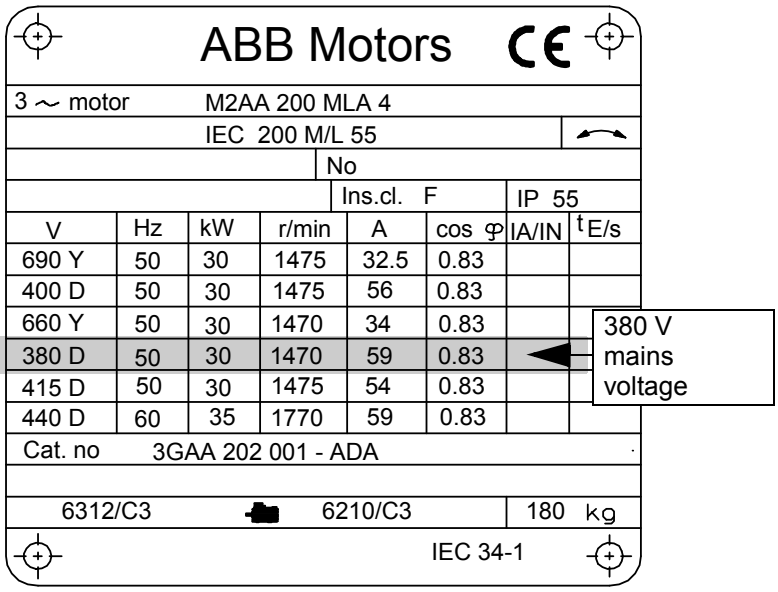
Start-up procedure

Before you start, ensure you have the motor nameplate and encoder data (if needed) at hand.		
Safety		
	The start-up may only be carried out by a qualified electrician. The safety instructions must be followed during the start-up procedure. See the safety instructions on the first pages of the appropriate hardware manual.	
☐	Check the installation. See the installation checklist in the appropriate hardware manual.	
☐	Check that the starting of the motor does not cause any danger. **De-couple the driven machine** if • there is a risk of damage in case of an incorrect direction of rotation, or • a normal ID run (*99.13 Idrun mode* = *Normal*) is required during the drive start-up, when the load torque is higher than 20% or the machinery is not able to withstand the nominal torque transient during the ID run.	
Powering up the drive		
☐	Connect the control panel to the drive using an appropriate Category 5E cable.	
☐	Switch the power on.	7-segment display on JCU Control Unit: 
☐	Switch to local control to ensure that external control is disabled by pressing the LOC REM button on the control panel. (Local control is indicated by the text “LOC” on the uppermost row on the display.)	

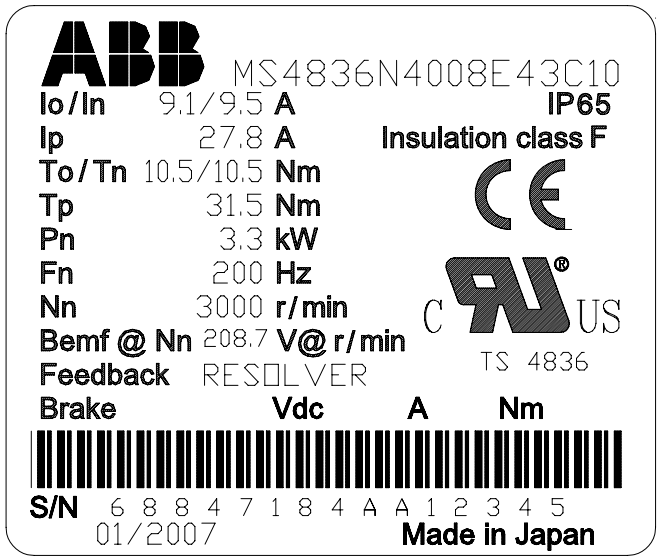
Entering basic data		
☐	To adjust drive parameters using the control panel, press MENU (right-hand side multifunction button). Highlight PARAMETERS on the list and press ENTER. • Use the up and down arrow buttons to browse the list of parameter groups. Highlight the desired group and press SEL to display the parameters within that group. • Highlight a parameter and press EDIT to adjust the value. • Parameter values are adjusted by using the up and down arrow buttons. (When adjusting pointer parameters, use the NEXT button to move between the parameter group, index and bit settings.) Press SAVE to accept the new parameter value, CANCEL to retain the old value. • At any point, press EXIT to return to the previous level.	
☐	Set parameter *16.15 Menu set sel* to *Load long* to make all parameters visible.	*16.15 Menu set sel*
☐	Select the language.	*99.01 Language*
Notes: • The following motor data parameters can be set using an assistant on the control panel. From the main menu, select ASSISTANTS – Firmware assistants – Motor Set-up. The assistant also evokes the ID run (see page *16*) if desired. • With multimotor drives, see page *16* before setting the motor data parameters.		
☐	Select the motor type: asynchronous or permanent magnet motor.	*99.04 Motor type*
☐	Select the motor control mode. DTC is suitable for most cases. For information on scalar control, see description of parameter *99.05 Motor ctrl mode*.	*99.05 Motor ctrl mode*

☐ Enter the motor data from the motor nameplate.

Asynchronous motor nameplate example:



Permanent magnet motor nameplate example:



At least parameters *99.06*…*99.10* must be set with DTC control (*99.05 Motor ctrl mode* = *DTC*). Better control accuracy can be achieved by setting also parameters *99.11*…*99.12*.

Note: Set the motor data to exactly the same value as on the motor nameplate. For example, if the motor nominal speed is 1470 rpm on the nameplate, setting the value of parameter *99.09 Mot nom speed* to 1500 rpm results in wrong operation of the drive.

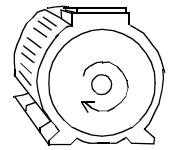
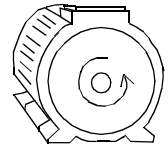
☐ • motor nominal current

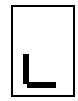
99.06 Mot nom current

Allowed range: approximately 1/6 × I_{2n} … 2 × I_{2n} of the drive (0…2 × I_{2nd} if parameter *99.05 Motor ctrl mode* = *Scalar*). With multimotor drives, see page *16*.

☐	• motor nominal voltage Allowed range: 1/6 × U_N … 2 × U_N of the drive. (U_N refers to the highest voltage in each nominal voltage range). With permanent magnet motors: The nominal voltage is the BackEMF voltage (at motor nominal speed). If the voltage is given as voltage per rpm, e.g. 60 V per 1000 rpm, the voltage for 3000 rpm nominal speed is 3 × 60 V = 180 V. Note that the nominal voltage is not equal to the equivalent DC motor voltage (E.D.C.M.) value given by some motor manufactures. The nominal voltage can be calculated by dividing the E.D.C.M. voltage by 1.7 (= square root of 3).	*99.07 Mot nom voltage*
☐	• motor nominal frequency Range: 5…500 Hz. With multimotor drives, see page *16*. With permanent magnet motor: If the frequency is not given on the motor nameplate, it has to be calculated with the following formula: $f = n \times p / 60$ where p = number of pole pairs, n = motor nominal speed.	*99.08 Mot nom freq*
☐	• motor nominal speed Range: 0…10000 rpm. With multimotor drives, see page *16*.	*99.09 Mot nom speed*
☐	• motor nominal power Range: 0…10000 kW. With multimotor drives, see page *16*.	*99.10 Mot nom power*
☐	• motor nominal cosφ (not applicable for permanent magnet motors). This value can be set for better DTC control accuracy. If value is not given by the motor manufacturer, use value 0 (i.e. default value). Range: 0…1.	*99.11 Mot nom cosfii*
☐	• motor nominal shaft torque. This value can be set for better DTC control accuracy. If value is not given by the motor manufacturer, use value 0 (i.e. default value). Range: 0…2147483.647 Nm.	*99.12 Mot nom torque*
☐	After the motor parameters have been set, alarm ID-RUN is generated to inform that the ID run needs to be performed.	Alarm: ID-RUN

Multimotor drives		
This section applies only to drive systems in which multiple motors are connected to the drive.		
☐	Check that the motors have the same relative slip (only for asynchronous motors), nominal voltage and number of poles. If the manufacturer motor data is insufficient, use the following formulas to calculate the slip and the number of poles: $p = Int\left(\frac{f_N \cdot 60}{n_N}\right)$ $n_s = \frac{f_N \cdot 60}{p}$ $s = \frac{n_S - n_N}{n_S} \cdot 100\%$ where p = number of pole pairs (= motor pole number / 2) f_N = motor nominal frequency in Hz n_N = motor nominal speed in rpm s = motor slip in % n_S = motor synchronous speed in rpm.	
☐	Set the sum of the motor nominal currents.	*99.06 Mot nom current*
☐	Set the nominal motor frequencies. Frequencies must be the same.	*99.08 Mot nom freq*
☐	Set the sum of the motor nominal powers. If the motor powers are close to each other or the same but the nominal speeds vary slightly, parameter *99.09 Mot nom speed* can be set to an average value of the motor speeds.	*99.10 Mot nom power* *99.09 Mot nom speed*
ID RUN (motor identification run)		
	WARNING! With Normal or Reduced ID run the motor will run at up to approximately 50…100% of the nominal speed during the ID run. ENSURE THAT IT IS SAFE TO RUN THE MOTOR BEFORE PERFORMING THE ID RUN!	
Note: Ensure that possible Safe Torque Off and emergency stop circuits are closed during the ID run.		

☐	Check the direction of rotation of the motor before starting the ID run. During the run (Normal or Reduced), the motor will rotate in the forward direction.	When drive output phases U2, V2 and W2 are connected to the corresponding motor terminals:  forward direction  reverse direction
☐	Select the motor identification method by parameter *99.13 Idrun mode*. During the Motor ID run, the drive will identify the characteristics of the motor for optimum motor control. The ID run is performed at the next start of the drive. **Notes:** • The motor shaft must NOT be locked and the load torque must be < 20% during Normal or Reduced ID run. With permanent magnet motor this restriction applies also when Standstill ID run is selected. • Mechanical brake is not opened by the logic for the ID run. • The ID run cannot be performed if parameter *99.05 Motor ctrl mode* = *Scalar*. **NORMAL ID** run should be selected whenever possible. **Note:** The driven machinery must be de-coupled from the motor with Normal ID run: • if the load torque is higher than 20%, or • if the machinery is not able to withstand the nominal torque transient during the ID run. The **REDUCED ID** run should be selected instead of the Normal ID run if the mechanical losses are higher than 20%, i.e. the motor cannot be de-coupled from the driven equipment, or full flux is required to keep the motor brake open (conical motor). The **STANDSTILL ID** run should be selected only if the Normal or Reduced ID run is not possible due to the restrictions caused by the connected mechanics (e.g. with lift or crane applications).	*99.13 Idrun mode* *11.07 Autophasing mode*

	AUTOPHASING can only be selected after the Normal/ Reduced/Standstill ID run has been performed once. Autophasing is used when an absolute encoder has been added/changed to a permanent magnet motor, but there is no need to perform the Normal/Reduced/Standstill ID run again. See parameter *11.07 Autophasing mode* on page *87* for information on autophasing modes.	
☐	Check the drive limits. The following must apply for all ID run methods: • *20.05 Maximum current* ≥ *99.06 Mot nom current* In addition, the following must apply for Reduced and Normal ID run: • *20.01 Maximum speed* > 55% of *99.09 Mot nom speed* • *20.02 Minimum speed* ≤ 0 • Supply voltage ≥ 65% of *99.07 Mot nom voltage* • Selected maximum torque limit (*20.06 Torq lim sel*) ≥ 100% (only for Normal ID run). When the ID run has been successfully completed, set the limit values as required by the application.	
☐	Start the motor (by pressing the START button) to activate the ID run. **Note:** The Run enable signal must be active. ID run is indicated by alarm ID-RUN and by a rotating display on the 7-segment display.	*10.11 Run enable* Alarm: ID-RUN 7-segment display:  rotating display
☐	If the ID run is not successfully completed, fault ID-RUN FAULT is generated.	Fault: ID-RUN FAULT
Selecting an application macro		
The drive has pre-defined parameter settings called application macros. Each macro is targeted for a specific application, and can be used as a basis for custom parameter settings. The result can then be saved as a user parameter set. For descriptions of the available macros, see page *30*. The application macro can be selected on the control panel. From the main menu, select ASSISTANTS – Firmware assistants – Application Macro.		
Motor overtemperature protection (1)		
☐	Select how the drive reacts when motor overtemperature is detected.	*31.01 Mot temp1 prot* *31.05 Mot temp2 prot*
☐	Select the motor temperature protection: motor thermal model (*Estimated*) or motor temperature measurement. For motor temperature measurement connections, see the *Hardware Manual*.	*31.02 Mot temp1 src* *31.06 Mot temp2 src*

Speed measurement with encoder/resolver		
An encoder/resolver feedback can be used for more accurate motor control. Follow these instructions when encoder/resolver interface module FEN-xx is installed in drive option Slot 1 or 2. **Note:** Two encoder interface modules of the same type are not allowed.		
☐	Select the used encoder/resolver. For more information, see parameter group *90 Enc module sel* on page *191*.	*90.01 Encoder 1 sel* *90.02 Encoder 2 sel*
☐	Set other necessary encoder/resolver parameters: • Absolute encoder parameters (group 91, page *193*) • Resolver parameters (group 92, page *196*) • Pulse encoder parameters (group 93, page *196*).	*91.01*…*91.31* *92.01*…*92.03* *93.01*…*93.13*
☐	Save new parameters settings into the permanent memory by setting parameter *16.07 Param save* to value *Save*.	*16.07 Param save*
☐	Set parameter *90.10 Enc par refresh* to *Configure* (or switch the drive power off and on again) so that the new parameter settings take effect.	*90.10 Enc par refresh*
Checking the encoder/resolver connection		
Follow these instructions when encoder/resolver interface module FEN-xx is installed in drive option Slot 1 or 2. **Note:** Two encoder interface modules of the same type are not allowed.		
☐	Set parameter *19.02 Speed fb sel* to *Estimated*.	*19.02 Speed fb sel*
☐	Enter a small speed reference value (for example 3% of the nominal motor speed). Reference can be entered on the control panel by selecting REF EDIT in the main menu.	
☐	Start the motor by pressing the START button.	
☐	Check that the estimated (*01.14 Motor speed est*) and actual (*01.08 Encoder1 speed* / *01.10 Encoder2 speed*) speeds are equal. If the values differ, check the encoder/ resolver parameter settings. **Hint:** If the actual speed (with a pulse encoder) differs form the reference value by a factor of 2, check the pulse number setting (*93.01 Enc1 pulse nr* / *93.11 Enc2 pulse nr*).	*01.14 Motor speed est* *01.08 Encoder1 speed* *01.10 Encoder2 speed*

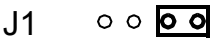
☐	If the direction of rotation is selected as forward, check that the actual speed (*01.08 Encoder1 speed* / *01.10 Encoder2 speed*) is positive: • If the actual direction of the rotation is forward and the actual speed negative, the phasing of the pulse encoder wires is reversed. • If the actual direction of the rotation is reverse and the actual speed negative, the motor cables are incorrectly connected. Changing the connection: Disconnect the main power, and wait for 5 minutes for the intermediate circuit capacitors to discharge. Do the necessary changes. Switch the power on and start the motor again. Check that the estimated and actual speed values are correct. If the direction of rotation is selected as reverse, the actual speed must be negative. **Note:** Resolver autotuning routines should always be performed after resolver cable connection has been modified. Autotuning routines can be activated by adjusting parameter *92.02 Exc signal ampl* or *92.03 Exc signal freq*, and then setting parameter *90.10 Enc par refresh* to *Configure*. If the resolver is used with a permanent magnet motor, an AUTOPHASING ID run should be performed as well.	*01.08 Encoder1 speed* *01.10 Encoder2 speed*
☐	Stop the motor by pressing the STOP button.	
☐	Set parameter *19.02 Speed fb sel* to *Enc1 speed* or *Enc2 speed*. If the speed feedback cannot be used in motor control: In special applications parameter *40.06 Force open loop* must be set to *True*.	*19.02 Speed fb sel*
Emergency stop circuit		
☐	If there is an emergency stop circuit in use, check that the circuit is functioning (emergency stop signal is connected to the digital input which is selected as the source for the emergency stop activation).	*10.13 Em stop off3* or *10.15 Em stop off1* (emergency stop control through fieldbus *02.22 FBA main cw*, bits 2…4)

Safe Torque Off		
The Safe Torque Off function disables the control voltage of the power semiconductors of the drive output stage, thus preventing the inverter from generating the voltage required to rotate the motor. For Safe Torque Off wiring, see the appropriate hardware manual.		
☐	If there is a Safe Torque Off circuit in use, check that the circuit functions.	
☐	Selects how the drive reacts when the Safe Torque Off function is active (i.e. when the control voltage of the power semiconductors of the drive output stage is disabled).	*30.07 Sto diagnostic*
Voltage control		
If the DC voltage drops due to input power cut off, the undervoltage controller will automatically decrease the motor torque in order to keep the voltage above the lower limit. To prevent the DC voltage from exceeding the overvoltage control limit, the overvoltage controller automatically decreases the generating torque when the limit is reached. When the overvoltage controller is limiting the generating torque, quick deceleration of the motor is not possible. Thus electrical braking (brake chopper and brake resistor) is needed in some applications to allow the drive to dissipate regenerative energy. The chopper connects the brake resistor to the intermediate circuit of the drive whenever the DC voltage exceeds the maximum limit.		
☐	Check that the overvoltage and undervoltage controllers are active.	*47.01 Overvolt ctrl* *47.02 Undervolt ctrl*
☐	If the application requires a brake resistor (the drive has a built-in brake chopper): • Set the brake chopper and resistor settings. **Note:** When a brake chopper and resistor are used, the overvoltage controller must be deactivated by parameter *47.01 Overvolt ctrl*. • Check that the connection is functioning. For more information on the brake resistor connection, see the appropriate hardware manual.	*48.01*…*48.07* *47.01 Overvolt ctrl*
Start function		
☐	Select the start function. Setting *11.01 Start mode* to *Automatic* selects a general-purpose start function. This setting also makes flying start (starting to a rotating motor) possible. The highest possible starting torque is achieved when *11.01 Start mode* is set to *Fast* (automatic optimised DC magnetising) or *Const time* (constant DC magnetising with user-defined magnetising time). **Note:** When *11.01 Start mode* is set to *Fast* or *Const time*, flying start (start to a rotating motor) is not possible.	*11.01 Start mode*

Limits		
☐	Set the operation limits according to the process requirements. **Note:** If load torque is suddenly lost when the drive is operating in torque control mode, the drive will rush to the defined negative or positive maximum speed. For safe operation, ensure the set limits are suitable for your application.	*20.01*…*20.07*
Motor overtemperature protection (2)		
☐	Set the alarm and fault limits for the motor overtemperature protection.	*31.03 Mot temp1 almLim* *31.04 Mot temp1 fltLim* *31.07 Mot temp2 almLim* *31.08 Mot temp2 fltLim*
☐	Set the typical ambient temperature of the motor.	*31.09 Mot ambient temp*
☐	If the temperature monitoring method (*31.02 Mot temp1 src* or *31.06 Mot temp2 src*) is set to *Estimated*, the motor thermal protection model must be configured as follows: • Set the maximum allowed operating load of the motor • Set the zero speed load. A higher value can be used if the motor has an external motor fan to boost the cooling • Set the break point frequency of the motor load curve • Set the motor nominal temperature rise • Set the time inside which the temperature has reached 63% of the nominal temperature.	*31.10 Mot load curve* *31.11 Zero speed load* *31.12 Break point* *31.13 Mot nom tempRise* *31.14 Mot therm time*
☐	If possible, perform the motor ID run again at this point (see page *16*).	*99.13 Idrun mode*
Fieldbus control		
Follow these instructions when the drive is controlled from a fieldbus control system via fieldbus adapter Fxxx. The adapter is installed in drive Slot 3.		
☐	Enable the communication between the drive and fieldbus adapter.	*50.01 Fba enable*
☐	Connect the fieldbus control system to the fieldbus adapter module.	
☐	Set the communication and adapter module parameters: See chapter *Fieldbus control* on page *243*.	
☐	Test that the communication functions.	

How to control the drive through the I/O interface

The table below instructs how to operate the drive through the digital and analogue inputs, when the default parameter settings are valid.

Preliminary settings	
Ensure the control connections are wired according to the connection diagram given in chapter *Application macros*.	
Switch to external control by pressing the LOC REM button on the control panel. (External control is indicated by the text “REM” on the uppermost row on the display.)	
Starting and controlling the speed of the motor	
Start the drive by switching digital input DI1 on. Digital input status can be monitored with signal *02.01 DI status*.	*02.01 DI status*
Check that analog input AI1 is used as a voltage input (selected by jumper J1 on the JCU Control Unit).	Voltage: J1 
Regulate the speed by adjusting the voltage on analogue input AI1.	
Check analogue input AI1 signal scaling. AI1 values can be monitored with signals *02.04 AI1* and *02.05 AI1 scaled*. When AI1 is used as a voltage input, the input is differential and the negative value corresponds to the negative speed and the positive value to the positive speed.	*13.02…13.05* *02.04 AI1* *02.05 AI1 scaled*
Stopping the motor	
Stop the drive by switching digital input DI1 off.	*02.01 DI status*

3

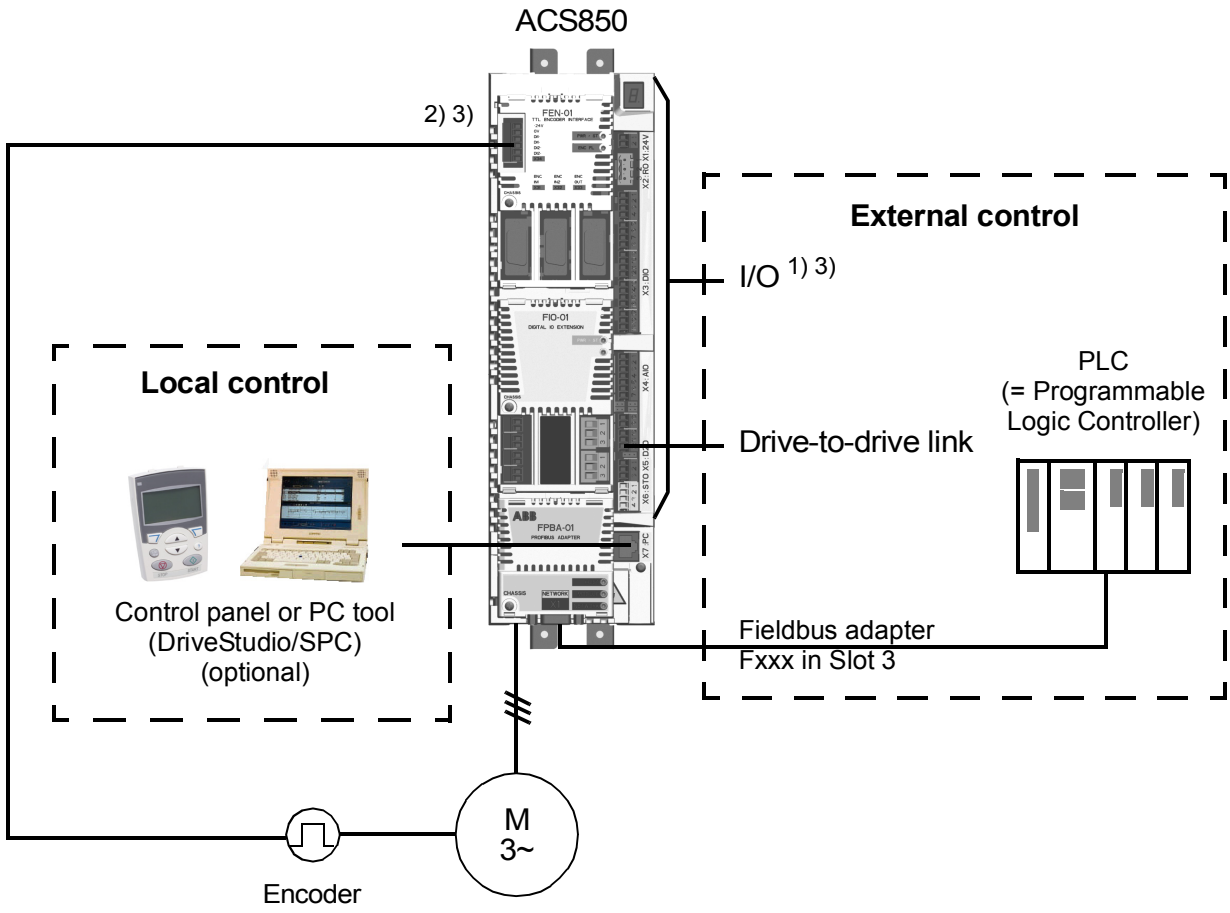
Control locations and operating modes

What this chapter contains

This chapter describes the control locations and operating modes of the drive.

Local control vs. external control

The drive has two main control locations: external and local. The control location is selected with the LOC/REM key on the control panel or with the PC tool (Take/ Release button).



1) Extra inputs/outputs can be added by installing optional I/O extension modules (FIO-xx) in drive Slot 1/2.

2) Encoder or resolver interface module (FEN-xx) installed in drive Slot 1/2

3) Two encoder/resolver interface modules of the same type are not allowed.

Local control

The control commands are given from the control panel keypad or from a PC equipped with DriveStudio and Solution Program Composer (SPC) when the drive is in local control. Speed and torque control modes are available for local control.

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 disabled by parameter *16.01 Local lock*.

The user can select by a parameter (*30.03 Local ctrl loss*) how the drive reacts to a control panel or PC tool communication break.

External control

When the drive is in external control, control commands are given through the fieldbus interface (via an optional fieldbus adapter module), the I/O terminals (digital and analogue inputs), optional I/O extension modules or the drive-to-drive link. External references are given through the fieldbus interface, analogue inputs, drive to drive link and encoder inputs.

Two external control locations, EXT1 and EXT2, are available. The user can select control signals (e.g. start and stop) and control modes for both external control locations. Depending on the user selection, either EXT1 or EXT2 is active at a time. Selection between EXT1/EXT2 is done via digital inputs or fieldbus control word.

Operating modes of the drive

The drive can operate in several control modes.

Speed control mode

Motor rotates at a speed proportional to the speed reference given to the drive. This mode can be used either with estimated speed used as feedback, or with an encoder or resolver for better speed accuracy.

Speed control mode is available in both local and external control.

Torque control mode

Motor torque is proportional to the torque reference given to the drive. This mode can be used either with estimated speed used as feedback, or with an encoder or resolver for more accurate and dynamic motor control.

Torque control mode is available in both local and external control.

Special control modes

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

- Emergency Stop modes OFF1 and OFF3: Drive stops along the defined deceleration ramp and drive modulation stops.
- Jogging mode: Drive starts and accelerates to the defined speed when the jogging signal is activated.

For more information, see parameter group *10 Start/stop* on page *79*.

4

Program features

What this chapter contains

This chapter describes the features of the control program.

Application macros

See chapter *Application macros* (page *51*).

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.

Autophasing is applicable to permanent magnet synchronous motors in these cases:

One-time measurement of the rotor and encoder position difference when an absolute encoder or resolver (one pole pair) is used

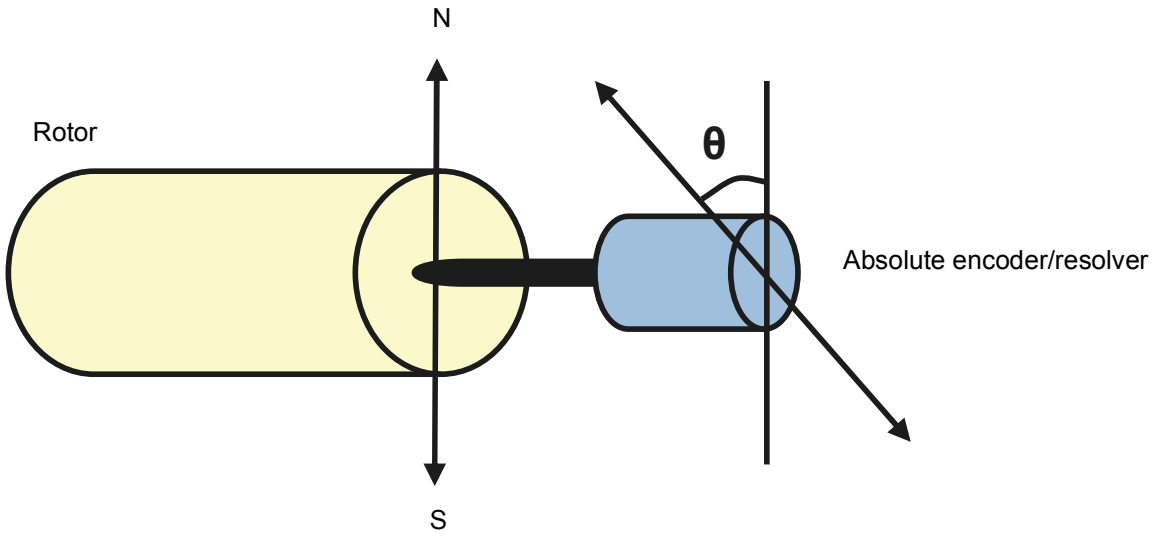
With open-loop motor control, repetitive measurement of the rotor position at every start.

Several autophasing modes are available (see parameter *11.07 Autophasing mode*).

The turning mode is recommended especially with case 1 as it is the most robust and accurate method. In turning mode, the motor shaft is turned back and forward (±360/polepairs)° in order to determine the rotor position. In case 2 (open-loop control), the shaft is turned only in one direction and the angle is smaller.

The standstill modes can be used if the motor cannot be turned (for example, when the load is connected). As the characteristics of motors and loads differ, testing must be done to find out the most suitable standstill mode.

The drive is also capable of determining the rotor position when started to a running motor in open-loop or closed-loop modes. In this situation, the setting of *11.07 Autophasing mode* has no effect.



Constant speeds

It is possible to predefine up to 7 constant speeds. Constant speeds can be activated, for example, through digital inputs. Constant speeds override the speed reference.

Settings

Parameter group *26 Constant speeds* (page *137*).

Critical speeds

A Critical speeds function is available for applications where it is necessary to avoid certain motor speeds or speed ranges because of, for example, mechanical resonance problems.

Settings

Parameter group *25 Critical speed* (page *136*).

Drive-to-drive link

The drive-to-drive link is a daisy-chained RS-485 transmission line that allows basic master/follower communication with one master drive and multiple followers.

The wiring of the drive-to-drive link is presented in the hardware manual of the drive.

Settings

Parameter group *57 D2D communication* (page *186*).

Emergency stop

Note: The user is responsible for installing the emergency stop devices and all the additional devices needed for the emergency stop to fulfil the required emergency stop category classes. For more information, contact your local ABB representative.

The emergency stop signal is to be connected to the digital input which is selected as the source for the emergency stop activation (par. *10.13 Em stop off3* or *10.15 Em stop off1*). Emergency stop can also be activated through fieldbus (*02.22 FBA main cw*).

Note: When an emergency stop signal is detected, the emergency stop function cannot be cancelled even though the signal is cancelled.

Encoder support

The program offers support for two encoders (or resolvers), encoder 1 and 2. Multiturn encoders are supported only as encoder 1. Three optional interface modules are available:

- TTL Encoder Interface FEN-01: two TTL inputs, TTL output (for encoder emulation and echo) and two digital inputs for position latching
- Absolute Encoder Interface FEN-11: absolute encoder input, TTL input, TTL output (for encoder emulation and echo) and two digital inputs for position latching
- Resolver Interface FEN-21: resolver input, TTL input, TTL output (for encoder emulation echo) and two digital inputs for position latching.
- HTL Encoder Interface FEN-31: HTL encoder input, TTL output (for encoder emulation and echo) and two digital inputs for position latching.

The interface module is connected to drive option Slot 1 or 2. **Note:** Two encoder interface modules of the same type are not allowed.

Settings

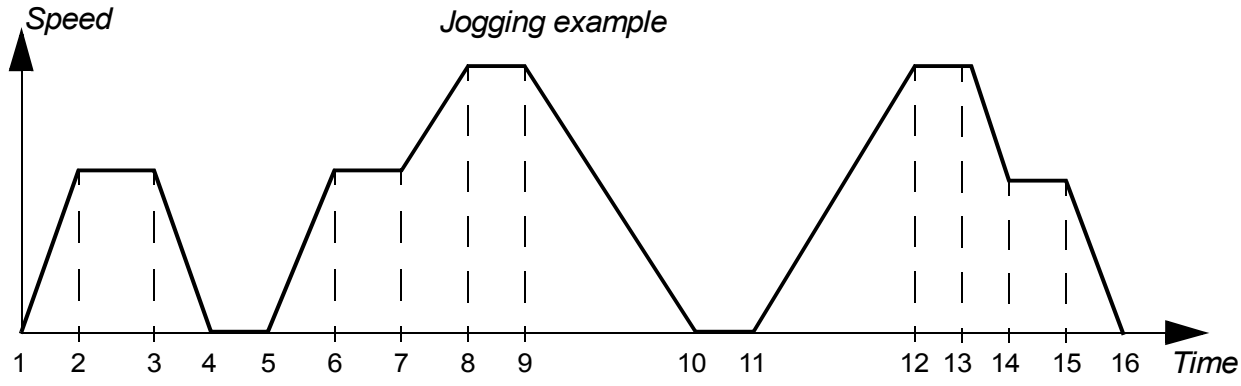
Parameter groups *91 Absol enc conf* (page *193*), *92 Resolver conf* (page *196*) and *93 Pulse enc conf* (page *196*).

Jogging

Two jogging functions (1 or 2) are available. When a jogging function is activated, the drive starts and accelerates to the defined jogging speed along the defined jogging acceleration ramp. When the function is deactivated, the drive decelerates to a stop along the defined jogging deceleration ramp. One push button can be used to start and stop the drive during jogging. The jogging function is typically used during servicing or commissioning to control the machinery locally.

Jogging functions 1 and 2 are activated by a parameter or through fieldbus. For activation through fieldbus, see parameter *02.22 FBA main cw*.

The figure and table below describe the operation of the drive during jogging. (Note that they cannot be directly applied to jogging commands through fieldbus as those require no enable signal; see parameter *10.09 Jog enable*.) They also represent how the drive shifts to normal operation (= jogging inactive) when the drive start command is switched on. Jog cmd = State of the jogging input; Jog enable = Jogging enabled by the source set by parameter *10.09 Jog enable*; Start cmd = State of the drive start command.



Phase	Jog cmd	Jog enable	Start cmd	Description
1-2	1	1	0	Drive accelerates to the jogging speed along the acceleration ramp of the jogging function.
2-3	1	1	0	Drive runs at the jogging speed.
3-4	0	1	0	Drive decelerates to zero speed along the deceleration ramp of the jogging function.
4-5	0	1	0	Drive is stopped.
5-6	1	1	0	Drive accelerates to the jogging speed along the acceleration ramp of the jogging function.
6-7	1	1	0	Drive runs at the jogging speed.
7-8	x	0	1	Jog enable is not active; normal operation continues.
8-9	x	0	1	Normal operation overrides the jogging. Drive follows the speed reference.
9-10	x	0	0	Drive decelerates to zero speed along the active deceleration ramp.
10-11	x	0	0	Drive is stopped.
11-12	x	0	1	Normal operation overrides the jogging. Drive accelerates to the speed reference along the active acceleration ramp.
12-13	1	1	1	Start command overrides the jog enable signal.
13-14	1	1	0	Drive decelerates to the jogging speed along the deceleration ramp of the jogging function.
14-15	1	1	0	Drive runs at the jogging speed.
15-16	x	0	0	Drive decelerates to zero speed along the deceleration ramp of the jogging function.

Note: Jogging is not operational when the drive start command is on, or if the drive is in local control.

Note: The ramp shape time is set to zero during jogging.

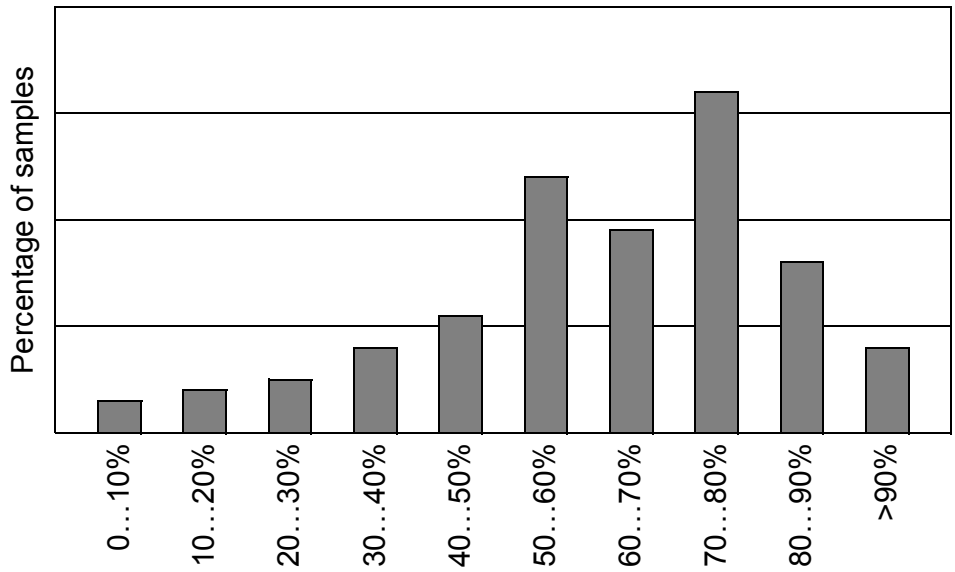
Load analyzer

Peak value logger

The user can select a signal to be monitored by the 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.

Amplitude loggers

The user can select a signal to be sampled at 200 ms intervals when the drive is running, 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 percentage points wide, and displays the percentage of the collected samples that fall within that range.



Amplitude ranges
(parameters *64.24*…*64.33*)

There is also an amplitude logger 1 which is fixed to monitor motor current. Amplitude logger 1 cannot be reset.

Settings

Parameter group *64 Load analyzer* (page *188*).

Maintenance counters

The program has six different maintenance counters that can be configured to generate an alarm when the counter reaches a pre-defined limit. The counter can be set to monitor any parameter. This feature is especially useful as a service reminder.

There are three types of counters:

- Ontime counter. Measures the time a digital source (for example, a bit in a status word) is on.
- Rising edge counter. This counter is incremented whenever the monitored digital source changes state from 0 to 1.
- Value counter. This counter measures, by integration, the monitored parameter. An alarm is given when the calculated area below the signal peak exceeds a user-defined limit.

Settings

Parameter group *44 Maintenance* (page *173*).

Mechanical brake control

A mechanical brake can be used for holding the motor and driven machinery at zero speed when the drive is stopped, or not powered.

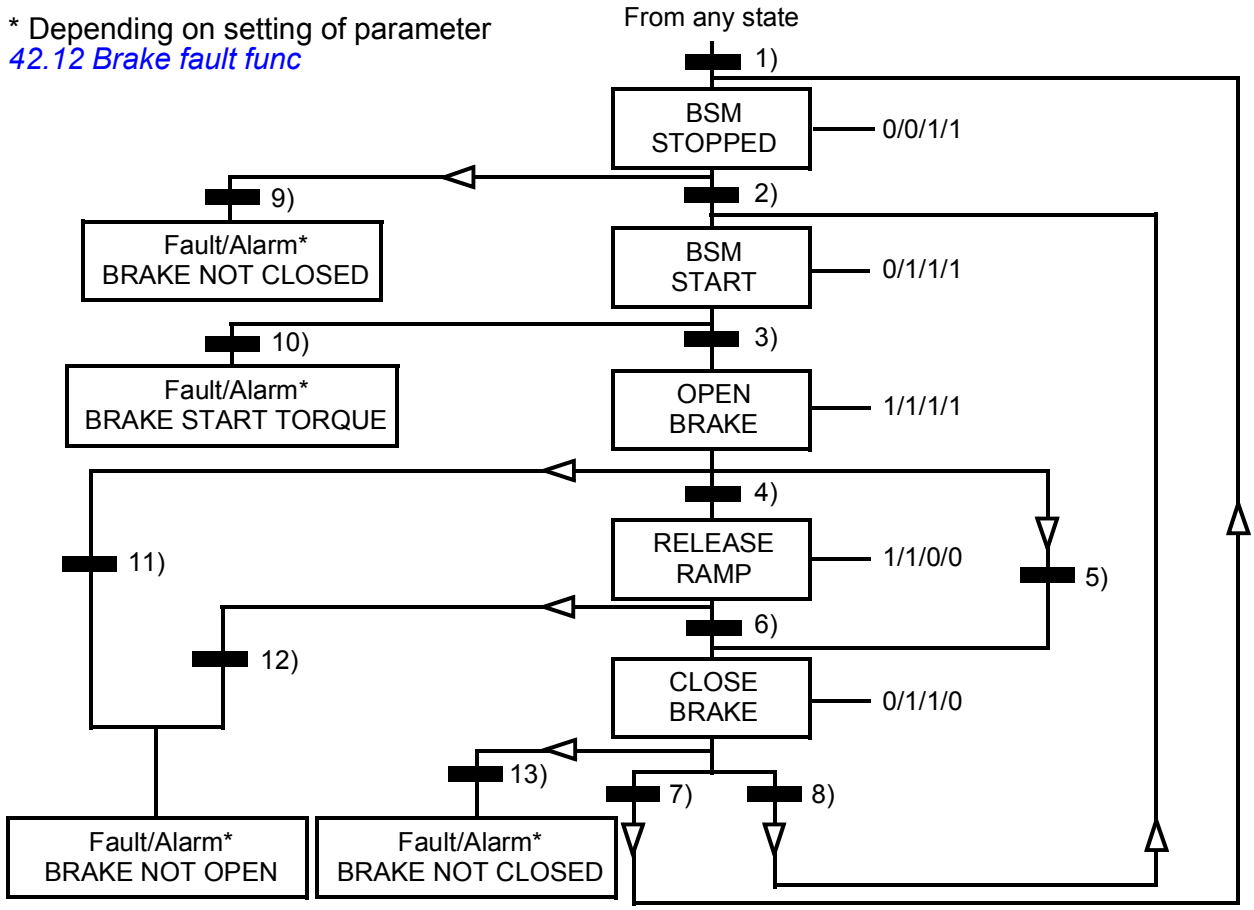
Parameters *03.15 Brake torq mem* and *03.16 Brake command* show the torque value stored when the brake close command is issued and the value of the brake command respectively.

Settings

Parameter group *42 Mech brake ctrl* (page *169*).

BSM = Brake State Machine

* Depending on setting of parameter *42.12 Brake fault func*



State (Symbol NN W/X/Y/Z)

- NN: State name
- W/X/Y/Z: State outputs/operations

W: 1 = Brake open command is active. 0 = Brake close command is active. (Controlled through selected digital/relay output with signal *03.16 Brake command*.)

X: 1 = Forced start (inverter is modulating). The function keeps the internal Start on until the brake is closed in spite of the status of the external Stop. Effective only when ramp stop has been selected as the stop mode (*11.03 Stop mode*). Run enable and faults override the forced start. 0 = No forced start (normal operation).

Y: 1 = Drive control mode is forced to speed/scalar.

Z: 1 = Ramp generator output is forced to zero. 0 = Ramp generator output is enabled (normal operation).

State change conditions (Symbol ▬)

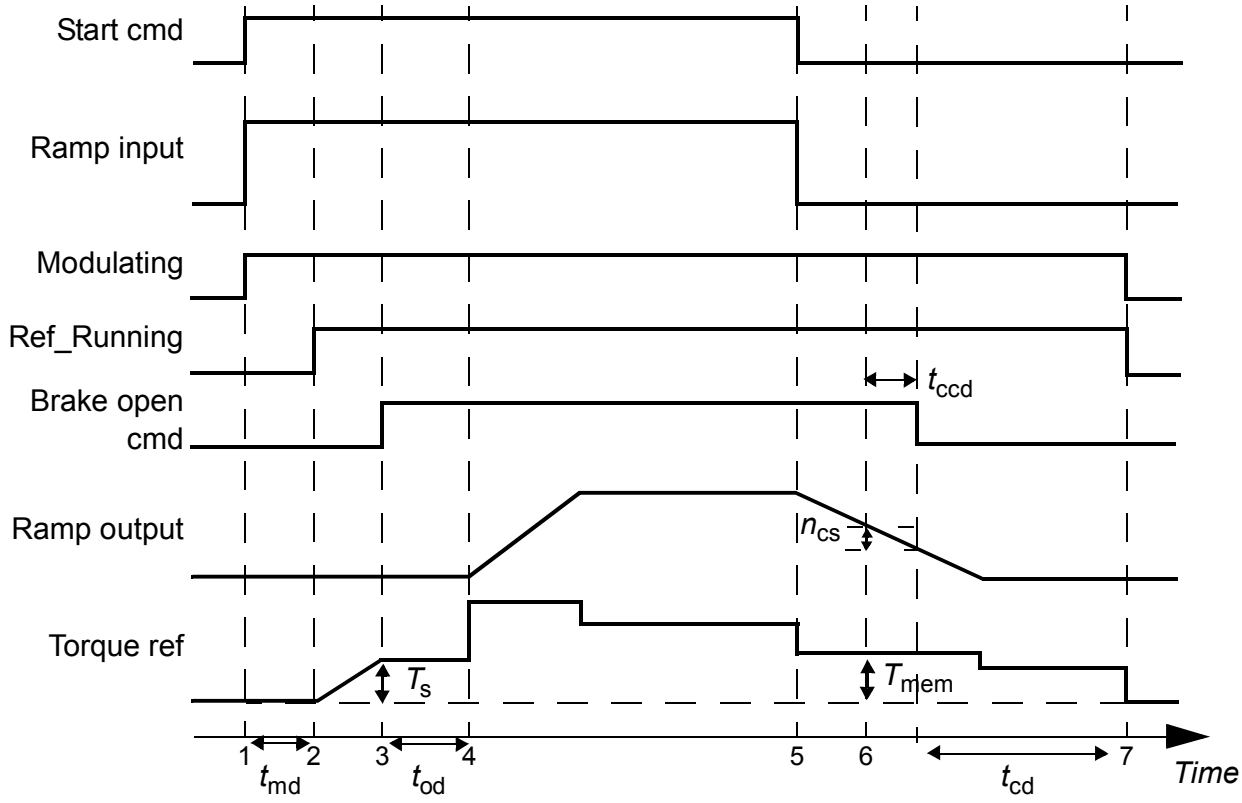
1) Brake control is active (*42.01 Brake ctrl* = *With ack* or *No ack*) OR modulation of the drive is requested to stop. The drive control mode is forced to speed/scalar.

2) External start command is on AND brake open request is on (source selected by *42.10 Brake close req* is 0) AND reopen delay (*42.07 Reopen delay*) has elapsed.

3) Starting torque required at brake release is reached (*42.08 Brake open torq*) AND brake hold is not active (*42.11 Brake hold open*). **Note:** With scalar control, the defined starting torque has no effect.
4) Brake is open (acknowledgement source selected by par. *42.02 Brake acknowl* is 1) AND the brake open delay has elapsed (*42.03 Open delay*). Start = 1.
5) 6) Start = 0 OR brake close command is active AND actual motor speed < brake close speed (*42.05 Close speed*) AND close command delay (*42.06 Close cmd delay*) has elapsed.
7) Brake is closed (acknowledgement = 0) AND brake close delay (*42.04 Close delay*) has elapsed. Start = 0.
8) Start = 1 AND brake open request is on (source selected by *42.10 Brake close req* is 0) AND reopen delay has elapsed.
9) Brake is open (acknowledgement = 1) AND brake close delay has elapsed.
10) Defined starting torque at brake release is not reached.
11) Brake is closed (acknowledgement = 0) AND brake open delay has elapsed.
12) Brake is closed (acknowledgement = 0).
13) Brake is open (acknowledgement = 1) AND brake close delay has elapsed. Fault is generated after brake close fault delay (*42.13 Close flt delay*) has elapsed.

Operation time scheme

The simplified time scheme below illustrates the operation of the brake control function.



T_s	Start torque at brake release (parameter *42.08 Brake open torq*)
T_{mem}	Stored torque value at brake close (signal *03.15 Brake torq mem*)
t_{md}	Motor magnetising delay
t_{od}	Brake open delay (parameter *42.03 Open delay*)
n_{cs}	Brake close speed (parameter *42.05 Close speed*)
t_{ccd}	Brake close command delay (parameter *42.06 Close cmd delay*)
t_{cd}	Brake close delay (parameter *42.04 Close delay*)

Example

The figure below shows a brake control application example.

WARNING! Make sure that the machinery into which the drive with brake control function is integrated fulfils the personnel safety regulations. Note that the frequency converter (a Complete Drive Module or a Basic Drive Module, as defined in IEC 61800-2), is not considered as a safety device mentioned in the European Machinery Directive and related harmonised

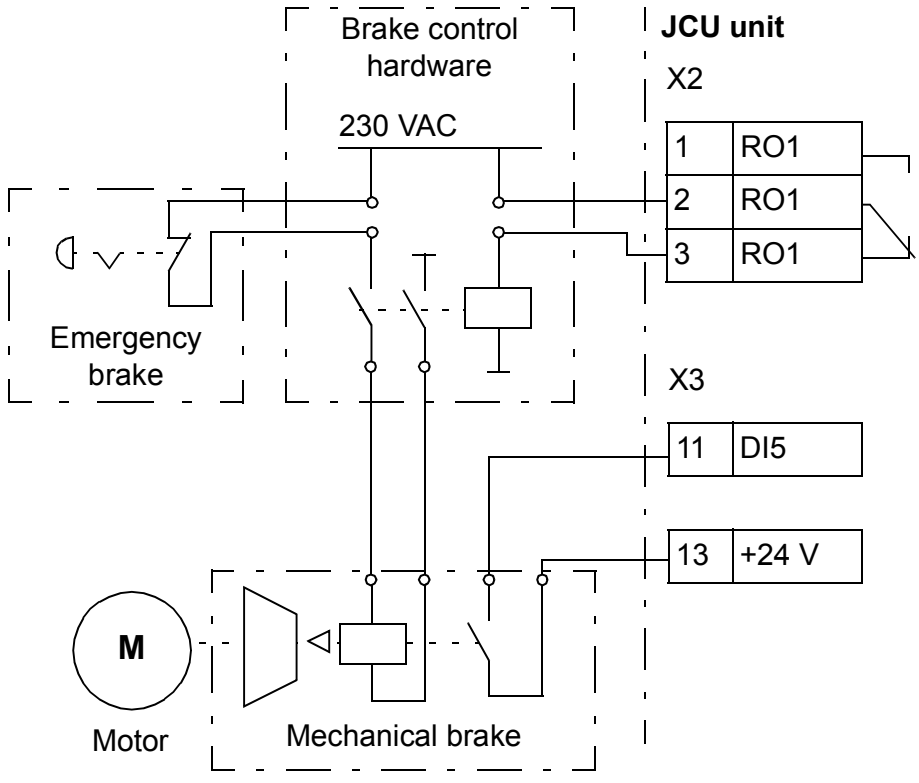
standards. Thus, the personnel safety of the complete machinery must not be based on a specific frequency converter feature (such as the brake control function), but it has to be implemented as defined in the application specific regulations.

The brake on/off is controlled via signal *03.16 Brake command*. The source for the brake supervision is selected by parameter *42.02 Brake acknowl*.

The brake control hardware and wirings need to be done by the user.

- Brake on/off control through selected relay/digital output.
- Brake supervision through selected digital input.
- Emergency brake switch in the brake control circuit.

- Brake on/off control through relay output (i.e. parameter *14.42 RO1 src* setting is P.03.16.00 = *03.16 Brake command*).
- Brake supervision through digital input DI5 (i.e. parameter *42.02 Brake acknowl* setting is P.02.01.04 = *02.01 DI status*, bit 4)

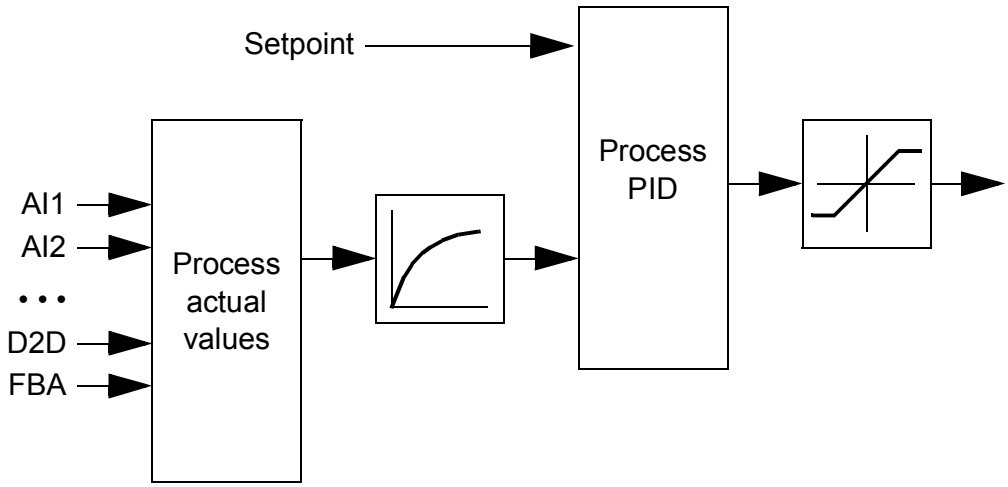


Process PID control

There is a built-in PID controller in the drive. The controller can be used to control process variables such as pressure, flow or fluid level.

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).

The simplified block diagram below illustrates the process PID control.

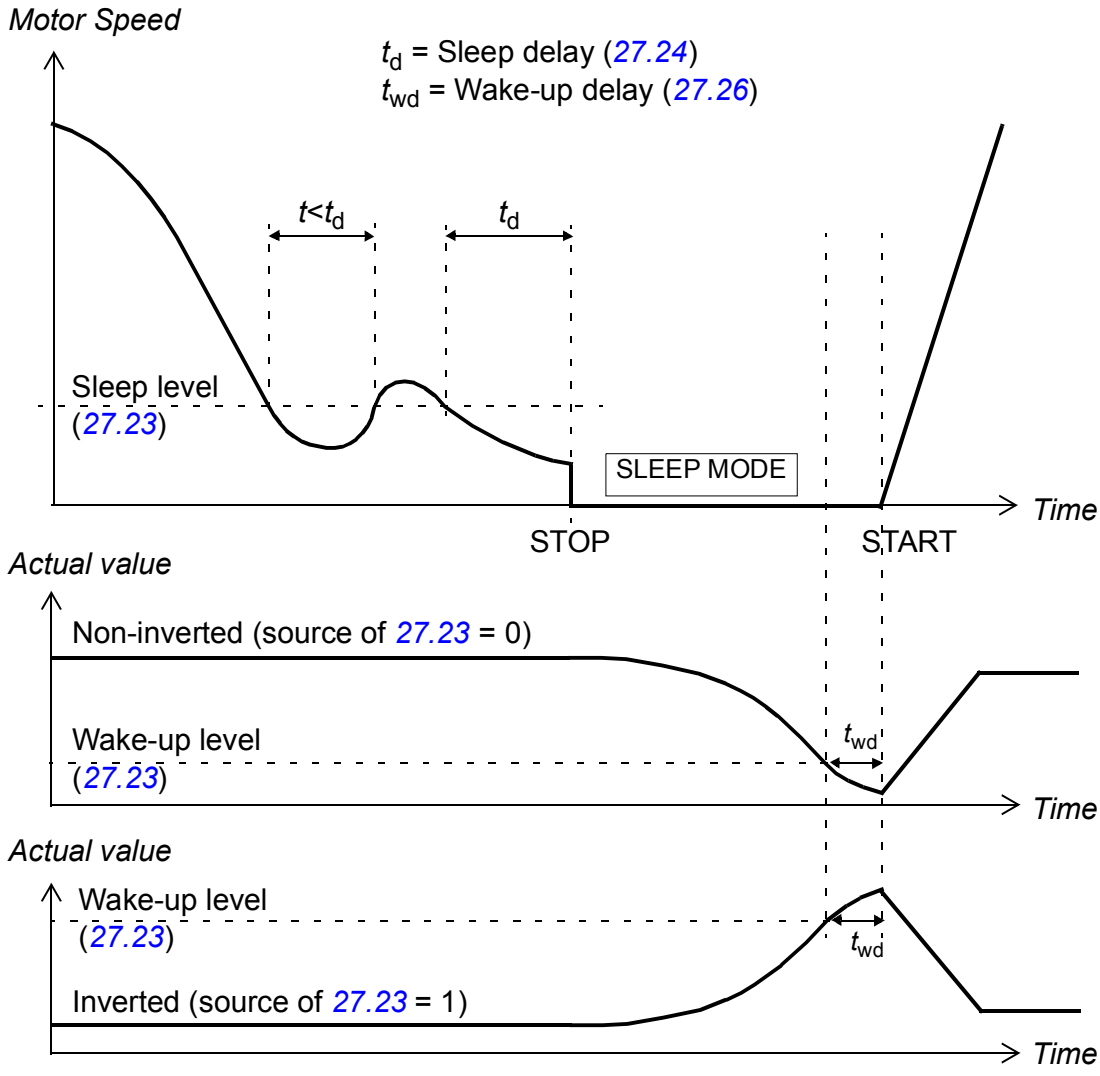


Sleep function for process PID control

The following example visualizes the operation of the sleep function.

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

when the pressure falls under the predefined minimum level and the wake-up delay has passed.



Settings

Parameter group *27 Process PID* (page *139*).

The PID control macro can be activated from the control panel main menu by selecting ASSISTANTS – Firmware assistants – Application Macro – PID control. See also page *56*.

Programmable analog inputs

The drive has two programmable analog inputs. Each of the inputs can be independently set as a voltage (0/2…10 V or -10…10 V) or current (0/4…20 mA) input by a jumper on the JCU Control Unit. Each input can be filtered, inverted and scaled. The number of analog inputs can be increased by using FIO-xx I/O extensions.

Settings

Parameter group *13 Analogue inputs* (page *89*).

Programmable analog outputs

The drive has one current and one voltage analog output. Each output can be filtered, inverted and scaled. The number of analog outputs can be increased by using FIO-xx I/O extensions.

Settings

Parameter group *15 Analogue outputs* (page *108*).

Programmable digital inputs and outputs

The drive has six digital inputs and three digital inputs/outputs. One of the digital inputs/outputs can be used as a frequency input, one as a frequency output.

The number of digital inputs/outputs can be increased by using FIO-xx I/O extensions.

Settings

Parameter group *14 Digital I/O* (page *96*).

Programmable relay outputs

The drive has one relay output. The signal to be indicated by the output can be selected by a parameter.

Additional relay outputs can be added by using FIO-xx I/O extensions.

Settings

Parameter group *14 Digital I/O* (page *96*).

Programmable protection functions

External fault (parameter *30.01*)

A source for an external fault signal is selected by this parameter. When the signal is lost, a fault is generated.

Local control loss detection (parameter *30.03*)

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

Motor phase loss detection (parameter *30.04*)

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

Earth fault detection (parameter *30.05*)

The earth fault detection function is based on sum current measurement. Note that

- an earth fault in the supply cable does not activate the protection
- in a grounded supply, the protection activates in 200 milliseconds
- in an ungrounded supply, the supply capacitance should be 1 microfarad or more
- the capacitive currents caused by shielded motor cables up to 300 metres will not activate the protection
- the protection is deactivated when the drive is stopped.

Supply phase loss detection (parameter *30.06*)

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

Safe Torque Off detection (parameter *30.07*)

The drive monitors the status of the Safe Torque Off input and . For more information on the Safe Torque Off function, see the *Hardware Manual* of the drive.

Switched supply and motor cabling (parameter *30.08*)

The drive can detect if the supply and motor cables have accidentally been switched (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 *30.09*…*30.12*)

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

Scalar motor control

It is possible to select scalar control as the motor control method instead of Direct Torque Control (DTC). In scalar control mode, the drive is controlled with a frequency reference. However, the outstanding performance of DTC is not achieved in scalar control.

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

- In multimotor drives: 1) if the load is not equally shared between the motors, 2) if the motors are of different sizes, or 3) if the motors are going to be changed after motor identification (ID run)

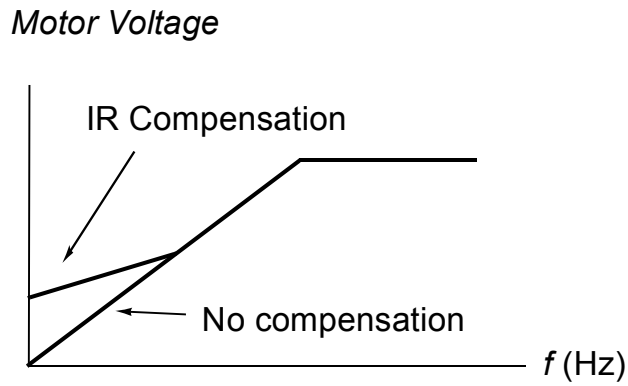
- If the nominal current of the motor is less than 1/6 of the nominal output current of the drive
- If the drive is used without a motor connected (for example, for test purposes)
- If the drive runs a medium-voltage motor through a step-up transformer.

In scalar control, some standard features are not available.

IR compensation for a scalar controlled drive

IR compensation is active only when the motor control mode is scalar. When IR compensation is activated, the drive gives an extra voltage boost to the motor at low speeds. IR compensation is useful in applications that require a high break-away torque.

In Direct Torque Control (DTC), no IR compensation is possible or needed.



Signal supervision

Three signals can be selected to be supervised by this function. Whenever the signal exceeds (or falls below) a predefined limit, a bit of *06.13 Superv status* is activated. Absolute values can be used.

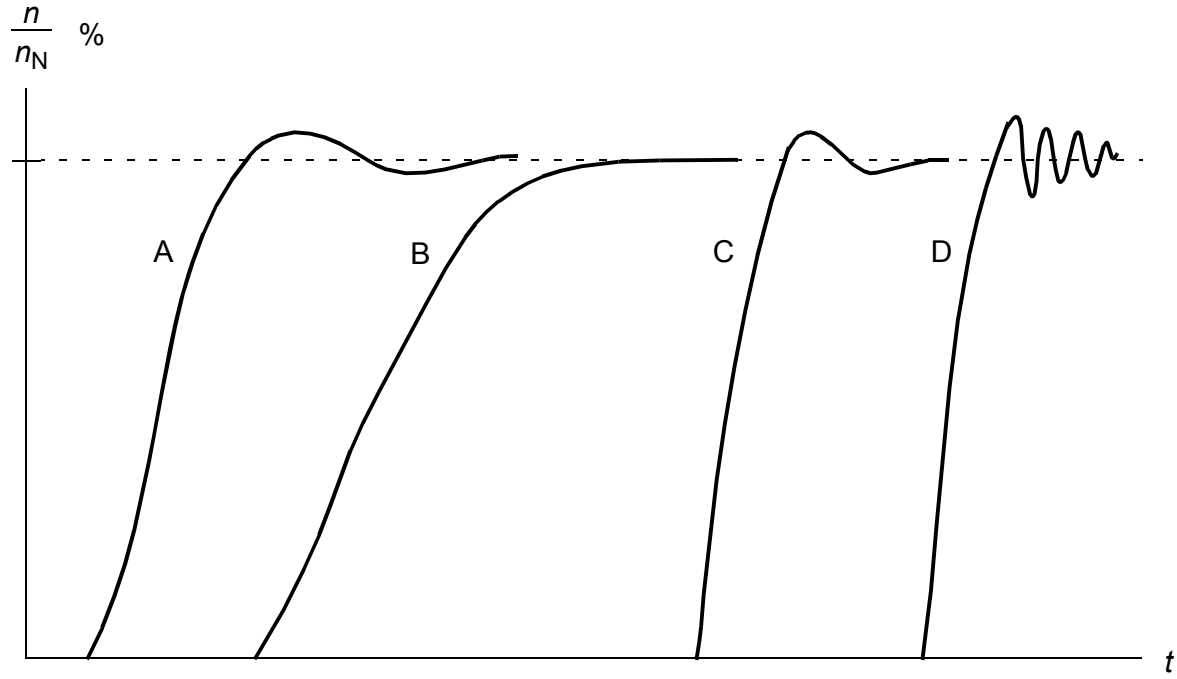
Settings

Parameter group *33 Supervision* (page *151*).

Speed controller tuning

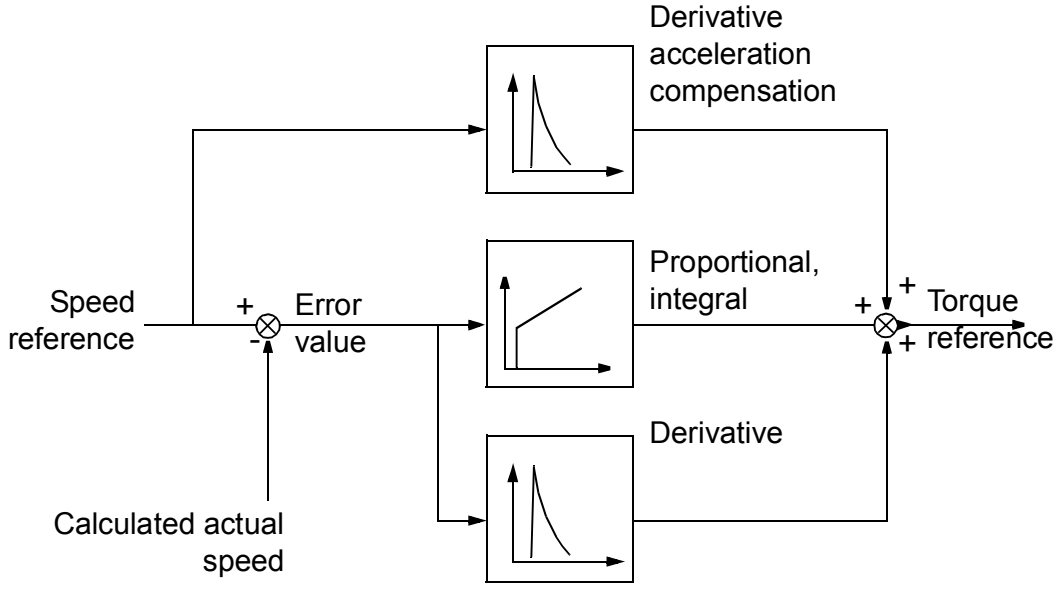
The speed controller of the drive can be automatically adjusted using the autotune function (parameter *23.20 PI tune mode*). Autotuning is based on the load and inertia of the motor and the machine. It is, however, also possible to manually adjust the controller gain, integration time and derivation time.

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

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



Settings

Parameter group *23 Speed ctrl* (page *128*).

Thermal motor protection

The motor can be protected against overheating by

- the motor thermal protection model
- measuring the motor temperature with PTC, KTY84 or Pt100 sensors. This will result in a more accurate motor model.

Thermal motor 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 at ambient temperature (defined by parameter *31.09 Mot ambient temp*). 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.

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

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

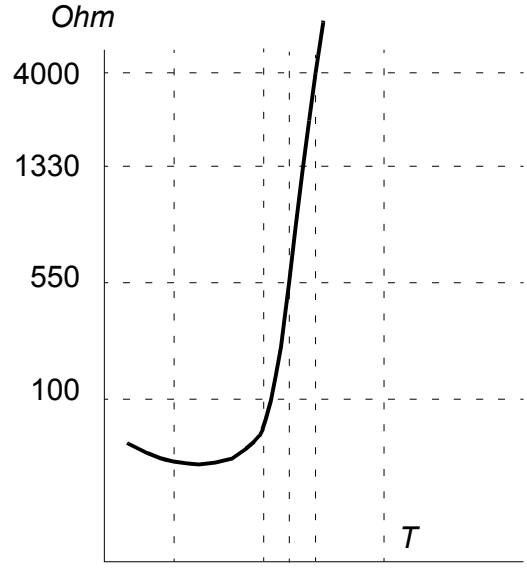
Temperature measurement

It is possible to detect motor overtemperature by connecting a motor temperature sensor to thermistor input TH of the drive or to optional encoder interface module FEN-xx.

Constant current is fed through the sensor. The resistance of the sensor increases as the motor temperature rises over the sensor reference temperature T_{ref}, as does the voltage over the resistor. The temperature measurement function reads the voltage and converts it into ohms.

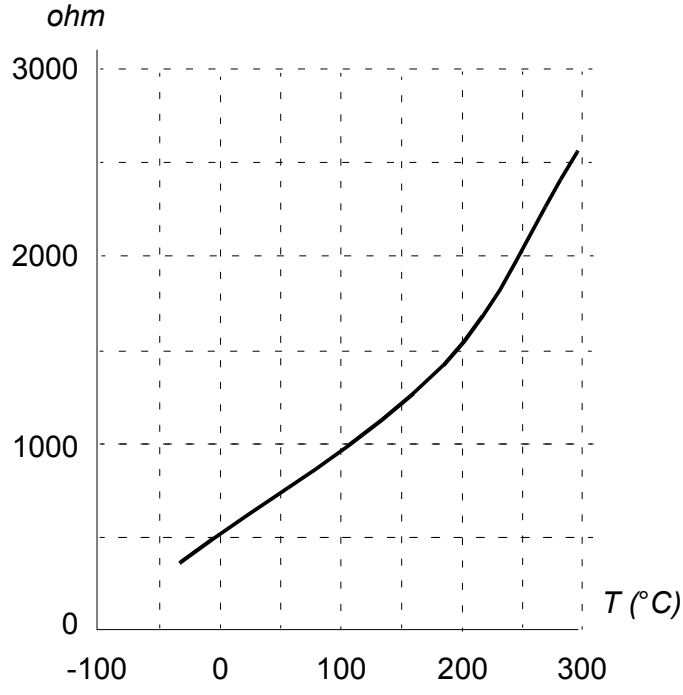
The figure below shows typical PTC sensor resistance values as a function of the motor operating temperature.

Temperature	PTC resistance
Normal	0…1.5 kohm
Excessive	≥ 4 kohm



The figure below shows typical KTY84 sensor resistance values as a function of the motor operating temperature.

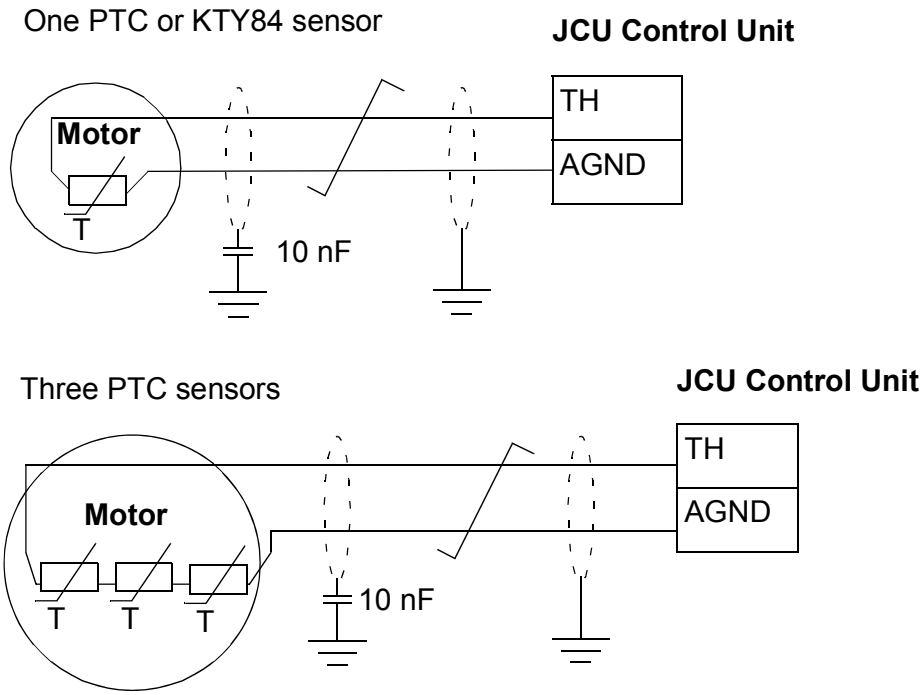
KTY84 scaling
90 °C = 936 ohm 110 °C = 1063 ohm 130 °C = 1197 ohm 150 °C = 1340 ohm



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

WARNING! As the thermistor input on the JCU Control Unit is 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 fulfil 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.

The figure below shows a motor temperature measurement when thermistor input TH is used.



For encoder interface module FEN-xx connection, see the *User's Manual* of the appropriate encoder interface module.

Settings

Parameter group *31 Mot therm prot* (page *145*).

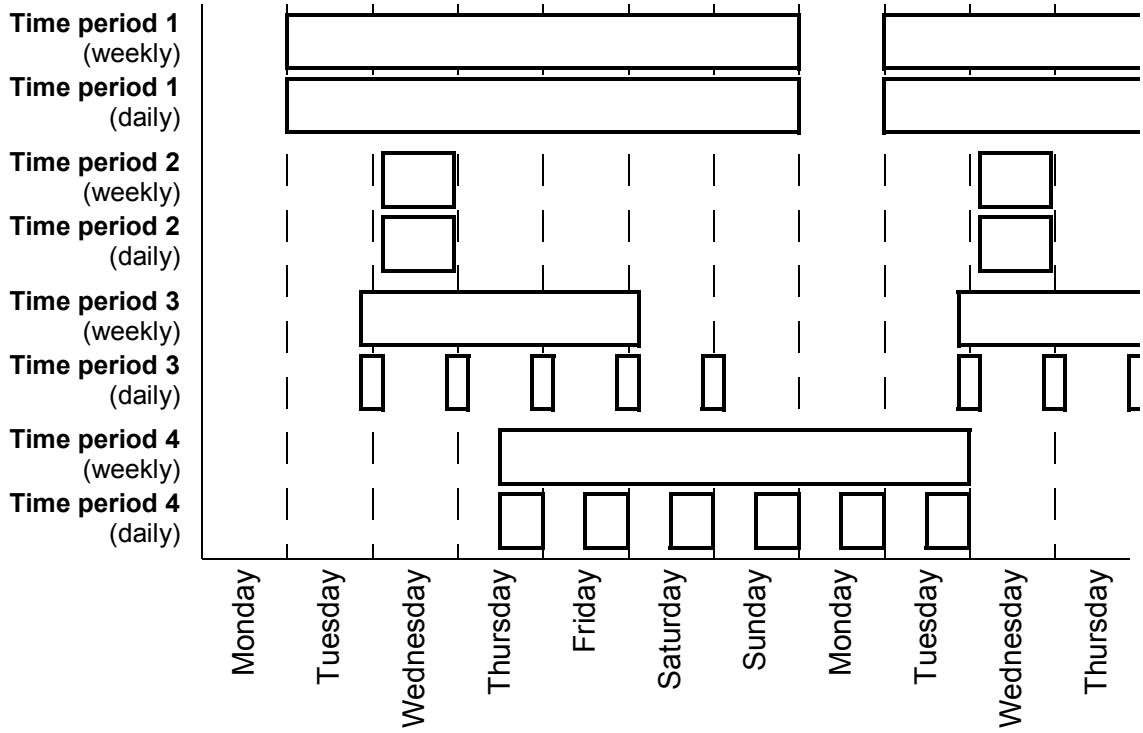
Timers

It is possible to define four different daily or weekly time periods. The time periods can be used to control four different timers. The on/off statuses of the four timers are indicated by bits 0…3 of parameter *06.14 Timed func stat*, from where the signal can be connected to any parameter with a bit pointer setting (see page *63*). In addition, bit 4 of parameter *06.14* is on if any one of the four timers is on.

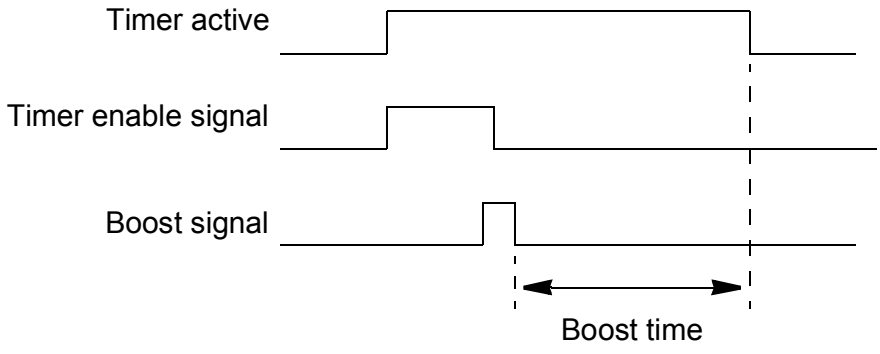
Each time period can be assigned to multiple timers; likewise, a timer can be controlled by multiple time periods.

The figure below presents how different time periods are active in daily and weekly modes.

Time period 1: Start time 00:00:00; Stop time 00:00:00 or 24:00:00; Start on Tuesday; Stop day Sunday
Time period 2: Start time 03:00:00; Stop time 23:00:00; Start day Wednesday; Stop day Wednesday
Time period 3: Start time 21:00:00; Stop time 03:00:00; Start day Tuesday; Stop day Saturday
Time period 4: Start time 12:00:00; Stop time 00:00:00 or 24:00:00; Start day Thursday; Stop day Tuesday



A “boost” function is also available for the activation of the timers: a signal source can be selected to extend the activation time for a parameter-adjustable time period.



Settings

Parameter group *36 Timed functions* (page *162*).

User load curve

The drive output can be limited by defining a user load curve. In practice, the user load curve consists of an overload and an underload curve, even though neither is compulsory. Each curve is formed by five points that represent output current or torque as a function of frequency.

An alarm or fault can be set up to occur when the curve is exceeded. The upper boundary (overload curve) can also be used as a torque or current limiter.

Settings

Parameter group *34 User load curve* (page *154*).

User *U/f* curve

The user can define a custom *U/f* curve (output voltage as a function of frequency). The curve can be used in special applications where linear and quadratic *U/f* ratios are not adequate (e.g. when motor break-away torque needs to be boosted).

Note: Each user-defined point defined must have a higher frequency and higher voltage than the previous point.

WARNING! High voltage at low frequencies may result in poor performance or motor damage due to overheating.

Settings

Parameter group *38 Flux ref* (page *167*).

5

Application macros

What this chapter contains

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

More information on the connectivity of the JCU control unit is given in the *Hardware Manual* of the drive.

General

Application macros are pre-defined parameter sets. When starting up the drive, the user typically selects one of the macros as a basis, makes the essential changes and saves the result as a user parameter set.

Application macros are activated through the control panel main menu by selecting ASSISTANTS – Firmware assistants – Application Macro. User parameter sets are managed by the parameters in group *16 System* (page *115*).

Factory macro

The Factory macro is suited to relatively straightforward speed control applications such as conveyors, pumps and fans, and test benches.

In external control, the control location is EXT1. The drive is speed-controlled; the reference signal is connected to analog input AI1. The sign of the reference determines the running direction. The start/stop commands are given through digital input DI1. Faults are reset through DI3.

The default parameter settings for the Factory macro are listed in chapter *Additional parameter data* (page *203*).

Default control connections for the Factory macro

		X1
External power input 24 V DC, 1.6 A	+24VI	1
	GND	2

		X2
Relay output: **Ready**	NO	1
	COM	2
	NC	3

		X3
+24 V DC	+24VD	1
Digital I/O ground	DGND	2
Digital input 1: **Stop/Start**	DI1	3
Digital input 2	DI2	4
+24 V DC	+24VD	5
Digital I/O ground	DGND	6
Digital input 3: **Reset**	DI3	7
Digital input 4	DI4	8
+24 V DC	+24VD	9
Digital I/O ground	DGND	10
Digital input 5	DI5	11
Digital input 6	DI6	12
+24 V DC	+24VD	13
Digital I/O ground	DGND	14
Digital input/output 1: **Output: Ready**	DIO1	15
Digital input/output 2: **Output: Running**	DIO2	16
+24 V DC	+24VD	17
Digital I/O ground	DGND	18
Digital input/output 3: **Output: Fault(-1)**	DIO3	19

		X4
Reference voltage (+)	+VREF	1
Reference voltage (–)	-VREF	2
Ground	AGND	3
Analog input AI1: **Speed reference 1**	AI1+	4
(Current or voltage, selectable by jumper J1)	AI1-	5
Analog input AI2	AI2+	6
(Current or voltage, selectable by jumper J2)	AI2-	7
AI1 current/voltage selection		J1
AI2 current/voltage selection		J2
Thermistor input	TH	8
Ground	AGND	9
Analog output 1: **Current %**	AO1 (I)	10
Analog output 2: **Speed %**	AO2 (U)	11
Ground	AGND	12

		X5
Drive-to-drive link termination		J3
Drive-to-drive link.	B	1
	A	2
	BGND	3

		X6
Safe Torque Off. Both circuits must be closed for the drive to start.	OUT1	1
	OUT2	2
	IN1	3
	IN2	4

Control panel connection	X7
Memory unit connection	X205

Hand/Auto macro

The Hand/Auto macro is suited for speed control applications where two external control devices are used.

The drive is speed-controlled from the external control locations EXT1 and EXT2. The selection between the control locations is done through digital input DI3.

The start/stop signal for EXT1 is connected to DI1 while running direction is determined by DI2. For EXT2, start/stop commands are given through DI6, the direction through DI5.

The reference signals for EXT1 and EXT2 are connected to analog inputs AI1 and AI2 respectively.

A constant speed (300 rpm) can be activated through DI4.

Default parameter settings for Hand/Auto macro

Below is a listing of default parameter values that differ from those listed in chapter *Additional parameter data* (page *203*).

Parameter		Hand/Auto macro default
No.	**Name**	
10.01	*Ext1 start func*	*In1St In2Dir*
10.03	*Ext1 start in2*	*DI2*
10.04	*Ext2 start func*	*In1St In2Dir*
10.05	*Ext2 start in1*	*DI6*
10.06	*Ext2 start in2*	*DI5*
10.10	*Fault reset sel*	C.FALSE
12.01	*Ext1/Ext2 sel*	*DI3*
13.05	*AI1 min scale*	0.000
13.09	*AI2 max scale*	1500.000
13.10	*AI2 min scale*	0.000
21.02	*Speed ref2 sel*	*AI2 scaled*
21.04	*Speed ref1/2 sel*	*DI3*
26.02	*Const speed sel1*	*DI4*
26.06	*Const speed1*	300 rpm

Default control connections for the Hand/Auto macro

		X1
External power input 24 V DC, 1.6 A	+24VI	1
	GND	2

		X2
Relay output: **Ready**	NO	1
	COM	2
	NC	3

		X3
+24 V DC	+24VD	1
Digital I/O ground	DGND	2
Digital input 1: **EXT1 Stop/Start**	DI1	3
Digital input 2: **EXT1 Direction**	DI2	4
+24 V DC	+24VD	5
Digital I/O ground	DGND	6
Digital input 3: **EXT1/EXT2 selection**	DI3	7
Digital input 4: **Constant speed 1**	DI4	8
+24 V DC	+24VD	9
Digital I/O ground	DGND	10
Digital input 5: **EXT2 Direction**	DI5	11
Digital input 6: **EXT2 Stop/Start**	DI6	12
+24 V DC	+24VD	13
Digital I/O ground	DGND	14
Digital input/output 1: **Output: Ready**	DIO1	15
Digital input/output 2: **Output: Running**	DIO2	16
+24 V DC	+24VD	17
Digital I/O ground	DGND	18
Digital input/output 3: **Output: Fault(-1)**	DIO3	19

		X4
Reference voltage (+)	+VREF	1
Reference voltage (–)	-VREF	2
Ground	AGND	3
Analog input 1: **EXT1 Reference (Speed ref1)**	AI1+	4
(Current or voltage, selectable by jumper J1)	AI1-	5
Analog input 2: **EXT2 Reference (Speed ref2)**	AI2+	6
(Current or voltage, selectable by jumper J2)	AI2-	7
AI1 current/voltage selection		J1
AI2 current/voltage selection		J2
Thermistor input	TH	8
Ground	AGND	9
Analog output 1: **Current %**	AO1 (I)	10
Analog output 2: **Speed %**	AO2 (U)	11
Ground	AGND	12

		X5
Drive-to-drive link termination		J3
Drive-to-drive link.	B	1
	A	2
	BGND	3

		X6
Safe Torque Off. Both circuits must be closed for the drive to start.	OUT1	1
	OUT2	2
	IN1	3
	IN2	4
Control panel connection		X7
Memory unit connection		X205

PID control macro

The PID control macro is suitable for process control applications, for example closed-loop pressure, level or flow control systems such as

- pressure boost pumps of municipal water supply systems
- level-controlling pumps of water reservoirs
- pressure boost pumps of district heating systems
- material flow control on a conveyor line.

The process reference signal is connected to analog input AI1 and the process feedback signal to AI2.

Alternatively, a direct speed reference can be given to the drive through AI1. Then the PID controller is bypassed and the drive no longer controls the process variable. Selection between direct speed control and process variable control is done through digital input DI3.

A constant speed (300 rpm) can be activated through DI4.

Default parameter settings for PID control macro

Below is a listing of default parameter values that differ from those listed in chapter *Additional parameter data* (page *203*).

Parameter		PID control macro default
No.	**Name**	
10.04	*Ext2 start func*	*In1*
10.05	*Ext2 start in1*	*DI6*
10.10	*Fault reset sel*	C.FALSE
12.01	*Ext1/Ext2 sel*	*DI3*
13.05	*AI1 min scale*	0.000
13.09	*AI2 max scale*	1500.000
13.10	*AI2 min scale*	0.000
21.02	*Speed ref2 sel*	*PID out*
21.04	*Speed ref1/2 sel*	*DI3*
26.02	*Const speed sel1*	*DI4*
26.06	*Const speed1*	300 rpm

Default control connections for the PID control macro

		X1
External power input 24 V DC, 1.6 A	+24VI	1
	GND	2

		X2
Relay output	NO	1
	COM	2
	NC	3

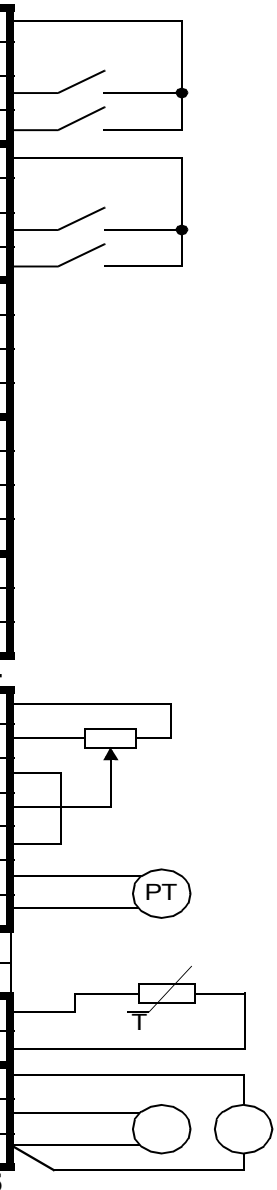
		X3
+24 V DC*	+24VD	1
Digital I/O ground	DGND	2
Digital input 1: **Stop/Start**	DI1	3
Digital input 2	DI2	4
+24 V DC*	+24VD	5
Digital I/O ground	DGND	6
Digital input 3: **Process or Speed control**	DI3	7
Digital input 4: **Constant speed 1**	DI4	8
+24 V DC*	+24VD	9
Digital I/O ground	DGND	10
Digital input 5	DI5	11
Digital input 6	DI6	12
+24 V DC*	+24VD	13
Digital I/O ground	DGND	14
Digital input/output 1	DIO1	15
Digital input/output 2	DIO2	16
+24 V DC*	+24VD	17
Digital I/O ground	DGND	18
Digital input/output 3	DIO3	19

		X4
Reference voltage (+)	+VREF	1
Reference voltage (–)	-VREF	2
Ground	AGND	3
Analog input 1: **Process or Speed reference**	AI1+	4
(Current or voltage, selectable by jumper J1)	AI1-	5
Analog input 2: **Process feedback**	AI2+	6
(Current or voltage, selectable by jumper J2)	AI2-	7
AI1 current/voltage selection		J1
AI2 current/voltage selection		J2
Thermistor input	TH	8
Ground	AGND	9
Analog output 1	AO1 (I)	10
Analog output 2	AO2 (U)	11
Ground	AGND	12

		X5
Drive-to-drive link termination		J3
Drive-to-drive link.	B	1
	A	2
	BGND	3

		X6
Safe Torque Off. Both circuits must be closed for the drive to start.	OUT1	1
	OUT2	2
	IN1	3
	IN2	4

Control panel connection	X7
Memory unit connection	X205



Torque control macro

This macro is used in applications in which torque control of the motor is required. Torque reference is given through analog input AI2, typically as a current signal in the range of 0…20 mA (corresponding to 0…100% of rated motor torque).

The start/stop signal is connected to digital input DI1, direction signal to DI2. The Run enable signal is applied to DI6.

Through DI3, it is possible to select speed control instead of torque control.

A constant speed (300 rpm) can be activated through DI4.

Default parameter settings for Torque control macro

Below is a listing of default parameter values that differ from those listed in chapter *Additional parameter data* (page *203*).

Parameter		Torque control macro default
No.	**Name**	
10.01	*Ext1 start func*	*In1St In2Dir*
10.03	*Ext1 start in2*	*DI2*
10.04	*Ext2 start func*	*In1St In2Dir*
10.05	*Ext2 start in1*	*DI1*
10.06	*Ext2 start in2*	*DI2*
10.10	*Fault reset sel*	C.FALSE
10.11	*Run enable*	*DI6*
12.01	*Ext1/Ext2 sel*	*DI3*
12.05	*Ext2 ctrl mode*	*Torque*
13.05	*AI1 min scale*	0.000
13.10	*AI2 min scale*	0.000
22.01	*Acc/Dec sel*	*DI5*
26.02	*Const speed sel1*	*DI4*
26.06	*Const speed1*	300 rpm

Default control connections for the Torque control macro

		X1
External power input 24 V DC, 1.6 A	+24VI	1
	GND	2

		X2
Relay output: **Ready**	NO	1
	COM	2
	NC	3

		X3
+24 V DC	+24VD	1
Digital I/O ground	DGND	2
Digital input 1: **Stop/Start**	DI1	3
Digital input 2: **Direction**	DI2	4
+24 V DC	+24VD	5
Digital I/O ground	DGND	6
Digital input 3: **Speed/Torque control selection**	DI3	7
Digital input 4: **Constant speed 1**	DI4	8
+24 V DC	+24VD	9
Digital I/O ground	DGND	10
Digital input 5: **Acc/Dec ramp 1/2 selection**	DI5	11
Digital input 6: **Run enable**	DI6	12
+24 V DC	+24VD	13
Digital I/O ground	DGND	14
Digital input/output 1: **Output: Ready**	DIO1	15
Digital input/output 2: **Output: Running**	DIO2	16
+24 V DC	+24VD	17
Digital I/O ground	DGND	18
Digital input/output 3: **Output: Fault(-1)**	DIO3	19

		X4
Reference voltage (+)	+VREF	1
Reference voltage (–)	-VREF	2
Ground	AGND	3
Analog input 1: **EXT1 Reference (Speed ref1)**	AI1+	4
(Current or voltage, selectable by jumper J1)	AI1-	5
Analog input 2: **EXT2 Reference (Torq ref1)**	AI2+	6
(Current or voltage, selectable by jumper J2)	AI2-	7
AI1 current/voltage selection		J1
AI2 current/voltage selection		J2
Thermistor input	TH	8
Ground	AGND	9
Analog output 1: **Current %**	AO1 (I)	10
Analog output 2: **Speed %**	AO2 (U)	11
Ground	AGND	12

		X5
Drive-to-drive link termination		J3
Drive-to-drive link.	B	1
	A	2
	BGND	3

		X6
Safe Torque Off. Both circuits must be closed for the drive to start.	OUT1	1
	OUT2	2
	IN1	3
	IN2	4
Control panel connection		X7
Memory unit connection		X205

Sequential control macro

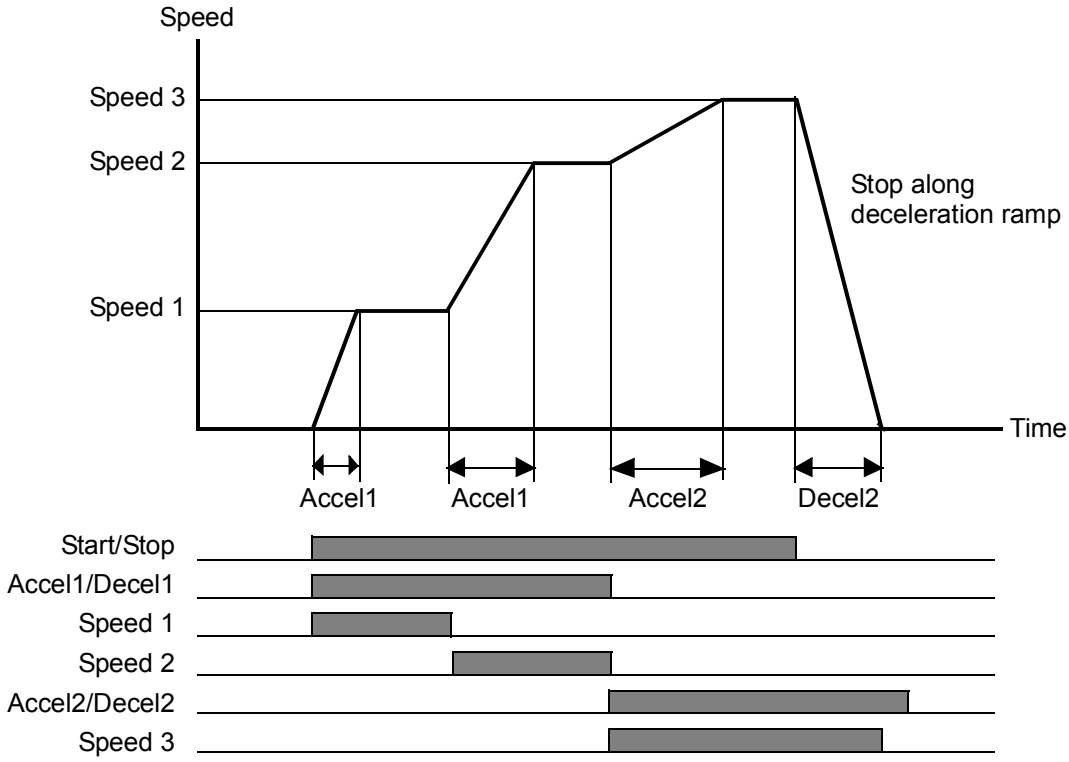
The Sequential control macro is suited for speed control applications in which speed reference, multiple constant speeds, and two acceleration and deceleration ramps can be used.

The macro offers seven preset constant speeds which can be activated by digital inputs DI4…DI6 (see parameter *26.01 Const speed func*). Two acceleration/ deceleration ramps are selectable through DI3.

An external speed reference can be given through analog input AI1. The reference is active only when no constant speed is activated (all of the digital inputs DI4…DI6 are off). Operational commands can also be given from the control panel.

Operation diagram

The figure below shows an example of the use of the macro.



Default parameter settings for Sequential control macro

Below is a listing of default parameter values that differ from those listed in chapter *Additional parameter data* (page *203*).

Parameter		Sequential control macro default
No.	**Name**	
10.01	*Ext1 start func*	*In1St In2Dir*
10.03	*Ext1 start in2*	*DI2*
10.10	*Fault reset sel*	C.FALSE
11.03	*Stop mode*	*Ramp*
13.05	*AI1 min scale*	0.000
22.01	*Acc/Dec sel*	*DI3*
26.01	*Const speed func*	0b01
26.02	*Const speed sel1*	*DI4*
26.03	*Const speed sel2*	*DI5*
26.04	*Const speed sel3*	*DI6*
26.06	*Const speed1*	300 rpm
26.07	*Const speed2*	600 rpm
26.08	*Const speed3*	900 rpm
26.09	*Const speed4*	1200 rpm
26.10	*Const speed5*	1500 rpm
26.11	*Const speed6*	2400 rpm
26.12	*Const speed7*	3000 rpm

Default control connections for the Sequential control macro

		X1
External power input 24 V DC, 1.6 A	+24VI	1
	GND	2

		X2
Relay output: **Ready**	NO	1
	COM	2
	NC	3

		X3
+24 V DC	+24VD	1
Digital I/O ground	DGND	2
Digital input 1: **Stop/Start**	DI1	3
Digital input 2: **Direction**	DI2	4
+24 V DC	+24VD	5
Digital I/O ground	DGND	6
Digital input 3: **Acc/Dec ramp 1/2 selection**	DI3	7
Digital input 4: **Constant speed sel1**	DI4	8
+24 V DC	+24VD	9
Digital I/O ground	DGND	10
Digital input 5: **Constant speed sel2**	DI5	11
Digital input 6: **Constant speed sel3**	DI6	12
+24 V DC	+24VD	13
Digital I/O ground	DGND	14
Digital input/output 1: **Output: Ready**	DIO1	15
Digital input/output 2: **Output: Running**	DIO2	16
+24 V DC	+24VD	17
Digital I/O ground	DGND	18
Digital input/output 3: **Output: Fault(-1)**	DIO3	19

		X4
Reference voltage (+)	+VREF	1
Reference voltage (–)	-VREF	2
Ground	AGND	3
Analog input 1: **EXT1 Reference (Speed ref1)**	AI1+	4
(Current or voltage, selectable by jumper J1)	AI1-	5
Analog input 2	AI2+	6
(Current or voltage, selectable by jumper J2)	AI2-	7
AI1 current/voltage selection		J1
AI2 current/voltage selection		J2
Thermistor input	TH	8
Ground	AGND	9
Analog output 1: **Current %**	AO1 (I)	10
Analog output 2: **Speed %**	AO2 (U)	11
Ground	AGND	12

		X5
Drive-to-drive link termination		J3
Drive-to-drive link.	B	1
	A	2
	BGND	3

		X6
Safe Torque Off. Both circuits must be closed for the drive to start.	OUT1	1
	OUT2	2
	IN1	3
	IN2	4
Control panel connection		X7
Memory unit connection		X205

6

Parameters

What this chapter contains

The chapter describes the parameters, including actual signals, of the control program.

Note: By default, a selective list of parameters is shown by the drive panel or DriveStudio. All parameters can be displayed by setting parameter *16.15 Menu set sel* to *Load long*.

Terms and abbreviations

Term	Definition
Actual signal	Type of parameter that is the result of a measurement or calculation by the drive. Actual signals can be monitored, but not adjusted, by the user. Parameter groups 1…9 typically contain actual signals.
Bit pointer setting	A parameter setting that points to the value of a bit in another parameter (usually an actual signal), or that can be fixed to 0 (FALSE) or 1 (TRUE). When adjusting a bit pointer setting on the optional control panel, “Const” is selected in order to fix the value to 0 (displayed as “C.False”) or 1 (“C.True”). “Pointer” is selected to define a source from another parameter. A pointer value is given in the format **P.xx.yy.zz**, where **xx** = parameter group, **yy** = parameter index, **zz** = bit number. Pointing to a nonexisting bit will be interpreted as 0 (FALSE). In addition to the “Const” and “Pointer” selections, bit pointer settings may also have other pre-selected settings.
FbEq	Fieldbus equivalent. The scaling between the value shown on the panel and the integer used in serial communication.
p.u.	Per unit
Value pointer setting	A parameter that points to the value of another actual signal or parameter. A pointer value is given in the format **P.xx.yy**, where **xx** = parameter group, **yy** = parameter index.

Parameter listing

No.	Name/Value	Description	FbEq
01 Actual values		Basic signals for monitoring of the drive.	
01.01	Motor speed rpm	Filtered actual speed in rpm. The used speed feedback is defined by parameter *19.02 Speed fb sel*. The filter time constant can be adjusted using parameter *19.03 MotorSpeed filt*.	100 = 1 rpm
01.02	Motor speed %	Actual speed in percent of the motor synchronous speed.	100 = 1%
01.03	Output frequency	Estimated drive output frequency in Hz.	100 = 1 Hz
01.04	Motor current	Measured motor current in A.	100 = 1 A
01.05	Motor current %	Motor current in percent of the nominal motor current.	10 = 1%
01.06	Motor torque	Motor torque in percent of the nominal motor torque. See also parameter *01.29 Torq nom scale*.	10 = 1%
01.07	Dc-voltage	Measured intermediate circuit voltage.	100 = 1 V
01.08	Encoder1 speed	Encoder 1 speed in rpm.	100 = 1 rpm
01.09	Encoder1 pos	Actual position of encoder 1 within one revolution.	100000000 = 1 rev
01.10	Encoder2 speed	Encoder 2 speed in rpm.	100 = 1 rpm
01.11	Encoder2 pos	Actual position of encoder 2 within one revolution.	100000000 = 1 rev
01.12	Pos act	Actual position of encoder 1 in revolutions.	1000 = 1 rev
01.13	Pos 2nd enc	Scaled actual position of encoder 2 in revolutions.	1000 = 1 rev
01.14	Motor speed est	Estimated motor speed in rpm.	100 = 1 rpm
01.15	Temp inverter	Estimated temperature of drive heatsink in degrees Celsius.	10 = 1 °C
01.16	Temp brk chopper	Brake chopper IGBT temperature in degrees Celsius.	10 = 1 °C
01.17	Motor temp1	Measured temperature of motor 1 in degrees Celsius.	10 = 1 °C
01.18	Motor temp2	Measured temperature of motor 2 in degrees Celsius.	10 = 1 °C
01.19	Used supply volt	Supply voltage as determined by the program.	10 = 1 V
01.20	Brake res load	Estimated temperature of the braking resistor. The value is given in percent of the temperature the resistor reaches when loaded with the power defined by parameter *48.04 Br power max cnt*.	1 = 1 °C
01.21	Cpu usage	Microprocessor load in percent.	1 = 1%
01.22	Power inu out	Drive output power in kW or hp, depending on setting of parameter *16.17 Power unit*.	100 = 1 kW or hp
01.23	Motor power	Measured motor power in kW or hp, depending on setting of parameter *16.17 Power unit*.	100 = 1 kW or hp
01.24	kWh inverter	Amount of energy that has passed through the drive (in either direction) in kilowatt-hours.	1 = 1 kWh
01.25	kWh supply	Amount of energy that the drive has taken from the AC supply in kilowatt-hours.	1 = 1 kWh
01.26	On-time counter	On-time counter. The counter runs when the drive is powered. Can be reset using the DriveStudio PC tool.	1 = 1 h
01.27	Run-time counter	Motor run-time counter. The counter runs when the inverter modulates. Can be reset using the DriveStudio PC tool.	1 = 1 h
01.28	Fan on-time	Running time of the drive cooling fan. Can be reset by entering 0.	1 = 1 h

No.	Name/Value	Description	FbEq
01.29	Torq nom scale	Nominal torque which corresponds to 100%. **Note:** This value is copied from parameter *99.12 Mot nom torque* if entered. Otherwise the value is calculated.	1000 = 1 N•m
01.30	Polepairs	Calculated number of pole pairs in the motor.	1 = 1
01.31	Mech time const	Mechanical time constant of the drive and the machinery as determined by the speed controller autotune function. See parameter group *23 Speed ctrl* on page *128*.	1000 = 1 s
01.32	Temp phase A	Measured temperature of phase U power stage in degrees Celsius.	10 = 1 °C
01.33	Temp phase B	Measured temperature of phase V power stage in degrees Celsius.	10 = 1 °C
01.34	Temp phase C	Measured temperature of phase W power stage in degrees Celsius.	10 = 1 °C
01.35	Saved energy	Energy saved in kWh compared to direct-on-line motor connection. See parameter group *45 Energy optimising* on page *179*.	1 = 1 kWh
01.36	Saved amount	Monetary savings compared to direct-on-line motor connection. This value is a multiplication of parameters *01.35 Saved energy* and *45.02 Energy tariff1*. See parameter group *45 Energy optimising* on page *179*.	1 = 1
01.37	Saved CO2	Reduction in CO_2 emissions in metric tons compared to direct-on-line motor connection. This value is a calculated by multiplying saved energy in megawatt-hours by 0.5 metric tons/MWh. See parameter group *45 Energy optimising* on page *179*.	1 = 1 metric ton

02 I/O values		Input and output signals.	
02.01	DI status	Status of digital inputs DI6…DI1. **Example:** 000001 = DI1 is on, DI2…DI6 are off. **Note:** If an FIO-21 extension is installed, the status of its digital input is indicated by parameter *02.03 DIO status*.	-
02.02	RO status	Status of relay outputs RO5…RO1. **Example:** 00001 = RO1 is energized, RO2…RO5 are de-energized.	-
02.03	DIO status	Status of digital input/outputs DIO10…DIO1. **Example:** 0000001001 = DIO1 and DIO4 are on, remainder are off. **Note:** If an FIO-21 extension is installed, the status of its digital input is also indicated by this parameter.	-
02.04	AI1	Value of analogue input AI1 in V or mA. Input type is selected with jumper J1 on the JCU Control Unit.	1000 = 1 unit
02.05	AI1 scaled	Scaled value of analogue input AI1. See parameters *13.04 AI1 max scale* and *13.05 AI1 min scale*.	1000 = 1 unit
02.06	AI2	Value of analogue input AI2 in V or mA. Input type is selected with jumper J2 on the JCU Control Unit.	1000 = 1 unit
02.07	AI2 scaled	Scaled value of analogue input AI2. See parameters *13.09 AI2 max scale* and *13.10 AI2 min scale*.	1000 = 1 unit
02.08	AI3	Value of analogue input AI3 in V or mA. For input type information, see the extension module manual.	1000 = 1 unit
02.09	AI3 scaled	Scaled value of analogue input AI3. See parameters *13.14 AI3 max scale* and *13.15 AI3 min scale*.	1000 = 1 unit
02.10	AI4	Value of analogue input AI4 in V or mA. For input type information, see the extension module manual.	1000 = 1 unit

No.	Name/Value	Description	FbEq
02.11	AI4 scaled	Scaled value of analogue input AI4. See parameters *13.19 AI4 max scale* and *13.20 AI4 min scale*.	1000 = 1 unit
02.12	AI5	Value of analogue input AI5 in V or mA. For input type information, see the extension module manual.	1000 = 1 unit
02.13	AI5 scaled	Scaled value of analogue input AI5. See parameters *13.24 AI5 max scale* and *13.25 AI5 min scale*.	1000 = 1 unit
02.14	AI6	Value of analogue input AI6 in V or mA. For input type information, see the extension module manual.	1000 = 1 unit
02.15	AI6 scaled	Scaled value of analogue input AI6. See parameters *13.29 AI6 max scale* and *13.30 AI6 min scale*.	1000 = 1 unit
02.16	AO1	Value of analogue output AO1 in mA.	1000 = 1 mA
02.17	AO2	Value of analogue output AO2 in V.	1000 = 1 V
02.18	AO3	Value of analogue output AO3 in mA.	1000 = 1 mA
02.19	AO4	Value of analogue output AO4 in mA.	1000 = 1 mA
02.20	Freq in	Frequency input value of DIO2 when it is used as a frequency input (parameter *14.06* is set to *Freq input*).	1000 = 1 Hz
02.21	Freq out	Frequency output value of DIO3 when it is used as a frequency output (parameter *14.10* is set to *Freq output*).	1000 = 1 Hz

No.	Name/Value	Description	FbEq
02.22	FBA main cw	Control Word for fieldbus communication. See also chapter *Fieldbus control*, page *243*. Log. = Logical combination (i.e. Bit AND/OR Selection parameter); Par. = Selection parameter.	-

Bit	Name	Value	Information	Log.	Par.
0*	Stop	1	Stop according to the stop mode selected by par. *11.03 Stop mode* or according to the requested stop mode (bits 2…6). **Note:** Simultaneous Stop and Start commands result in a Stop command.	OR	*10.01*, *10.04*
		0	No action.		
1	Start	1	Start. **Note:** Simultaneous Stop and Start commands result in a Stop command.	OR	*10.01*, *10.04*
		0	No action.		
2*	StpMode em off	1	Emergency OFF2 (bit 0 must be 1). Drive is stopped by cutting off motor power supply (the motor coasts to stop). The drive will restart only with the next rising edge of the Start signal when the Run enable signal is on.	AND	–
		0	No action.		
3*	StpMode em stop	1	Emergency stop OFF3 (bit 0 must be 1). Stop within time defined by *22.12 Em stop time*.	AND	*10.13*
		0	No action.		
4*	StpMode off1	1	Emergency stop OFF1 (bit 0 must be 1). Stop along the currently active deceleration ramp.	AND	*10.15*
		0	No action.		
5*	StpMode ramp	1	Stop along the currently active deceleration ramp.	–	*11.03*
		0	No action.		
6*	StpMode coast	1	Coast to stop.	–	*11.03*
		0	No action.		
7	Run enable	1	Activate Run enable.	AND	*10.11*
		0	Activate Run disable.		
8	Reset	0 -> 1	Fault reset if an active fault exists.	OR	*10.10*
		other	No action.		

(continued)

* If all stop mode bits (2…6) are 0, stop mode is selected by parameter *11.03 Stop mode*. Coast stop (bit 6) overrides the emergency stop (bits 2/3/4). Emergency stop overrides normal ramp stop (bit 5).

No.	Name/Value	Description	FbEq

Bit	Name	Value	Information	Log.	Par.
(continued)					
9	Jogging 1	1	Activate Jogging 1. See section *Jogging* on page *32*.	OR	*10.07*
		0	Jogging 1 disabled.		
10	Jogging 2	1	Activate Jogging 2. See section *Jogging* on page *32*.	OR	*10.08*
		0	Jogging 2 disabled.		
11	Remote cmd	1	Fieldbus control enabled.	–	–
		0	Fieldbus control disabled.		
12	Ramp out 0	1	Force output of Ramp Function Generator to zero. The drive ramps to a stop (current and DC voltage limits are in force).	–	–
		0	No action.		
13	Ramp hold	1	Halt ramping (Ramp Function Generator output held).	–	–
		0	No action.		
14	Ramp in 0	1	Force input of Ramp Function Generator to zero.	–	–
		0	No action.		
15	Ext1 / Ext2	1	Switch to external control location EXT2.	OR	*12.01*
		0	Switch to external control location EXT1.		
16	Req startinh	1	Activate start inhibit.	–	–
		0	No start inhibit.		
17	Local ctl	1	Request local control for Control Word. Used when the drive is controlled from a PC tool or panel or local fieldbus. • Local fieldbus: Transfer to fieldbus local control (control through fieldbus Control Word or reference). Fieldbus steals the control. • Panel or PC tool: Transfer to local control.	–	–
		0	Request external control.		
18	FbLocal ref	1	Request fieldbus local control.	–	–
		0	No fieldbus local control.		
19…27	Reserved				
28	CW B28	Freely programmable control bits. See parameters *50.08*…*50.11* and the user manual of the fieldbus adapter.		–	–
29	CW B29				
30	CW B30				
31	CW B31				

No.	Name/Value	Description	FbEq
02.24	FBA main sw	Status Word for fieldbus communication. See also chapter *Fieldbus control*, page *243*.	-

Bit	Name	Value	Information
0	Ready	1	Drive is ready to receive Start command.
		0	Drive is not ready.
1	Enabled	1	External Run enable signal is received.
		0	No external Run enable signal is received.
2	Running	1	Drive is modulating.
		0	Drive is not modulating.
3	Ref running	1	Normal operation is enabled. Drive is running and following given reference.
		0	Normal operation is disabled. Drive is not following given reference (for example, it is modulating during magnetization).
4	Em off (OFF2)	1	Emergency OFF2 is active.
		0	Emergency OFF2 is inactive.
5	Em stop (OFF3)	1	Emergency stop OFF3 (ramp stop) is active.
		0	Emergency stop OFF3 is inactive.
6	Ack startinh	1	Start inhibit is active.
		0	Start inhibit is inactive.
7	Alarm	1	An alarm is active. See chapter *Fault tracing*.
		0	No alarm is active.
8	At setpoint	1	Drive is at setpoint. Actual value equals reference value (i.e. the difference between the actual speed and speed reference is within the speed window defined by parameter *19.10 Speed window*).
		0	Drive has not reached setpoint.

(continued)

No.	Name/Value	Description	FbEq

Bit	Name	Value	Information
(continued)			
9	Limit	1	Operation is limited by any of the torque limits.
		0	Operation is within the torque limits.
10	Above limit	1	Actual speed exceeds limit defined by parameter *19.08 Above speed lim*.
		0	Actual speed is within the defined limits.
11	Ext2 act	1	External control location EXT2 is active.
		0	External control location EXT1 is active.
12	Local fb	1	Fieldbus local control is active.
		0	Fieldbus local control is inactive.
13	Zero speed	1	Drive speed is below limit defined by parameter *19.06 Zero speed limit*.
		0	Drive has not reached zero speed limit.
14	Rev act	1	Drive is running in reverse direction.
		0	Drive is running in forward direction.
15	Reserved		
16	Fault	1	A fault is active. See chapter *Fault tracing*.
		0	No fault is active.
17	Local panel	1	Local control is active, i.e. the drive is controlled from PC tool or control panel.
		0	Local control is inactive.
18…26	Reserved		
27	Request ctl	1	Control Word is requested from fieldbus.
		0	Control Word is not requested from fieldbus.
28	CW B28	Programmable control bits (unless fixed by the used profile). See parameters *50.08*…*50.11* and the user manual of the fieldbus adapter.	
29	CW B29		
30	CW B30		
31	CW B31		

No.	Name/Value	Description	FbEq
02.26	FBA main ref1	Scaled fieldbus reference 1. See parameter *50.04 Fba ref1 modesel*.	1 = 1
02.27	FBA main ref2	Scaled fieldbus reference 2. See parameter *50.05 Fba ref2 modesel*.	1 = 1
02.30	D2D main cw	Drive-to-drive control word received from the master. See also actual signal *02.31 D2D follower cw*.	-

Bit	Information
0	Stop.
1	Start.
2 … 6	Reserved.
7	Run enable. By default, not connected in a follower drive.
8	Reset. By default, not connected in a follower drive.
9 … 14	Freely assignable through bit pointer settings.
15	EXT1/EXT2 selection. 0 = EXT1 active, 1 = EXT2 active. By default, not connected in a follower drive.

No.	Name/Value	Description	FbEq
02.31	D2D follower cw	Drive-to-drive control word sent to the followers by default. See also parameter group *57 D2D communication*.	-

Bit	Information
0	Stop.
1	Start.
2 … 6	Reserved.
7	Run enable.
8	Reset.
9 … 14	Reserved.
15	EXT1/EXT2 selection. 0 = EXT1 active, 1 = EXT2 active.

02.32	D2D ref1	Drive-to-drive reference 1 received from the master.	1 = 1
02.33	D2D ref2	Drive-to-drive reference 2 received from the master.	1 = 1
02.34	Panel ref	Reference given from the control panel.	100 = 1 rpm
02.35	FEN DI status	Status of the digital inputs of FEN-xx encoder interfaces in drive option slots 1 and 2. Examples: 000001 (01h) = DI1 of FEN-xx in slot 1 is ON, all others are OFF. 000010 (02h) = DI2 of FEN-xx in slot 1 is ON, all others are OFF. 010000 (10h) = DI1 of FEN-xx in slot 2 is ON, all others are OFF. 100000 (20h) = DI2 of FEN-xx in slot 2 is on, all others are OFF.	-

03 Control values		Speed control, torque control, and other values.	
03.03	SpeedRef unramp	Used speed reference ramp input in rpm.	100 = 1 rpm
03.05	SpeedRef ramped	Ramped and shaped speed reference in rpm.	100 = 1 rpm
03.06	SpeedRef used	Used speed reference in rpm (reference before speed error calculation).	100 = 1 rpm
03.07	Speed error filt	Filtered speed error value in rpm.	100 = 1 rpm
03.08	Acc comp torq	Output of the acceleration compensation (torque in percent).	10 = 1%
03.09	Torq ref sp ctrl	Limited speed controller output torque in percent.	10 = 1%
03.11	Torq ref ramped	Ramped torque reference in percent.	10 = 1%
03.12	Torq ref sp lim	Torque reference limited by the rush control (value in percent). Torque is limited to ensure that the speed is between the minimum and maximum speed limits defined by parameters *20.01 Maximum speed* and *20.02 Minimum speed*.	10 = 1%
03.13	Torq ref to TC	Torque reference in percent for the torque control.	10 = 1%
03.14	Torq ref used	Torque reference after frequency, voltage and torque limiters. 100% corresponds to the motor nominal torque.	10 = 1%
03.15	Brake torq mem	Torque value (in percent) stored when the mechanical brake close command is issued.	10 = 1%
03.16	Brake command	Brake on/off command; 0 = close, 1 = open. For brake on/off control, connect this signal to a relay output (or digital output). See section *Mechanical brake control* on page *35*.	1 = 1
03.17	Flux ref used	Used flux reference in percent.	1 = 1%
03.18	Speed ref pot	Output of the motor potentiometer function. (The motor potentiometer is configured using parameters *21.10*…*21.12*.)	100 = 1 rpm

No.	Name/Value	Description	FbEq
04 Appl values		Process and counter values.	
04.01	Process act1	Process feedback 1 for the process PID controller.	100 = 1 unit
04.02	Process act2	Process feedback 2 for the process PID controller.	100 = 1 unit
04.03	Process act	Final process feedback after process feedback selection and modification.	100 = 1 unit
04.04	Process PID err	Process PID error, i.e. difference between PID setpoint and feedback.	10 = 1 unit
04.05	Process PID out	Output of the process PID controller.	10 = 1 unit
04.06	Process var1	Process variable 1. See parameter group *35 Process variable*.	1000 = 1
04.07	Process var2	Process variable 2. See parameter group *35 Process variable*.	1000 = 1
04.08	Process var3	Process variable 3. See parameter group *35 Process variable*.	1000 = 1
04.09	Counter ontime1	Reading of on-time counter 1. See parameter *44.01 Ontime1 func*.	1 = 1 s
04.10	Counter ontime2	Reading of on-time counter 2. See parameter group *44.05 Ontime2 func*.	1 = 1 s
04.11	Counter edge1	Reading of rising edge counter 1. See parameter group *44.09 Edge count1 func*.	1 = 1
04.12	Counter edge2	Reading of rising edge counter 2. See parameter group *44.14 Edge count2 func*.	1 = 1
04.13	Counter value1	Reading of value counter 1. See parameter group *44.19 Val count1 func*.	1 = 1
04.14	Counter value2	Reading of value counter 2. See parameter group *44.24 Val count2 func*.	1 = 1

No.	Name/Value	Description	FbEq
06 Drive status		Drive status words.	
06.01	Status word1	Status word 1 sent to the master.	-

Bit	Name	Information
0	Ready	1 = Drive is ready to receive start command.
		0 = Drive is not ready.
1	Enabled	1 = External run enable signal is received.
		0 = No external run enable signal is received.
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	Em off (off2)	1 = Emergency OFF2 is active.
		0 = Emergency OFF2 is inactive.
5	Em stop (off3)	1 = Emergency OFF3 (ramp stop) is active.
		0 = Emergency OFF3 is inactive.
6	Ack startinh	1 = Start inhibit is active.
		0 = Start inhibit is inactive.
7	Alarm	1 = Alarm is active. See chapter *Fault tracing*.
		0 = No alarm is active.
8	Ext2 act	1 = External control EXT2 is active.
		0 = External control EXT1 is active.
9	Local fb	1 = Fieldbus local control is active.
		0 = Fieldbus local control is inactive.
10	Fault	1 = Fault is active. See chapter *Fault tracing*.
		0 = No fault is active.
11	Local panel	1 = Local control is active, ie. drive is controlled from PC tool or control panel.
		0 = Local control is inactive.
12	Fault(-1)	1 = No fault is active.
		0 = Fault is active. See chapter *Fault tracing*.
13…31	Reserved	

No.	Name/Value	Description	FbEq
06.02	Status word2	Status word 2 sent to the master.	-

Bit	Name	Information
0	Start act	1 = Drive start command is active.
		0 = Drive start command is inactive.
1	Stop act	1 = Drive stop command is active.
		0 = Drive stop command is inactive.
2	Ready relay	1 = Ready to function: run enable signal on, no fault, emergency stop signal off, no ID run inhibition. Connected by default to DIO1 by par. *14.03 DIO1 out src*.
		0 = Not ready to function.
3	Modulating	1 = Modulating: IGBTs are controlled, ie. the drive is RUNNING.
		0 = No modulation: IGBTs are not controlled.
4	Ref running	1 = Normal operation is enabled. Running. Drive follows the given reference.
		0 = Normal operation is disabled. Drive is not following the given reference (eg. in magnetization phase drive is modulating).
5	Jogging	1 = Jogging function 1 or 2 is active.
		0 = Jogging function is inactive.
6	Off1	1 = Emergency stop OFF1 is active.
		0 = Emergency stop OFF1 is inactive.
7	Start inh mask	1 = Maskable (by par. *12.01 Start inhibit*) start inhibit is active.
		0 = No maskable start inhibit is active.
8	Start inh nomask	1 = Non-maskable start inhibit is active.
		0 = No non-maskable start inhibit is active.
9	Chrg rel closed	1 = Charging relay is closed.
		0 = Charging relay is open.
10	Sto act	1 = Safe Torque Off function is active. See parameter *30.07 Sto diagnostic*.
		0 = Safe Torque Off function is inactive.
11	Reserved	
12	Ramp in 0	1 = Ramp Function Generator input is forced to zero.
		0 = Normal operation.
13	Ramp hold	1 = Ramp Function Generator output is held.
		0 = Normal operation.
14	Ramp out 0	1 = Ramp Function Generator output is forced to zero.
		0 = Normal operation.
15…31	Reserved	

No.	Name/Value	Description	FbEq
06.03	Speed ctrl stat	Speed control status word.	-

Bit	Name	Information
0	Speed act neg	1 = Actual speed is negative.
1	Zero speed	1 = Actual speed has reached the zero speed limit (parameters *19.06 Zero speed limit* and *19.07 Zero speed delay*).
2	Above limit	1 = Actual speed has exceeded the supervision limit (parameter *19.08 Above speed lim*).
3	At setpoint	1 = The difference between the actual speed and the unramped speed reference is within the speed window (parameter *19.10 Speed window*).
4	Reserved	
5	PI tune active	1 = Speed controller autotuning procedure is active.
6	PI tune request	1 = Speed controller autotuning has been requested by parameter *23.20 PI tune mode*.
7	PI tune done	1 = Speed controller autotuning procedure has been completed successfully.
8…15	Reserved	

06.05	Limit word1	Limit word 1.	-

Bit	Name	Information
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 limit parameters in group *20 Limits*.
1	Spd ctl tlim min	1 = Speed controller output minimum torque limit is active. The limit is defined by parameter *23.10 Min torq sp ctrl*.
2	Spd ctl tlim max	1 = Speed controller output maximum torque limit is active. The limit is defined by parameter *23.09 Max torq sp ctrl*.
3	Torq ref max	1 = Torque reference (*03.11 Torq ref ramped*) maximum limit is active. The limit is defined by parameter *24.03 Maximum torq ref*.
4	Torq ref min	1 = Torque reference (*03.11 Torq ref ramped*) minimum limit is active. The limit is defined by parameter *24.04 Minimum torq ref*.
5	Tlim max speed	1 = Torque reference maximum value is limited by the rush control, because of maximum speed limit *20.01 Maximum speed*.
6	Tlim min speed	1 = Torque reference minimum value is limited by the rush control, because of minimum speed limit *20.02 Minimum speed*.
7	Reserved	

No.	Name/Value	Description	FbEq
06.07	Torq lim status	Torque controller limitation status word.	-

Bit	Name	Information
0	Undervoltage	1 = Intermediate circuit DC undervoltage. *
1	Overvoltage	1 = Intermediate circuit DC overvoltage. *
2	Minimum torque	1 = Torque reference minimum limit is active. The limit is defined by parameter *24.04 Minimum torq ref*. *
3	Maximum torque	1 = Torque reference maximum limit is active. The limit is defined by parameter *24.03 Maximum torq ref*. *
4	Internal current	1 = An inverter current limit is active. The limit is identified by bits 8…11.
5	Load angle	1 = For permanent magnet motor only: Load angle limit is active, i.e. the motor cannot produce more torque.
6	Motor pull-out	1 = For asynchronous motor only: Motor pull-out limit is active, i.e. the motor cannot produce more torque.
7	Reserved	
8	Thermal	1 = Input current is limited by main circuit thermal limit.
9	SOA current	1 = Internal Safe Operating Area current limit is active (limits the drive output current). **
10	User current	1 = Maximum inverter output current limit is active. The limit is defined by parameter *20.05 Maximum current*. **
11	Thermal IGBT	1 = Calculated thermal current value limits the inverter output current. **

* One of bits 0…3 can be on simultaneously. The bit typically indicates the limit that is exceeded first.
** Only one of bits 9…11 can be on simultaneously. The bit typically indicates the limit that is exceeded first.

06.12	Op mode ack	Operation mode acknowledge: 0 = Stopped, 1 = Speed, 2 = Torque, 3 = Min, 4 = Max, 5 = Add, 10 = Scalar, 11 = Forced Magn (i.e. DC Hold)	1 = 1
06.13	Superv status	Supervision status word. Bits 0…2 reflect the status of supervisory functions 1…3 respectively. The functions are configured in parameter group *33 Supervision* (page *151*).	-
06.14	Timed func stat	Bits 0…3 show the on/off status of the four timers (1…4 respectively) configured in parameter group *36 Timed functions*. Bit 4 is on if any one of the four timers is on.	-
06.15	Counter status	Counter status word. Shows whether the maintenance counters configured in parameter group *44 Maintenance* have exceeded their limits.	-

Bit	Name	Information
0	Ontime1	1 = On-time counter 1 has reached its preset limit.
1	Ontime2	1 = On-time counter 2 has reached its preset limit.
2	Edge1	1 = Rising edge counter 1 has reached its preset limit.
3	Edge2	1 = Rising edge counter 2 has reached its preset limit.
4	Value1	1 = Value counter 1 has reached its preset limit.
5	Value2	1 = Value counter 2 has reached its preset limit.

08 Alarms & faults		Alarm and fault information.	
08.01	Active fault	Fault code of the latest fault.	1 = 1
08.02	Last fault	Fault code of the 2nd latest fault.	1 = 1

No.	Name/Value	Description	FbEq
08.03	Fault time hi	Time (real time or power-on time) at which the active fault occurred in format dd.mm.yy (day, month and year).	1 = 1 d
08.04	Fault time lo	Time (real time or power-on time) at which the active fault occurred in format hh.mm.ss (hours, minutes and seconds).	1 = 1
08.05	Alarm word1	Alarm word 1. For possible causes and remedies, see chapter *Fault tracing*.	-

Bit	Name
0	Brake start torq
1	Brake not closed
2	Brake not open
3	Safe torq off
4	Sto mode
5	Motor temp1
6	Em off
7	Run enable
8	Id run
9	Em stop
10	Position scaling
11	Br overtemp
12	BC igbt overtemp
13	Device overtemp
14	Int board ovtemp
15	BC mod overtemp

08.06	Alarm word2	Alarm word 2. For possible causes and remedies, see chapter *Fault tracing*.	-

Bit	Name
0	Inu overtemp
1	FBA comm
2	Panel loss
3	AI supervision
4	FBA par conf
5	No motor data
6	Encoder1
7	Encoder2
8	Latch pos1
9	Latch pos2
10	Enc emul
11	FEN temp meas
12	Emul max freq
13	Emul pos ref
14	Resolver atune
15	Enc1 cable

No.	Name/Value	Description	FbEq
08.07	Alarm word3	Alarm word 3. For possible causes and remedies, see chapter *Fault tracing*.	-

Bit	Name
0	Enc2 cable
1	D2D comm
2	D2D buffer ol
3	PS comm
4	Restore
5	Curr meas calib
6	Autophasing
7	Earthfault
8	Autoreset
9	Motor nom value
10	D2D config
11	Stall
12	Load curve
13	Load curve conf
14	U/f curve conf
15	Speed meas

08.08	Alarm word4	Alarm word 4. For possible causes and remedies, see chapter *Fault tracing*.	-

Bit	Name
0	Option comm loss
1	Solution prog
2	Motor temp2

09 System info		Drive type, program revision and option slot occupation information.	
09.01	Drive type	Displays the drive type (for example, ACS850).	-
09.02	Drive rating id	Displays the inverter type (ACS850-xx-…) of the drive. 0 = Unconfigured, 101 = 03A0, 102 = 03A6, 103 = 04A8, 104 = 06A0, 105 = 08A0, 106 = 010A, 107 = 014A, 108 = 018A, 109 = 025A, 110 = 030A, 111 = 035A, 112 = 044A, 113 = 050A, 114 = 061A, 115 = 078A, 116 = 094A, 117 = 103A, 118 = 144A, 119 = 166A, 120 = 202A, 121 = 225A, 122 = 260A, 123 = 290A, 124 = 430A, 125 = 521A, 126 = 602A, 127 = 693A, 128 = 720A	1 = 1
09.03	Firmware id	Displays the firmware name. E.g. UIFI.	-
09.04	Firmware ver	Displays the version of the firmware package in the drive, e.g. E00F hex.	-
09.05	Firmware patch	Displays the version of the firmware patch in the drive.	1 = 1
09.10	Int logic ver	Displays the version of the logic on the main circuit board of the drive.	-

No.	Name/Value	Description	FbEq
09.20	Option slot1	Displays the type of the optional module in option slot 1. 0 = No option, 1 = No comm, 2 = Unknown, 3 = FEN-01, 4 = FEN-11, 5 = FEN-21, 6 = FIO-01, 7 = FIO-11, 8 = FPBA-01, 9 = FPBA-02, 10 = FCAN-01, 11 = FDNA-01, 12 = FENA-01, 13 = FENA-02, 14 = FLON-01, 15 = FRSA-00, 16 = FMBA-01, 17 = FFOA-01, 18 = FFOA-02, 19 = FSEN-01, 20 = FEN-31, 21 = FIO-21, 22 = FSCA-01, 23 = FSEA-21	1 = 1
09.21	Option slot2	Displays the type of the optional module in option slot 2. See signal *09.20 Option slot1*.	1 = 1
09.22	Option slot3	Displays the type of the optional module in option slot 3. See signal *09.20 Option slot1*.	1 = 1

10 Start/stop		Start/stop/direction etc. signal source selections.	
10.01	Ext1 start func	Selects the source of start and stop commands for external control location 1 (EXT1). **Note:** This parameter cannot be changed while the drive is running.	
	Not sel	No start or stop command sources selected.	0
	In1	The source of the start and stop commands is selected by parameter *10.02 Ext1 start in1*. The state transitions of the source bit are interpreted as follows: **State of source (via par *10.02*)** / **Command** 0 -> 1 / Start 1 -> 0 / Stop	1
	3-wire	The sources of the start and stop commands is selected by parameters *10.02 Ext1 start in1* and *10.03 Ext1 start in2*. The state transitions of the source bits are interpreted as follows: **State of source 1 (via par. *10.02*)** / **State of source 2 (via par. *10.03*)** / **Command** 0 -> 1 / 1 / Start Any / 1 -> 0 / Stop Any / 0 / Stop	2
	FBA	The start and stop commands are taken from the fieldbus.	3
	D2D	The start and stop commands are taken from another drive through the D2D (Drive-to-drive) Control Word.	4
	In1F In2R	The source selected by *10.02 Ext1 start in1* is the forward start signal, the source selected by *10.03 Ext1 start in2* is the reverse start signal. **State of source 1 (via par. *10.02*)** / **State of source 2 (via par. *10.03*)** / **Command** 0 / 0 / Stop 1 / 0 / Start forward 0 / 1 / Start reverse 1 / 1 / Stop	5
	In1St In2Dir	The source selected by *10.02 Ext1 start in1* is the start signal (0 = stop, 1 = start), the source selected by *10.03 Ext1 start in2* is the direction signal (0 = forward, 1 = reverse).	6

<table>
<tr><th>No.</th><th>Name/Value</th><th>Description</th><th>FbEq</th></tr>
<tr><td>10.02</td><td>Ext1 start in1</td><td>Selects source 1 of start and stop commands for external control location EXT1. See parameter 10.01 Ext1 start func, selections In1 and 3-wire.
Note: This parameter cannot be changed while the drive is running.</td><td></td></tr>
<tr><td></td><td>DI1</td><td>Digital input DI1 (as indicated by 02.01 DI status, bit 0).</td><td>1073742337</td></tr>
<tr><td></td><td>DI6</td><td>Digital input DI1 (as indicated by 02.01 DI status, bit 5).</td><td>1074070017</td></tr>
<tr><td></td><td>DIO4</td><td>Digital input/output DIO4 (as indicated by 02.03 DIO status, bit 3).</td><td>1073938947</td></tr>
<tr><td></td><td>Timed func</td><td>Bit 4 of parameter 06.14 Timed func stat. The bit is on when at least one of the four timers configured in parameter group 36 Timed functions is on.</td><td>1074005518</td></tr>
<tr><td></td><td>Const</td><td rowspan="2">Constant and bit pointer settings (see Terms and abbreviations on page 63).</td><td rowspan="2">-</td></tr>
<tr><td></td><td>Pointer</td></tr>
<tr><td>10.03</td><td>Ext1 start in2</td><td>Selects source 2 of start and stop commands for external control location EXT1. See parameter 10.01 Ext1 start func, selection 3-wire.
Note: This parameter cannot be changed while the drive is running.</td><td></td></tr>
<tr><td></td><td>DI2</td><td>Digital input DI2 (as indicated by 02.01 DI status, bit 1).</td><td>1073807873</td></tr>
<tr><td></td><td>DI5</td><td>Digital input DI5 (as indicated by 02.01 DI status, bit 4).</td><td>1074004481</td></tr>
<tr><td></td><td>DIO5</td><td>Digital input/output DIO5 (as indicated by 02.03 DIO status, bit 4).</td><td>1074004483</td></tr>
<tr><td></td><td>Const</td><td rowspan="2">Bit pointer setting (see Terms and abbreviations on page 63).</td><td rowspan="2">-</td></tr>
<tr><td></td><td>Pointer</td></tr>
<tr><td>10.04</td><td>Ext2 start func</td><td>Selects the source of start and stop commands for external control location 2 (EXT2).
Note: This parameter cannot be changed while the drive is running.</td><td></td></tr>
<tr><td></td><td>Not sel</td><td>No start or stop command sources selected.</td><td>0</td></tr>
<tr><td></td><td>In1</td><td>The source of the start and stop commands is selected by parameter 10.05 Ext2 start in1. The state transitions of the source bit are interpreted as follows:
<table><tr><th>State of source (via par 10.05)</th><th>Command</th></tr><tr><td>0 -> 1</td><td>Start</td></tr><tr><td>1 -> 0</td><td>Stop</td></tr></table></td><td>1</td></tr>
<tr><td></td><td>3-wire</td><td>The sources of the start and stop commands is selected by parameters 10.05 Ext2 start in1 and 10.06 Ext2 start in2. The state transitions of the source bits are interpreted as follows:
<table><tr><th>State of source 1 (via par. 10.05)</th><th>State of source 2 (via par. 10.06)</th><th>Command</th></tr><tr><td>0 -> 1</td><td>1</td><td>Start</td></tr><tr><td>Any</td><td>1 -> 0</td><td>Stop</td></tr><tr><td>Any</td><td>0</td><td>Stop</td></tr></table></td><td>2</td></tr>
<tr><td></td><td>FBA</td><td>The start and stop commands are taken from the fieldbus.</td><td>3</td></tr>
</table>

<table>
<tr><th>No.</th><th>Name/Value</th><th>Description</th><th>FbEq</th></tr>
<tr><td></td><td>D2D</td><td>The start and stop commands are taken from another drive through the D2D (Drive-to-drive) Control Word.</td><td>4</td></tr>
<tr><td></td><td>In1F In2R</td><td>The source selected by 10.05 Ext2 start in1 is the forward start signal, the source selected by 10.06 Ext2 start in2 is the reverse start signal.
<table><tr><th>State of source 1 (via par. 10.05)</th><th>State of source 2 (via par. 10.06)</th><th>Command</th></tr><tr><td>0</td><td>0</td><td>Stop</td></tr><tr><td>1</td><td>0</td><td>Start forward</td></tr><tr><td>0</td><td>1</td><td>Start reverse</td></tr><tr><td>1</td><td>1</td><td>Stop</td></tr></table></td><td>5</td></tr>
<tr><td></td><td>In1St In2Dir</td><td>The source selected by 10.05 Ext2 start in1 is the start signal (0 = stop, 1 = start), the source selected by 10.06 Ext2 start in2 is the direction signal (0 = forward, 1 = reverse).</td><td>6</td></tr>
<tr><td>10.05</td><td>Ext2 start in1</td><td>Selects source 1 of start and stop commands for external control location EXT2. See parameter 10.04 Ext2 start func, selections In1 and 3-wire.
Note: This parameter cannot be changed while the drive is running.</td><td></td></tr>
<tr><td></td><td>DI1</td><td>Digital input DI1 (as indicated by 02.01 DI status, bit 0).</td><td>1073742337</td></tr>
<tr><td></td><td>DI6</td><td>Digital input DI1 (as indicated by 02.01 DI status, bit 5).</td><td>1074070017</td></tr>
<tr><td></td><td>DIO4</td><td>Digital input/output DIO4 (as indicated by 02.03 DIO status, bit 3).</td><td>1073938947</td></tr>
<tr><td></td><td>Timed func</td><td>Bit 4 of parameter 06.14 Timed func stat. The bit is on when any one of the four timers configured in parameter group 36 Timed functions is on.</td><td>1074005518</td></tr>
<tr><td></td><td>Const</td><td rowspan="2">Bit pointer setting (see Terms and abbreviations on page 63).</td><td rowspan="2">-</td></tr>
<tr><td></td><td>Pointer</td></tr>
<tr><td>10.06</td><td>Ext2 start in2</td><td>Selects source 2 of start and stop commands for external control location EXT2. See parameter 10.04 Ext2 start func, selection 3-wire.
Note: This parameter cannot be changed while the drive is running.</td><td></td></tr>
<tr><td></td><td>DI2</td><td>Digital input DI2 (as indicated by 02.01 DI status, bit 1).</td><td>1073807873</td></tr>
<tr><td></td><td>DI5</td><td>Digital input DI5 (as indicated by 02.01 DI status, bit 4).</td><td>1074004481</td></tr>
<tr><td></td><td>DIO5</td><td>Digital input/output DIO5 (as indicated by 02.03 DIO status, bit 4).</td><td>1074004483</td></tr>
<tr><td></td><td>Const</td><td rowspan="2">Bit pointer setting (see Terms and abbreviations on page 63).</td><td rowspan="2">-</td></tr>
<tr><td></td><td>Pointer</td></tr>
</table>

No.	Name/Value	Description	FbEq
10.07	Jog1 start	If enabled by parameter *10.09 Jog enable*, selects the source for the activation of jogging function 1. (Jogging function 1 can also be activated through fieldbus regardless of parameter *10.09*.) 1 = Active. See also other jogging function parameters: *10.08 Jog2 start*, *10.09 Jog enable*, *21.07 Speed ref jog1*, *21.08 Speed ref jog2*, *22.10 Acc time jogging*, *22.11 Dec time jogging* and *19.07 Zero speed delay*. **Note:** This parameter cannot be changed while the drive is running.	
	DI3	Digital input DI3 (as indicated by *02.01 DI status*, bit 2).	1073873409
	DI4	Digital input DI4 (as indicated by *02.01 DI status*, bit 3).	1073938945
	DI5	Digital input DI5 (as indicated by *02.01 DI status*, bit 4).	1074004481
	DI6	Digital input DI6 (as indicated by *02.01 DI status*, bit 5).	1074070017
	DIO4	Digital input/output DIO4 (as indicated by *02.03 DIO status*, bit 3).	1073938947
	DIO5	Digital input/output DIO5 (as indicated by *02.03 DIO status*, bit 4).	1074004483
	Const	Bit pointer setting (see *Terms and abbreviations* on page *63*).	-
	Pointer		
10.08	Jog2 start	If enabled by parameter *10.09 Jog enable*, selects the source for the activation of jogging function 2. (Jogging function 2 can also be activated through fieldbus regardless of parameter *10.09*.) 1 = Active. See also parameter *10.07 Jog1 start*. **Note:** This parameter cannot be changed while the drive is running.	
	DI3	Digital input DI3 (as indicated by *02.01 DI status*, bit 2).	1073873409
	DI4	Digital input DI4 (as indicated by *02.01 DI status*, bit 3).	1073938945
	DI5	Digital input DI5 (as indicated by *02.01 DI status*, bit 4).	1074004481
	DI6	Digital input DI6 (as indicated by *02.01 DI status*, bit 5).	1074070017
	DIO4	Digital input/output DIO4 (as indicated by *02.03 DIO status*, bit 3).	1073938947
	DIO5	Digital input/output DIO5 (as indicated by *02.03 DIO status*, bit 4).	1074004483
	Const	Bit pointer setting (see *Terms and abbreviations* on page *63*).	-
	Pointer		
10.09	Jog enable	Selects the source for enabling parameters *10.07 Jog1 start* and *10.08 Jog2 start*. **Note:** Jogging can be enabled using this parameter only when no start command from an external control location is active. On the other hand, if jogging is already enabled, the drive cannot be started from an external control location apart from jog commands through fieldbus.	
	DI3	Digital input DI3 (as indicated by *02.01 DI status*, bit 2).	1073873409
	DI4	Digital input DI4 (as indicated by *02.01 DI status*, bit 3).	1073938945
	DI5	Digital input DI5 (as indicated by *02.01 DI status*, bit 4).	1074004481

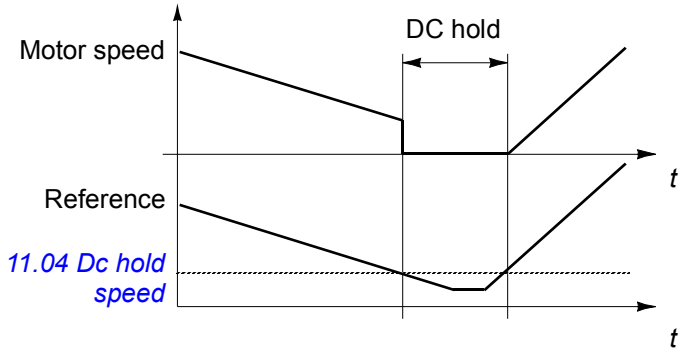
No.	Name/Value	Description	FbEq
	DI6	Digital input DI6 (as indicated by *02.01 DI status*, bit 5).	1074070017
	DIO4	Digital input/output DIO4 (as indicated by *02.03 DIO status*, bit 3).	1073938947
	DIO5	Digital input/output DIO5 (as indicated by *02.03 DIO status*, bit 4).	1074004483
	DIO6	Digital input/output DIO6 (as indicated by *02.03 DIO status*, bit 5).	1074070019
	Const	Bit pointer setting (see *Terms and abbreviations* on page *63*).	-
	Pointer		
10.10	Fault reset sel	Selects the source of the external fault reset signal. The signal resets the drive after a fault trip if the cause of the fault no longer exists. 0 -> 1 = Fault reset.	
	DI1	Digital input DI1 (as indicated by *02.01 DI status*, bit 0).	1073742337
	DI2	Digital input DI2 (as indicated by *02.01 DI status*, bit 1).	1073807873
	DI3	Digital input DI3 (as indicated by *02.01 DI status*, bit 2).	1073873409
	DI4	Digital input DI4 (as indicated by *02.01 DI status*, bit 3).	1073938945
	DI5	Digital input DI5 (as indicated by *02.01 DI status*, bit 4).	1074004481
	DI6	Digital input DI6 (as indicated by *02.01 DI status*, bit 5).	1074070017
	DIO4	Digital input/output DIO4 (as indicated by *02.03 DIO status*, bit 3).	1073938947
	DIO5	Digital input/output DIO5 (as indicated by *02.03 DIO status*, bit 4).	1074004483
	DIO6	Digital input/output DIO6 (as indicated by *02.03 DIO status*, bit 5).	1074070019
	Const	Bit pointer setting (see *Terms and abbreviations* on page *63*).	-
	Pointer		
10.11	Run enable	Selects the source of the external run enable signal. If the run enable signal is switched off, the drive will not start, or coasts to stop if running. 1 = Run enable. **Note:** This parameter cannot be changed while the drive is running.	
	DI1	Digital input DI1 (as indicated by *02.01 DI status*, bit 0).	1073742337
	DI2	Digital input DI2 (as indicated by *02.01 DI status*, bit 1).	1073807873
	DI3	Digital input DI3 (as indicated by *02.01 DI status*, bit 2).	1073873409
	DI4	Digital input DI4 (as indicated by *02.01 DI status*, bit 3).	1073938945
	DI5	Digital input DI5 (as indicated by *02.01 DI status*, bit 4).	1074004481
	DI6	Digital input DI6 (as indicated by *02.01 DI status*, bit 5).	1074070017
	DIO4	Digital input/output DIO4 (as indicated by *02.03 DIO status*, bit 3).	1073938947
	DIO5	Digital input/output DIO5 (as indicated by *02.03 DIO status*, bit 4).	1074004483
	DIO6	Digital input/output DIO6 (as indicated by *02.03 DIO status*, bit 5).	1074070019

No.	Name/Value	Description	FbEq
	Const	Bit pointer setting (see *Terms and abbreviations* on page *63*).	-
	Pointer		
10.13	Em stop off3	Selects the source of the emergency stop OFF3 signal. The drive is stopped along the emergency stop ramp time defined by parameter *22.12 Em stop time*. 0 = OFF3 active. **Note:** This parameter cannot be changed while the drive is running.	
	DI1	Digital input DI1 (as indicated by *02.01 DI status*, bit 0).	1073742337
	DI2	Digital input DI2 (as indicated by *02.01 DI status*, bit 1).	1073807873
	DI3	Digital input DI3 (as indicated by *02.01 DI status*, bit 2).	1073873409
	DI4	Digital input DI4 (as indicated by *02.01 DI status*, bit 3).	1073938945
	DI5	Digital input DI5 (as indicated by *02.01 DI status*, bit 4).	1074004481
	DI6	Digital input DI6 (as indicated by *02.01 DI status*, bit 5).	1074070017
	DIO4	Digital input/output DIO4 (as indicated by *02.03 DIO status*, bit 3).	1073938947
	DIO5	Digital input/output DIO5 (as indicated by *02.03 DIO status*, bit 4).	1074004483
	DIO6	Digital input/output DIO6 (as indicated by *02.03 DIO status*, bit 5).	1074070019
	Const	Bit pointer setting (see *Terms and abbreviations* on page *63*).	-
	Pointer		
10.15	Em stop off1	Selects the source of the emergency stop OFF1 signal. The drive is stopped using the active deceleration time. Emergency stop can also be activated through fieldbus (*02.22 FBA main cw*). 0 = OFF1 active. **Note:** This parameter cannot be changed while the drive is running.	
	DI1	Digital input DI1 (as indicated by *02.01 DI status*, bit 0).	1073742337
	DI2	Digital input DI2 (as indicated by *02.01 DI status*, bit 1).	1073807873
	DI3	Digital input DI3 (as indicated by *02.01 DI status*, bit 2).	1073873409
	DI4	Digital input DI4 (as indicated by *02.01 DI status*, bit 3).	1073938945
	DI5	Digital input DI5 (as indicated by *02.01 DI status*, bit 4).	1074004481
	DI6	Digital input DI6 (as indicated by *02.01 DI status*, bit 5).	1074070017
	DIO4	Digital input/output DIO4 (as indicated by *02.03 DIO status*, bit 3).	1073938947
	DIO5	Digital input/output DIO5 (as indicated by *02.03 DIO status*, bit 4).	1074004483
	DIO6	Digital input/output DIO6 (as indicated by *02.03 DIO status*, bit 5).	1074070019
	Const	Bit pointer setting (see *Terms and abbreviations* on page *63*).	-
	Pointer		

No.	Name/Value	Description	FbEq
10.17	Start enable	Selects the source for the Start enable signal. 1 = Start enable. If the signal is switched off, the drive will not start or coasts to stop if running.	
	DI1	Digital input DI1 (as indicated by *02.01 DI status*, bit 0).	1073742337
	DI2	Digital input DI2 (as indicated by *02.01 DI status*, bit 1).	1073807873
	DI3	Digital input DI3 (as indicated by *02.01 DI status*, bit 2).	1073873409
	DI4	Digital input DI4 (as indicated by *02.01 DI status*, bit 3).	1073938945
	DI5	Digital input DI5 (as indicated by *02.01 DI status*, bit 4).	1074004481
	DI6	Digital input DI6 (as indicated by *02.01 DI status*, bit 5).	1074070017
	DIO4	Digital input/output DIO4 (as indicated by *02.03 DIO status*, bit 3).	1073938947
	DIO5	Digital input/output DIO5 (as indicated by *02.03 DIO status*, bit 4).	1074004483
	DIO6	Digital input/output DIO6 (as indicated by *02.03 DIO status*, bit 5).	1074070019
	Const	Bit pointer setting (see *Terms and abbreviations* on page *63*).	-
	Pointer		
10.19	Start inhibit	Enables the start inhibit function. The function prevents drive restart (i.e. protects against unexpected start) if • the drive trips on a fault and the fault is reset, • the run enable signal is activated while the start command is active (see parameter *10.11 Run enable*), • control changes from local to remote, or • external control switches from EXT1 to EXT2 or vice versa. An active start inhibit can be reset with a stop command. Note that in certain applications it is necessary to allow the drive to restart.	
	Disabled	The start inhibit function is disabled.	0
	Enabled	The start inhibit function is enabled.	1

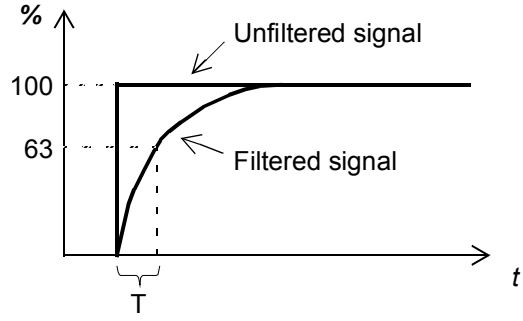
11 Start/stop mode		Start, stop, magnetization etc. settings.	
11.01	Start mode	Selects the motor start function. **Notes**: • Selections *Fast* and *Const time* are ignored if parameter 99.05 is set to *Scalar*. • Starting to a rotating machine is not possible when DC magnetizing is selected (*Fast* or *Const time*). • With permanent magnet motors, *Automatic* start must be used.	
	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. **Note:** This parameter cannot be changed while the drive is running.	0

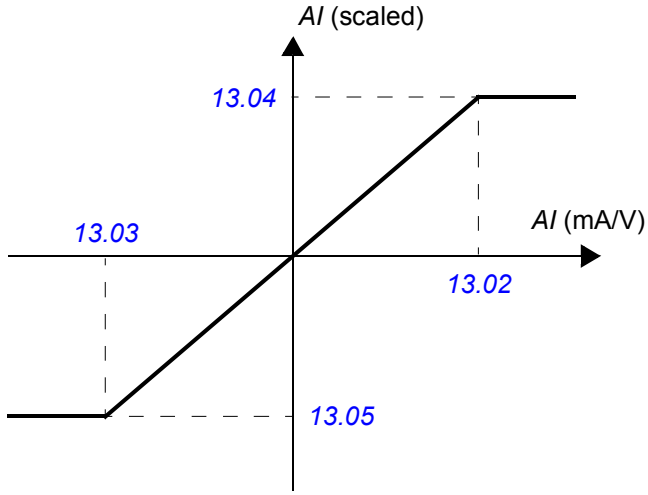
<table>
<tr><th>No.</th><th>Name/Value</th><th>Description</th><th>FbEq</th></tr>
<tr><td></td><td>Const time</td><td>The drive pre-magnetizes the motor before start. The pre-magnetizing time is defined by parameter 11.02 Dc-magn time. This mode should be selected if constant pre-magnetizing time is required (e.g. if the motor start must be synchronized with the release of a mechanical brake). This setting also guarantees the highest possible break-away torque when the pre-magnetizing time is set long enough.
 
WARNING! The drive will start after the set magnetizing time has passed even if motor magnetization is not completed. In applications where a full break-away torque is essential, ensure that the constant magnetizing time is long enough to allow generation of full magnetization and torque.</td><td>1</td></tr>
<tr><td></td><td>Automatic</td><td>Automatic start guarantees optimal motor start in most cases. It includes the flying start function (starting to a rotating machine) and the automatic restart function (a stopped motor can be restarted immediately without waiting the motor flux to die away). The drive motor control program identifies the flux as well as the mechanical state of the motor and starts the motor instantly under all conditions.
Note: If parameter 99.05 Motor ctrl mode is set to Scalar, no flying start or automatic restart is possible by default.</td><td>2</td></tr>
<tr><td>11.02</td><td>Dc-magn time</td><td>Defines the constant DC magnetizing time. See parameter 11.01 Start mode. After the start command, the drive automatically premagnetizes the motor the set time.
To ensure full magnetizing, set this value to the same value as or higher than the rotor time constant. If not known, use the rule-of-thumb value given in the table below:
<table><tr><th>Motor rated power</th><th>Constant magnetizing time</th></tr><tr><td>< 1 kW</td><td>≥ 50 to 100 ms</td></tr><tr><td>1 to 10 kW</td><td>≥ 100 to 200 ms</td></tr><tr><td>10 to 200 kW</td><td>≥ 200 to 1000 ms</td></tr><tr><td>200 to 1000 kW</td><td>≥ 1000 to 2000 ms</td></tr></table>Note: This parameter cannot be changed while the drive is running.</td><td></td></tr>
<tr><td></td><td>0 … 10000 ms</td><td>Constant DC magnetizing time.</td><td>1 = 1 ms</td></tr>
<tr><td>11.03</td><td>Stop mode</td><td>Selects the motor stop function.</td><td></td></tr>
<tr><td></td><td>Coast</td><td>Stop by cutting of the motor power supply. The motor coasts to a stop.
 
WARNING! If the mechanical brake is used, ensure it is safe to stop the drive by coasting.</td><td>1</td></tr>
<tr><td></td><td>Ramp</td><td>Stop along ramp. See parameter group 22 Speed ref ramp on page 125.</td><td>2</td></tr>
<tr><td>11.04</td><td>Dc hold speed</td><td>Defines the DC hold speed. See parameter 11.06 Dc hold.</td><td></td></tr>
<tr><td></td><td>0.0 … 1000.0 rpm</td><td>DC hold speed.</td><td>10 = 1 rpm</td></tr>
<tr><td>11.05</td><td>Dc hold curr ref</td><td>Defines the DC hold current in percent of the motor nominal current. See parameter 11.06 Dc hold.</td><td></td></tr>
<tr><td></td><td>0 … 100%</td><td>DC hold current.</td><td>1 = 1%</td></tr>
</table>

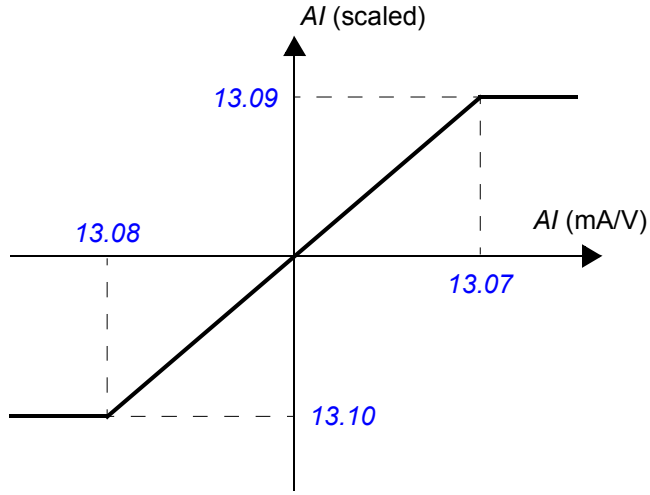
No.	Name/Value	Description	FbEq
11.06	Dc hold	Enables the DC hold function. The function makes it possible to lock the rotor at zero speed. When both the reference and the speed drop below the value of parameter *11.04 Dc hold speed*, the drive will stop generating sinusoidal current and start to inject DC into the motor. The current is set by parameter *11.05 Dc hold curr ref*. When the reference speed exceeds parameter *11.04 Dc hold speed*, normal drive operation continues.  **Notes:** • The DC hold function has no effect if the start signal is switched off. • The DC hold function can only be activated in speed control mode. • The DC hold function cannot be activated if parameter *99.05 Motor ctrl mode* is set to *Scalar*. • Injecting DC current into the motor causes the motor to heat up. In applications where long DC hold times are required, externally ventilated motors should be used. If the DC hold period is long, the DC hold cannot prevent the motor shaft from rotating if a constant load is applied to the motor.	
	Disabled	The DC hold function is disabled.	0
	Enabled	The DC hold function is enabled.	1
11.07	Autophasing mode	Selects the way autophasing is performed during the ID run. See section *Autophasing* on page *30*.	
	Turning	This mode gives the most accurate autophasing result. This mode can be used, and is recommended, if it is allowed for the motor to rotate during the ID run and the start-up is not time-critical. **Note:** This mode will cause the motor to rotate during the ID run.	0
	Standstill 1	Faster than the *Turning* mode, but not as accurate. The motor will not rotate.	1
	Standstill 2	An alternative standstill autophasing mode that can be used if the *Turning* mode cannot be used, and the *Standstill 1* mode gives erratic results. However, this mode is considerably slower than *Standstill 1*.	2

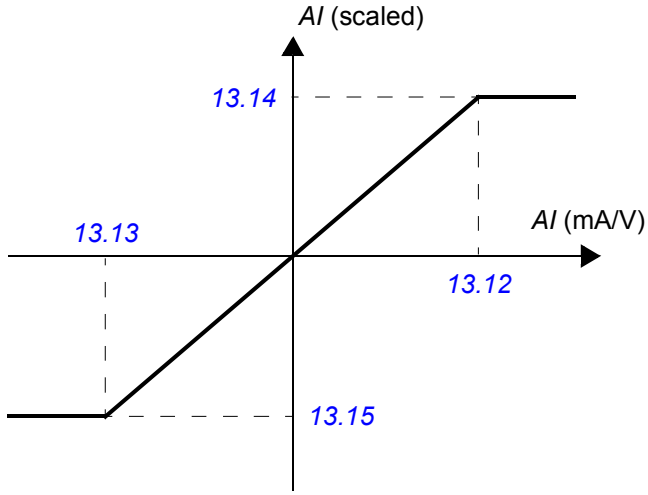
12 Operating mode		Operating mode and external reference source selection.	
12.01	Ext1/Ext2 sel	Selects the source for external control location EXT1/EXT2 selection.	
	DI1	Digital input DI1 (as indicated by *02.01 DI status*, bit 0).	1073742337

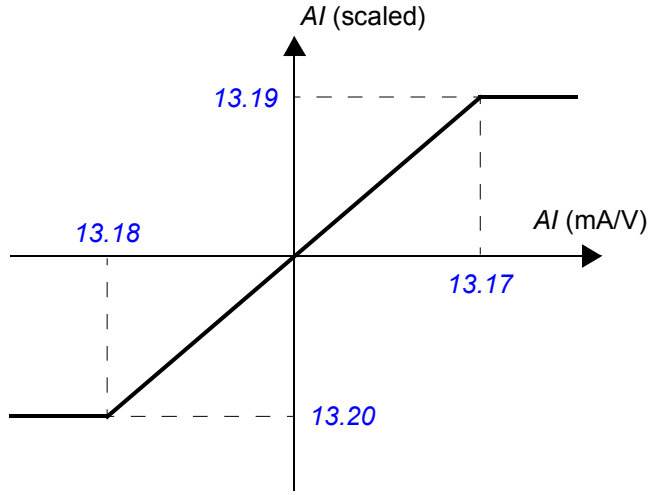
No.	Name/Value	Description	FbEq
	DI2	Digital input DI2 (as indicated by *02.01 DI status*, bit 1).	1073807873
	DI3	Digital input DI3 (as indicated by *02.01 DI status*, bit 2).	1073873409
	DI4	Digital input DI4 (as indicated by *02.01 DI status*, bit 3).	1073938945
	DI5	Digital input DI5 (as indicated by *02.01 DI status*, bit 4).	1074004481
	DI6	Digital input DI6 (as indicated by *02.01 DI status*, bit 5).	1074070017
	DIO4	Digital input/output DIO4 (as indicated by *02.03 DIO status*, bit 3).	1073938947
	DIO5	Digital input/output DIO5 (as indicated by *02.03 DIO status*, bit 4).	1074004483
	DIO6	Digital input/output DIO6 (as indicated by *02.03 DIO status*, bit 5).	1074070019
	Const	Bit pointer setting (see *Terms and abbreviations* on page *63*).	-
	Pointer		
12.03	Ext1 ctrl mode	Selects the operating mode for external control location EXT1.	
	Speed	Speed control. Torque reference is *03.09 Torq ref sp ctrl*.	1
	Torque	Torque control. Torque reference is *03.12 Torq ref sp lim*.	2
	Min	Combination of selections *Speed* and *Torque*: Torque selector compares the torque reference and the speed controller output and the smaller of the two is used.	3
	Max	Combination of selections *Speed* and *Torque*: Torque selector compares the torque reference and the speed controller output and the greater of the two is used.	4
	Add	Combination of selections *Speed* and *Torque*: Torque selector adds the speed controller output to the torque reference.	5
12.05	Ext2 ctrl mode	Selects the operating mode for external control location EXT2.	
	Speed	Speed control. Torque reference is *03.09 Torq ref sp ctrl*.	1
	Torque	Torque control. Torque reference is *03.12 Torq ref sp lim*.	2
	Min	Combination of selections *Speed* and *Torque*: Torque selector compares the torque reference and the speed controller output and the smaller of the two is used.	3
	Max	Combination of selections *Speed* and *Torque*: Torque selector compares the torque reference and the speed controller output and the greater of the two is used.	4
	Add	Combination of selections *Speed* and *Torque*: Torque selector adds the speed controller output to the torque reference.	5

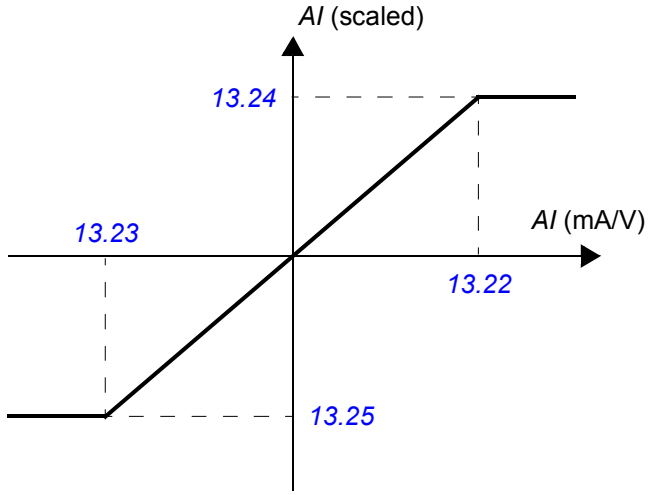
No.	Name/Value	Description	FbEq
13 Analogue inputs		Analog input signal processing.	
13.01	AI1 filt time	Defines the filter time constant for analogue input AI1.  $O = I \times (1 - e^{-t/T})$ I = filter input (step) O = filter output *t* = time T = filter time constant **Note:** The signal is also filtered due to the signal interface hardware (approximately 0.25 ms time constant). This cannot be changed by any parameter.	
	0.000 … 30.000 s	Filter time constant.	1000 = 1 s
13.02	AI1 max	Defines the maximum value for analogue input AI1. The input type is selected with jumper J1 on the JCU Control Unit.	
	-22.000 … 22.000 mA or -11.000 … 11.000 V	Maximum AI1 value.	1000 = 1 unit
13.03	AI1 min	Defines the minimum value for analogue input AI1. The input type is selected with jumper J1 on the JCU Control Unit.	
	-22.000 … 22.000 mA or -11.000 … 11.000 V	Minimum AI1 value.	1000 = 1 unit

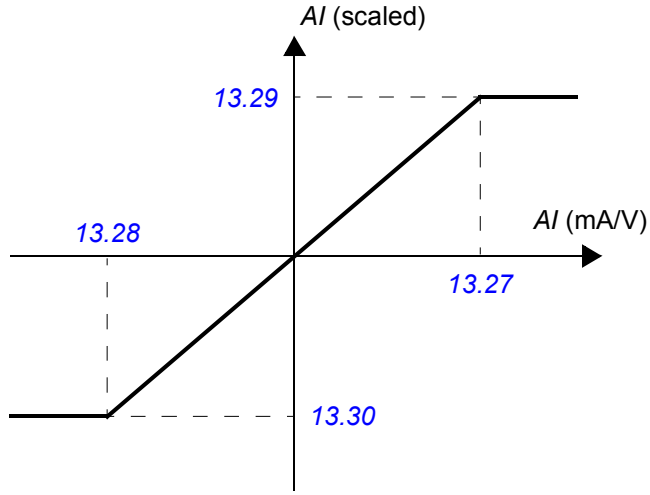
No.	Name/Value	Description	FbEq
13.04	AI1 max scale	Defines the real value that corresponds to the maximum analogue input AI1 value defined by parameter *13.02 AI1 max*. 	
	-32768.000 … 32768.000	Real value corresponding to maximum AI1 value.	1000 = 1
13.05	AI1 min scale	Defines the real value that corresponds to the minimum analogue input AI1 value defined by parameter *13.03 AI1 min*. See the drawing at parameter *13.04 AI1 max scale*.	
	-32768.000 …32768.000	Real value corresponding to minimum AI1 value.	1000 = 1
13.06	AI2 filt time	Defines the filter time constant for analogue input AI2. See parameter *13.01 AI1 filt time*.	
	0.000 … 30.000 s	Filter time constant.	1000 = 1 s
13.07	AI2 max	Defines the maximum value for analogue input AI2. The input type is selected with jumper J2 on the JCU Control Unit.	
	-22.000 … 22.000 mA or -11.000 … 11.000 V	AI2 maximum value.	1000 = 1 unit
13.08	AI2 min	Defines the minimum value for analogue input AI2. The input type is selected with jumper J2 on the JCU Control Unit.	
	-22.000 … 22.000 mA or -11.000 … 11.000 V	AI2 minimum value.	1000 = 1 unit

No.	Name/Value	Description	FbEq
13.09	AI2 max scale	Defines the real value that corresponds to the maximum analogue input AI2 value defined by parameter *13.07 AI2 max*.  	
	-32768.000 … 32768.000	Real value corresponding to maximum AI2 value.	1000 = 1
13.10	AI2 min scale	Defines the real value that corresponds to the minimum analogue input AI2 value defined by parameter *13.08 AI2 min*. See the drawing at parameter *13.09 AI2 max scale*.	
	-32768.000 … 32768.000	Real value corresponding to minimum AI2 value.	1000 = 1
13.11	AI3 filt time	Defines the filter time constant for analogue input AI3. See parameter *13.01 AI1 filt time*.	
	0.000 … 30.000 s	Filter time constant.	1000 = 1 s
13.12	AI3 max	Defines the maximum value for analogue input AI3. The input type depends on the type and/or settings of the I/O extension module installed. See the user documentation of the extension module.	
	-22.000 … 22.000 mA or -11.000 … 11.000 V	AI3 maximum value.	1000 = 1 unit
13.13	AI3 min	Defines the minimum value for analogue input AI3. The input type depends on the type and/or settings of the I/O extension module installed. See the user documentation of the extension module.	
	-22.000 … 22.000 mA or -11.000 … 11.000 V	AI3 minimum value.	1000 = 1 unit

No.	Name/Value	Description	FbEq
13.14	AI3 max scale	Defines the real value that corresponds to the maximum analogue input AI3 value defined by parameter *13.12 AI3 max*. 	
	-32768.000 … 32768.000	Real value corresponding to maximum AI3 value.	1000 = 1
13.15	AI3 min scale	Defines the real value that corresponds to the minimum analogue input AI3 value defined by parameter *13.13 AI3 min*. See the drawing at parameter *13.14 AI3 max scale*.	
	-32768.000 … 32768.000	Real value corresponding to minimum AI3 value.	1000 = 1
13.16	AI4 filt time	Defines the filter time constant for analogue input AI4. See parameter *13.01 AI1 filt time*.	
	0.000 … 30.000 s	Filter time constant.	1000 = 1 s
13.17	AI4 max	Defines the maximum value for analogue input AI4. The input type depends on the type and/or settings of the I/O extension module installed. See the user documentation of the extension module.	
	-22.000 … 22.000 mA or -11.000 … 11.000 V	AI4 maximum value.	1000 = 1 unit
13.18	AI4 min	Defines the minimum value for analogue input AI4. The input type depends on the type and/or settings of the I/O extension module installed. See the user documentation of the extension module.	
	-22.000 … 22.000 mA or -11.000 … 11.000 V	AI4 minimum value.	1000 = 1 unit

No.	Name/Value	Description	FbEq
13.19	AI4 max scale	Defines the real value that corresponds to the maximum analogue input AI4 value defined by parameter *13.17 AI4 max*.  	
	-32768.000 … 32768.000	Real value corresponding to maximum AI4 value.	1000 = 1
13.20	AI4 min scale	Defines the real value that corresponds to the minimum analogue input AI4 value defined by parameter *13.18 AI4 min*. See the drawing at parameter *13.19 AI4 max scale*.	
	-32768.000 … 32768.000	Real value corresponding to minimum AI4 value.	1000 = 1
13.21	AI5 filt time	Defines the filter time constant for analogue input AI5. See parameter *13.01 AI1 filt time*.	
	0.000 … 30.000 s	Filter time constant.	1000 = 1 s
13.22	AI5 max	Defines the maximum value for analogue input AI5. The input type depends on the type and/or settings of the I/O extension module installed. See the user documentation of the extension module.	
	-22.000 … 22.000 mA or -11.000 … 11.000 V	AI5 maximum value.	1000 = 1 unit
13.23	AI5 min	Defines the minimum value for analogue input AI5. The input type depends on the type and/or settings of the I/O extension module installed. See the user documentation of the extension module.	
	-22.000 … 22.000 mA or -11.000 … 11.000 V	AI5 minimum value.	1000 = 1 unit

No.	Name/Value	Description	FbEq
13.24	AI5 max scale	Defines the real value that corresponds to the maximum analogue input AI5 value defined by parameter *13.22 AI5 max*. 	
	-32768.000 … 32768.000	Real value corresponding to maximum AI5 value.	1000 = 1
13.25	AI5 min scale	Defines the real value that corresponds to the minimum analogue input AI5 value defined by parameter *13.23 AI5 min*. See the drawing at parameter *13.24 AI5 max scale*.	
	-32768.000 … 32768.000	Real value corresponding to minimum AI5 value.	1000 = 1
13.26	AI6 filt time	Defines the filter time constant for analogue input AI6. See parameter *13.01 AI1 filt time*.	
	0.000 … 30.000 s	Filter time constant.	1000 = 1 s
13.27	AI6 max	Defines the maximum value for analogue input AI6. The input type depends on the type and/or settings of the I/O extension module installed. See the user documentation of the extension module.	
	-22.000 … 22.000 mA or -11.000 … 11.000 V	AI6 maximum value.	1000 = 1 unit
13.28	AI6 min	Defines the minimum value for analogue input AI6. The input type depends on the type and/or settings of the I/O extension module installed. See the user documentation of the extension module.	
	-22.000 … 22.000 mA or -11.000 … 11.000 V	AI6 minimum value.	1000 = 1 unit

No.	Name/Value	Description	FbEq
13.29	AI6 max scale	Defines the real value that corresponds to the maximum analogue input AI6 value defined by parameter *13.27 AI6 max*.  	
	-32768.000 … 32768.000	Real value corresponding to maximum AI6 value.	1000 = 1
13.30	AI6 min scale	Defines the real value that corresponds to the minimum analogue input AI6 value defined by parameter *13.28 AI6 min*. See the drawing at parameter *13.29 AI6 max scale*.	
	-32768.000 … 32768.000	Real value corresponding to minimum AI6 value.	1000 = 1
13.31	AI tune	Triggers the AI tuning function. Connect the signal to the input and select the appropriate tuning function.	
	No action	AI tune is not activated.	0
	AI1 min tune	Current analogue input AI1 signal value is set as minimum value of AI1 into parameter *13.03 AI1 min*. The value reverts back to *No action* automatically.	1
	AI1 max tune	Current analogue input AI1 signal value is set as maximum value of AI1 into parameter *13.02 AI1 max*. The value reverts back to *No action* automatically.	2
	AI2 min tune	Current analogue input AI2 signal value is set as minimum value of AI2 into parameter *13.08 AI2 min*. The value reverts back to *No action* automatically.	3
	AI2 max tune	Current analogue input AI2 signal value is set as maximum value of AI2 into parameter *13.07 AI2 max*. The value reverts back to *No action* automatically.	4
13.32	AI superv func	Selects how the drive reacts when analogue input signal limit is reached. The limit is selected by parameter *13.33 AI superv cw*.	
	No	No action taken.	0
	Fault	The drive trips on an AI SUPERVISION fault.	1

No.	Name/Value	Description	FbEq
	Spd ref Safe	The drive generates an AI SUPERVISION alarm and sets the speed to the speed defined by parameter *30.02 Speed ref safe*.  **WARNING!** Make sure that it is safe to continue operation in case of a communication break.	2
	Last speed	The drive generates an AI SUPERVISION alarm and freezes the speed to the level the drive was operating at. The speed is determined by the average speed over the previous 10 seconds.  **WARNING!** Make sure that it is safe to continue operation in case of a communication break.	3
13.33	AI superv cw	Selects the analogue input signal supervision limit.	

Bit	Supervision	Action selected by parameter *13.32 AI superv func* is taken if
0	AI1<min	AI1 signal value falls below the value defined by equation: par. *13.03 AI1 min* - 0.5 mA or V
1	AI1>max	AI1 signal value exceeds the value defined by equation: par. *13.02 AI1 max* + 0.5 mA or V
2	AI2<min	AI2 signal value falls below the value defined by equation: par. *13.08 AI2 min* - 0.5 mA or V
3	AI2>min	AI1 signal value exceeds the value defined by equation: par. *13.07 AI2 max* + 0.5 mA or V

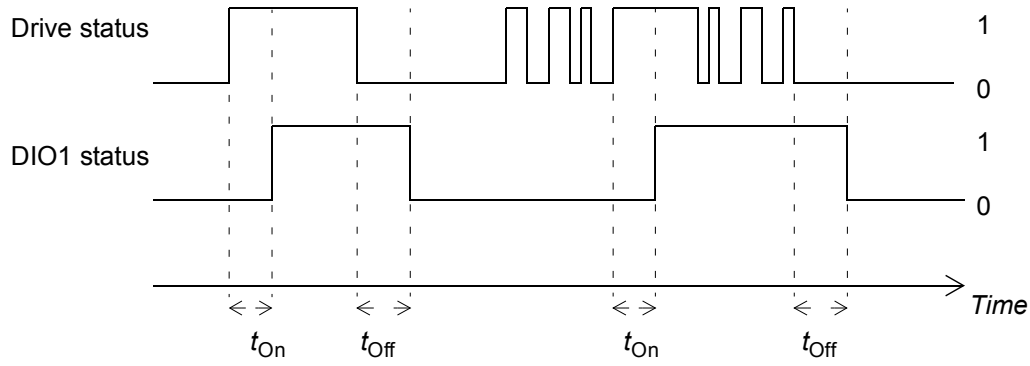
Example: If parameter value is set to 0b0010, bit 1 AI1>max is selected.

14 Digital I/O		Configuration of digital input/outputs and relay outputs.	
14.01	DI invert mask	Inverts status of digital inputs as reported by *02.01 DI status*.	

Bit	Name
0	1 = Invert DI1
1	1 = Invert DI2
2	1 = Invert DI3
3	1 = Invert DI4
4	1 = Invert DI5
5	1 = Invert DI6

14.02	DIO1 conf	Selects whether DIO1 is used as a digital output or input.	
	Output	DIO1 is used as a digital output.	0
	Input	DIO1 is used as a digital input.	1
14.03	DIO1 out src	Selects a drive signal to be connected to digital output DIO1 (when *14.02 DIO1 conf* is set to *Output*).	
	Brake cmd	*03.16 Brake command* (see page *71*).	1073742608
	Ready	Bit 0 of *06.01 Status word1* (see page *73*).	1073743361
	Enabled	Bit 1 of *06.01 Status word1* (see page *73*).	1073808897
	Started	Bit 2 of *06.01 Status word1* (see page *73*).	1073874433
	Running	Bit 3 of *06.01 Status word1* (see page *73*).	1073939969

No.	Name/Value	Description	FbEq
	Alarm	Bit 7 of *06.01 Status word1* (see page *73*).	1074202113
	Ext2 active	Bit 8 of *06.01 Status word1* (see page *73*).	1074267649
	Fault	Bit 10 of *06.01 Status word1* (see page *73*).	1074398721
	Fault(-1)	Bit 12 of *06.01 Status word1* (see page *73*).	1074529793
	Ready relay	Bit 2 of *06.02 Status word2* (see page *74*).	1073874434
	RunningRelay	Bit 3 of *06.02 Status word2* (see page *74*).	1073939970
	Ref running	Bit 4 of *06.02 Status word2* (see page *74*).	1074005506
	Charge ready	Bit 9 of *06.02 Status word2* (see page *74*).	1074333186
	Neg speed	Bit 0 of *06.03 Speed ctrl stat* (see page *75*).	1073743363
	Zero speed	Bit 1 of *06.03 Speed ctrl stat* (see page *75*).	1073808899
	Above limit	Bit 2 of *06.03 Speed ctrl stat* (see page *75*).	1073874435
	At setpoint	Bit 3 of *06.03 Speed ctrl stat* (see page *75*).	1073939971
	Supervision1	Bit 0 of *06.13 Superv status* (see page *76*).	1073743373
	Supervision2	Bit 1 of *06.13 Superv status* (see page *76*).	1073808909
	Supervision3	Bit 2 of *06.13 Superv status* (see page *76*).	1073874445
	Const	Bit pointer setting (see *Terms and abbreviations* on page *63*).	-
	Pointer		
14.04	DIO1 Ton	Defines the on (activation) delay for digital input/output DIO1 when *14.02 DIO1 conf* is set to *Output*.	

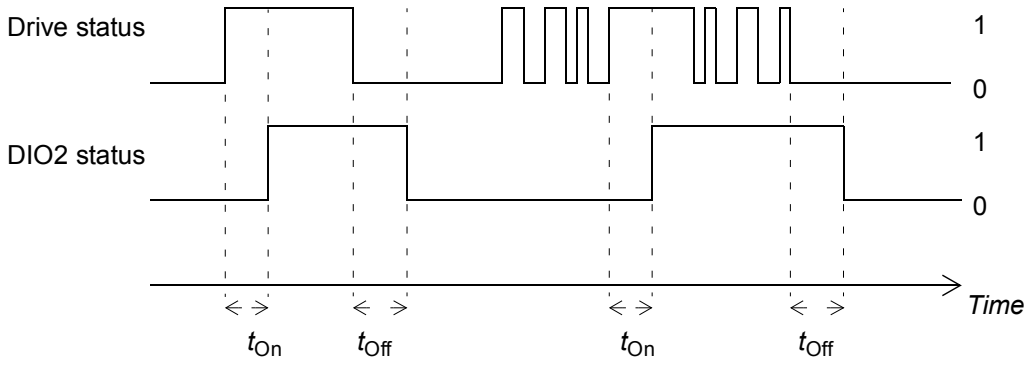


t_{On} *14.04 DIO1 Ton*

t_{Off} *14.05 DIO1 Toff*

	0.0 … 3000.0 s	On (activation) delay for DIO1 when set as an output.	10 = 1 s
14.05	DIO1 Toff	Defines the off (deactivation) delay for digital input/output DIO1 when *14.02 DIO1 conf* is set to *Output*. See parameter *14.04 DIO1 Ton*.	
	0.0 … 3000.0 s	Off (deactivation) delay for DIO1 when set as an output.	10 = 1 s
14.06	DIO2 conf	Selects whether DIO2 is used as a digital output, digital input or frequency input.	
	Output	DIO2 is used as a digital output.	0
	Input	DIO2 is used as a digital input.	1
	Freq input	DIO2 is used as a frequency input.	2

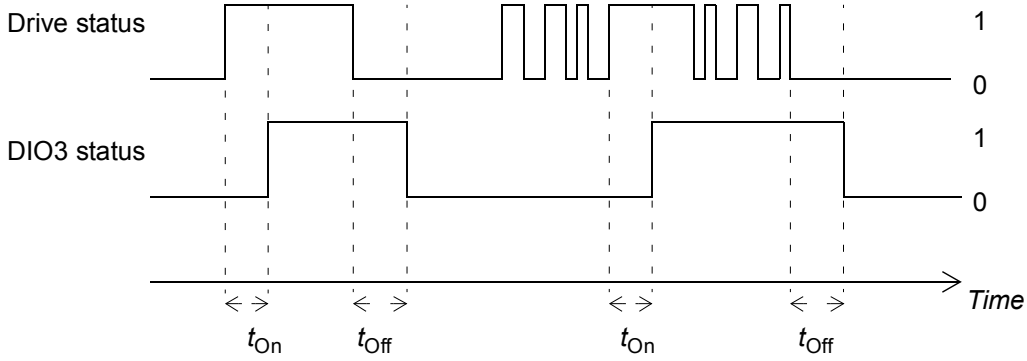
No.	Name/Value	Description	FbEq
14.07	DIO2 out src	Selects a drive signal to be connected to digital output DIO2 (when *14.06 DIO2 conf* is set to *Output*).	
	Brake cmd	*03.16 Brake command* (see page *71*).	1073742608
	Ready	Bit 0 of *06.01 Status word1* (see page *73*).	1073743361
	Enabled	Bit 1 of *06.01 Status word1* (see page *73*).	1073808897
	Started	Bit 2 of *06.01 Status word1* (see page *73*).	1073874433
	Running	Bit 3 of *06.01 Status word1* (see page *73*).	1073939969
	Alarm	Bit 7 of *06.01 Status word1* (see page *73*).	1074202113
	Ext2 active	Bit 8 of *06.01 Status word1* (see page *73*).	1074267649
	Fault	Bit 10 of *06.01 Status word1* (see page *73*).	1074398721
	Fault(-1)	Bit 12 of *06.01 Status word1* (see page *73*).	1074529793
	Ready relay	Bit 2 of *06.02 Status word2* (see page *74*).	1073874434
	RunningRelay	Bit 3 of *06.02 Status word2* (see page *74*).	1073939970
	Ref running	Bit 4 of *06.02 Status word2* (see page *74*).	1074005506
	Charge ready	Bit 9 of *06.02 Status word2* (see page *74*).	1074333186
	Neg speed	Bit 0 of *06.03 Speed ctrl stat* (see page *75*).	1073743363
	Zero speed	Bit 1 of *06.03 Speed ctrl stat* (see page *75*).	1073808899
	Above limit	Bit 2 of *06.03 Speed ctrl stat* (see page *75*).	1073874435
	At setpoint	Bit 3 of *06.03 Speed ctrl stat* (see page *75*).	1073939971
	Supervision1	Bit 0 of *06.13 Superv status* (see page *76*).	1073743373
	Supervision2	Bit 1 of *06.13 Superv status* (see page *76*).	1073808909
	Supervision3	Bit 2 of *06.13 Superv status* (see page *76*).	1073874445
	Const	Bit pointer setting (see *Terms and abbreviations* on page *63*).	-
	Pointer		
14.08	DIO2 Ton	Defines the on (activation) delay for digital input/output DIO2 when *14.06 DIO2 conf* is set to *Output*.	
	0.0 … 3000.0 s	On (activation) delay for DIO2 when set as an output.	10 = 1 s



t_{On} *14.08 DIO2 Ton*

t_{Off} *14.09 DIO2 Toff*

No.	Name/Value	Description	FbEq
14.09	DIO2 Toff	Defines the off (deactivation) delay for digital input/output DIO2 when *14.06 DIO2 conf* is set to *Output*. See parameter *14.08 DIO2 Ton*.	
	0.0 … 3000.0 s	Off (deactivation) delay for DIO2 when set as an output.	10 = 1 s
14.10	DIO3 conf	Selects whether DIO3 is used as a digital output, digital input or frequency output.	
	Output	DIO3 is used as a digital output.	0
	Input	DIO3 is used as a digital input.	1
	Freq output	DIO3 is used as a frequency output.	3
14.11	DIO3 out src	Selects a drive signal to be connected to digital output DIO3 (when *14.10 DIO3 conf* is set to *Output*).	
	Brake cmd	*03.16 Brake command* (see page *71*).	1073742608
	Ready	Bit 0 of *06.01 Status word1* (see page *73*).	1073743361
	Enabled	Bit 1 of *06.01 Status word1* (see page *73*).	1073808897
	Started	Bit 2 of *06.01 Status word1* (see page *73*).	1073874433
	Running	Bit 3 of *06.01 Status word1* (see page *73*).	1073939969
	Alarm	Bit 7 of *06.01 Status word1* (see page *73*).	1074202113
	Ext2 active	Bit 8 of *06.01 Status word1* (see page *73*).	1074267649
	Fault	Bit 10 of *06.01 Status word1* (see page *73*).	1074398721
	Fault(-1)	Bit 12 of *06.01 Status word1* (see page *73*).	1074529793
	Ready relay	Bit 2 of *06.02 Status word2* (see page *74*).	1073874434
	RunningRelay	Bit 3 of *06.02 Status word2* (see page *74*).	1073939970
	Ref running	Bit 4 of *06.02 Status word2* (see page *74*).	1074005506
	Charge ready	Bit 9 of *06.02 Status word2* (see page *74*).	1074333186
	Neg speed	Bit 0 of *06.03 Speed ctrl stat* (see page *75*).	1073743363
	Zero speed	Bit 1 of *06.03 Speed ctrl stat* (see page *75*).	1073808899
	Above limit	Bit 2 of *06.03 Speed ctrl stat* (see page *75*).	1073874435
	At setpoint	Bit 3 of *06.03 Speed ctrl stat* (see page *75*).	1073939971
	Supervision1	Bit 0 of *06.13 Superv status* (see page *76*).	1073743373
	Supervision2	Bit 1 of *06.13 Superv status* (see page *76*).	1073808909
	Supervision3	Bit 2 of *06.13 Superv status* (see page *76*).	1073874445
	Const	Bit pointer setting (see *Terms and abbreviations* on page *63*).	-
	Pointer		

No.	Name/Value	Description	FbEq
14.12	DIO3 Ton	Defines the on (activation) delay for digital input/output DIO3 when *14.10 DIO3 conf* is set to *Output*.	
		 t_{On} *14.12 DIO3 Ton* t_{Off} *14.13 DIO3 Toff*	
	0.0 … 3000.0 s	On (activation) delay for DIO3 when set as a digital output.	10 = 1 s
14.13	DIO3 Toff	Defines the off (deactivation) delay for digital input/output DIO3 when *14.10 DIO3 conf* is set to *Output*. See parameter *14.12 DIO3 Ton*.	
	0.0 … 3000.0 s	Off (deactivation) delay for DIO3 when set as a digital output.	10 = 1 s
14.14	DIO4 conf	Selects whether DIO4 is used as a digital output or input.	
	Output	DIO4 is used as a digital output.	0
	Input	DIO4 is used as a digital input.	1
14.15	DIO4 out src	Selects a drive signal to be connected to digital output DIO4 (when *14.14 DIO4 conf* is set to *Output*).	
	Brake cmd	*03.16 Brake command* (see page *71*).	1073742608
	Ready	Bit 0 of *06.01 Status word1* (see page *73*).	1073743361
	Enabled	Bit 1 of *06.01 Status word1* (see page *73*).	1073808897
	Started	Bit 2 of *06.01 Status word1* (see page *73*).	1073874433
	Running	Bit 3 of *06.01 Status word1* (see page *73*).	1073939969
	Alarm	Bit 7 of *06.01 Status word1* (see page *73*).	1074202113
	Ext2 active	Bit 8 of *06.01 Status word1* (see page *73*).	1074267649
	Fault	Bit 10 of *06.01 Status word1* (see page *73*).	1074398721
	Fault(-1)	Bit 12 of *06.01 Status word1* (see page *73*).	1074529793
	Ready relay	Bit 2 of *06.02 Status word2* (see page *74*).	1073874434
	RunningRelay	Bit 3 of *06.02 Status word2* (see page *74*).	1073939970
	Ref running	Bit 4 of *06.02 Status word2* (see page *74*).	1074005506
	Charge ready	Bit 9 of *06.02 Status word2* (see page *74*).	1074333186
	Neg speed	Bit 0 of *06.03 Speed ctrl stat* (see page *75*).	1073743363
	Zero speed	Bit 1 of *06.03 Speed ctrl stat* (see page *75*).	1073808899
	Above limit	Bit 2 of *06.03 Speed ctrl stat* (see page *75*).	1073874435
	At setpoint	Bit 3 of *06.03 Speed ctrl stat* (see page *75*).	1073939971
	Supervision1	Bit 0 of *06.13 Superv status* (see page *76*).	1073743373

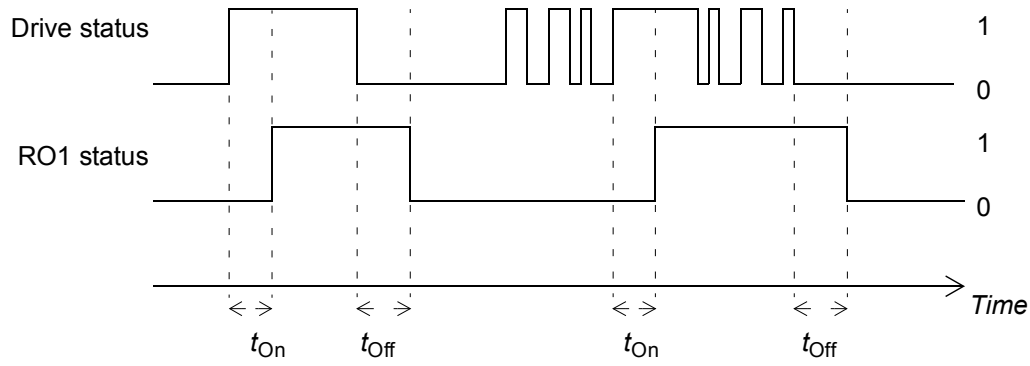
No.	Name/Value	Description	FbEq
	Supervision2	Bit 1 of *06.13 Superv status* (see page *76*).	1073808909
	Supervision3	Bit 2 of *06.13 Superv status* (see page *76*).	1073874445
	Const	Bit pointer setting (see *Terms and abbreviations* on page *63*).	-
	Pointer		
14.18	DIO5 conf	Selects whether DIO5 is used as a digital output or input.	
	Output	DIO5 is used as a digital output.	0
	Input	DIO5 is used as a digital input.	1
14.19	DIO5 out src	Selects a drive signal to be connected to digital output DIO5 (when *14.18 DIO5 conf* is set to *Output*).	
	Brake cmd	*03.16 Brake command* (see page *71*).	1073742608
	Ready	Bit 0 of *06.01 Status word1* (see page *73*).	1073743361
	Enabled	Bit 1 of *06.01 Status word1* (see page *73*).	1073808897
	Started	Bit 2 of *06.01 Status word1* (see page *73*).	1073874433
	Running	Bit 3 of *06.01 Status word1* (see page *73*).	1073939969
	Alarm	Bit 7 of *06.01 Status word1* (see page *73*).	1074202113
	Ext2 active	Bit 8 of *06.01 Status word1* (see page *73*).	1074267649
	Fault	Bit 10 of *06.01 Status word1* (see page *73*).	1074398721
	Fault(-1)	Bit 12 of *06.01 Status word1* (see page *73*).	1074529793
	Ready relay	Bit 2 of *06.02 Status word2* (see page *74*).	1073874434
	RunningRelay	Bit 3 of *06.02 Status word2* (see page *74*).	1073939970
	Ref running	Bit 4 of *06.02 Status word2* (see page *74*).	1074005506
	Charge ready	Bit 9 of *06.02 Status word2* (see page *74*).	1074333186
	Neg speed	Bit 0 of *06.03 Speed ctrl stat* (see page *75*).	1073743363
	Zero speed	Bit 1 of *06.03 Speed ctrl stat* (see page *75*).	1073808899
	Above limit	Bit 2 of *06.03 Speed ctrl stat* (see page *75*).	1073874435
	At setpoint	Bit 3 of *06.03 Speed ctrl stat* (see page *75*).	1073939971
	Supervision1	Bit 0 of *06.13 Superv status* (see page *76*).	1073743373
	Supervision2	Bit 1 of *06.13 Superv status* (see page *76*).	1073808909
	Supervision3	Bit 2 of *06.13 Superv status* (see page *76*).	1073874445
	Const	Bit pointer setting (see *Terms and abbreviations* on page *63*).	-
	Pointer		
14.22	DIO6 conf	Selects whether DIO6 is used as a digital output or input.	
	Output	DIO6 is used as a digital output.	0
	Input	DIO6 is used as a digital input.	1
14.23	DIO6 out src	Selects a drive signal to be connected to digital output DIO6 (when *14.22 DIO6 conf* is set to *Output*).	
	Brake cmd	*03.16 Brake command* (see page *71*).	1073742608
	Ready	Bit 0 of *06.01 Status word1* (see page *73*).	1073743361
	Enabled	Bit 1 of *06.01 Status word1* (see page *73*).	1073808897
	Started	Bit 2 of *06.01 Status word1* (see page *73*).	1073874433
	Running	Bit 3 of *06.01 Status word1* (see page *73*).	1073939969
	Alarm	Bit 7 of *06.01 Status word1* (see page *73*).	1074202113

No.	Name/Value	Description	FbEq
	Ext2 active	Bit 8 of *06.01 Status word1* (see page *73*).	1074267649
	Fault	Bit 10 of *06.01 Status word1* (see page *73*).	1074398721
	Fault(-1)	Bit 12 of *06.01 Status word1* (see page *73*).	1074529793
	Ready relay	Bit 2 of *06.02 Status word2* (see page *74*).	1073874434
	RunningRelay	Bit 3 of *06.02 Status word2* (see page *74*).	1073939970
	Ref running	Bit 4 of *06.02 Status word2* (see page *74*).	1074005506
	Charge ready	Bit 9 of *06.02 Status word2* (see page *74*).	1074333186
	Neg speed	Bit 0 of *06.03 Speed ctrl stat* (see page *75*).	1073743363
	Zero speed	Bit 1 of *06.03 Speed ctrl stat* (see page *75*).	1073808899
	Above limit	Bit 2 of *06.03 Speed ctrl stat* (see page *75*).	1073874435
	At setpoint	Bit 3 of *06.03 Speed ctrl stat* (see page *75*).	1073939971
	Supervision1	Bit 0 of *06.13 Superv status* (see page *76*).	1073743373
	Supervision2	Bit 1 of *06.13 Superv status* (see page *76*).	1073808909
	Supervision3	Bit 2 of *06.13 Superv status* (see page *76*).	1073874445
	Const	Bit pointer setting (see *Terms and abbreviations* on page *63*).	-
	Pointer		
14.26	DIO7 conf	Selects whether DIO7 is used as a digital output or input.	
	Output	DIO7 is used as a digital output.	0
	Input	DIO7 is used as a digital input.	1
14.27	DIO7 out src	Selects a drive signal to be connected to digital output DIO7 (when *14.26 DIO7 conf* is set to *Output*).	
	Brake cmd	*03.16 Brake command* (see page *71*).	1073742608
	Ready	Bit 0 of *06.01 Status word1* (see page *73*).	1073743361
	Enabled	Bit 1 of *06.01 Status word1* (see page *73*).	1073808897
	Started	Bit 2 of *06.01 Status word1* (see page *73*).	1073874433
	Running	Bit 3 of *06.01 Status word1* (see page *73*).	1073939969
	Alarm	Bit 7 of *06.01 Status word1* (see page *73*).	1074202113
	Ext2 active	Bit 8 of *06.01 Status word1* (see page *73*).	1074267649
	Fault	Bit 10 of *06.01 Status word1* (see page *73*).	1074398721
	Fault(-1)	Bit 12 of *06.01 Status word1* (see page *73*).	1074529793
	Ready relay	Bit 2 of *06.02 Status word2* (see page *74*).	1073874434
	RunningRelay	Bit 3 of *06.02 Status word2* (see page *74*).	1073939970
	Ref running	Bit 4 of *06.02 Status word2* (see page *74*).	1074005506
	Charge ready	Bit 9 of *06.02 Status word2* (see page *74*).	1074333186
	Neg speed	Bit 0 of *06.03 Speed ctrl stat* (see page *75*).	1073743363
	Zero speed	Bit 1 of *06.03 Speed ctrl stat* (see page *75*).	1073808899
	Above limit	Bit 2 of *06.03 Speed ctrl stat* (see page *75*).	1073874435
	At setpoint	Bit 3 of *06.03 Speed ctrl stat* (see page *75*).	1073939971
	Supervision1	Bit 0 of *06.13 Superv status* (see page *76*).	1073743373
	Supervision2	Bit 1 of *06.13 Superv status* (see page *76*).	1073808909
	Supervision3	Bit 2 of *06.13 Superv status* (see page *76*).	1073874445

No.	Name/Value	Description	FbEq
	Const	Bit pointer setting (see *Terms and abbreviations* on page *63*).	-
	Pointer		
14.30	DIO8 conf	Selects whether DIO8 is used as a digital output or input.	
	Output	DIO8 is used as a digital output.	0
	Input	DIO8 is used as a digital input.	1
14.31	DIO8 out src	Selects a drive signal to be connected to digital output DIO8 (when *14.30 DIO8 conf* is set to *Output*).	
	Brake cmd	*03.16 Brake command* (see page *71*).	1073742608
	Ready	Bit 0 of *06.01 Status word1* (see page *73*).	1073743361
	Enabled	Bit 1 of *06.01 Status word1* (see page *73*).	1073808897
	Started	Bit 2 of *06.01 Status word1* (see page *73*).	1073874433
	Running	Bit 3 of *06.01 Status word1* (see page *73*).	1073939969
	Alarm	Bit 7 of *06.01 Status word1* (see page *73*).	1074202113
	Ext2 active	Bit 8 of *06.01 Status word1* (see page *73*).	1074267649
	Fault	Bit 10 of *06.01 Status word1* (see page *73*).	1074398721
	Fault(-1)	Bit 12 of *06.01 Status word1* (see page *73*).	1074529793
	Ready relay	Bit 2 of *06.02 Status word2* (see page *74*).	1073874434
	RunningRelay	Bit 3 of *06.02 Status word2* (see page *74*).	1073939970
	Ref running	Bit 4 of *06.02 Status word2* (see page *74*).	1074005506
	Charge ready	Bit 9 of *06.02 Status word2* (see page *74*).	1074333186
	Neg speed	Bit 0 of *06.03 Speed ctrl stat* (see page *75*).	1073743363
	Zero speed	Bit 1 of *06.03 Speed ctrl stat* (see page *75*).	1073808899
	Above limit	Bit 2 of *06.03 Speed ctrl stat* (see page *75*).	1073874435
	At setpoint	Bit 3 of *06.03 Speed ctrl stat* (see page *75*).	1073939971
	Supervision1	Bit 0 of *06.13 Superv status* (see page *76*).	1073743373
	Supervision2	Bit 1 of *06.13 Superv status* (see page *76*).	1073808909
	Supervision3	Bit 2 of *06.13 Superv status* (see page *76*).	1073874445
	Const	Bit pointer setting (see *Terms and abbreviations* on page *63*).	-
	Pointer		
14.34	DIO9 conf	Selects whether DIO9 is used as a digital output or input.	
	Output	DIO9 is used as a digital output.	0
	Input	DIO9 is used as a digital input.	1
14.35	DIO9 out src	Selects a drive signal to be connected to digital output DIO9 (when *14.34 DIO9 conf* is set to *Output*).	
	Brake cmd	*03.16 Brake command* (see page *71*).	1073742608
	Ready	Bit 0 of *06.01 Status word1* (see page *73*).	1073743361
	Enabled	Bit 1 of *06.01 Status word1* (see page *73*).	1073808897
	Started	Bit 2 of *06.01 Status word1* (see page *73*).	1073874433
	Running	Bit 3 of *06.01 Status word1* (see page *73*).	1073939969
	Alarm	Bit 7 of *06.01 Status word1* (see page *73*).	1074202113
	Ext2 active	Bit 8 of *06.01 Status word1* (see page *73*).	1074267649
	Fault	Bit 10 of *06.01 Status word1* (see page *73*).	1074398721

No.	Name/Value	Description	FbEq
	Fault(-1)	Bit 12 of *06.01 Status word1* (see page *73*).	1074529793
	Ready relay	Bit 2 of *06.02 Status word2* (see page *74*).	1073874434
	RunningRelay	Bit 3 of *06.02 Status word2* (see page *74*).	1073939970
	Ref running	Bit 4 of *06.02 Status word2* (see page *74*).	1074005506
	Charge ready	Bit 9 of *06.02 Status word2* (see page *74*).	1074333186
	Neg speed	Bit 0 of *06.03 Speed ctrl stat* (see page *75*).	1073743363
	Zero speed	Bit 1 of *06.03 Speed ctrl stat* (see page *75*).	1073808899
	Above limit	Bit 2 of *06.03 Speed ctrl stat* (see page *75*).	1073874435
	At setpoint	Bit 3 of *06.03 Speed ctrl stat* (see page *75*).	1073939971
	Supervision1	Bit 0 of *06.13 Superv status* (see page *76*).	1073743373
	Supervision2	Bit 1 of *06.13 Superv status* (see page *76*).	1073808909
	Supervision3	Bit 2 of *06.13 Superv status* (see page *76*).	1073874445
	Const	Bit pointer setting (see *Terms and abbreviations* on page *63*).	-
	Pointer		
14.38	DIO10 conf	Selects whether DIO10 is used as a digital output or input.	
	Output	DIO10 is used as a digital output.	0
	Input	DIO10 is used as a digital input.	1
14.39	DIO10 out src	Selects a drive signal to be connected to digital output DIO10 (when *14.38 DIO10 conf* is set to *Output*).	
	Brake cmd	*03.16 Brake command* (see page *71*).	1073742608
	Ready	Bit 0 of *06.01 Status word1* (see page *73*).	1073743361
	Enabled	Bit 1 of *06.01 Status word1* (see page *73*).	1073808897
	Started	Bit 2 of *06.01 Status word1* (see page *73*).	1073874433
	Running	Bit 3 of *06.01 Status word1* (see page *73*).	1073939969
	Alarm	Bit 7 of *06.01 Status word1* (see page *73*).	1074202113
	Ext2 active	Bit 8 of *06.01 Status word1* (see page *73*).	1074267649
	Fault	Bit 10 of *06.01 Status word1* (see page *73*).	1074398721
	Fault(-1)	Bit 12 of *06.01 Status word1* (see page *73*).	1074529793
	Ready relay	Bit 2 of *06.02 Status word2* (see page *74*).	1073874434
	RunningRelay	Bit 3 of *06.02 Status word2* (see page *74*).	1073939970
	Ref running	Bit 4 of *06.02 Status word2* (see page *74*).	1074005506
	Charge ready	Bit 9 of *06.02 Status word2* (see page *74*).	1074333186
	Neg speed	Bit 0 of *06.03 Speed ctrl stat* (see page *75*).	1073743363
	Zero speed	Bit 1 of *06.03 Speed ctrl stat* (see page *75*).	1073808899
	Above limit	Bit 2 of *06.03 Speed ctrl stat* (see page *75*).	1073874435
	At setpoint	Bit 3 of *06.03 Speed ctrl stat* (see page *75*).	1073939971
	Supervision1	Bit 0 of *06.13 Superv status* (see page *76*).	1073743373
	Supervision2	Bit 1 of *06.13 Superv status* (see page *76*).	1073808909
	Supervision3	Bit 2 of *06.13 Superv status* (see page *76*).	1073874445
	Const	Bit pointer setting (see *Terms and abbreviations* on page *63*).	-
	Pointer		

No.	Name/Value	Description	FbEq
14.42	RO1 src	Selects a drive signal to be connected to relay output RO1.	
	Brake cmd	*03.16 Brake command* (see page *71*).	1073742608
	Ready	Bit 0 of *06.01 Status word1* (see page *73*).	1073743361
	Enabled	Bit 1 of *06.01 Status word1* (see page *73*).	1073808897
	Started	Bit 2 of *06.01 Status word1* (see page *73*).	1073874433
	Running	Bit 3 of *06.01 Status word1* (see page *73*).	1073939969
	Alarm	Bit 7 of *06.01 Status word1* (see page *73*).	1074202113
	Ext2 active	Bit 8 of *06.01 Status word1* (see page *73*).	1074267649
	Fault	Bit 10 of *06.01 Status word1* (see page *73*).	1074398721
	Fault(-1)	Bit 12 of *06.01 Status word1* (see page *73*).	1074529793
	Ready relay	Bit 2 of *06.02 Status word2* (see page *74*).	1073874434
	RunningRelay	Bit 3 of *06.02 Status word2* (see page *74*).	1073939970
	Ref running	Bit 4 of *06.02 Status word2* (see page *74*).	1074005506
	Charge ready	Bit 9 of *06.02 Status word2* (see page *74*).	1074333186
	Neg speed	Bit 0 of *06.03 Speed ctrl stat* (see page *75*).	1073743363
	Zero speed	Bit 1 of *06.03 Speed ctrl stat* (see page *75*).	1073808899
	Above limit	Bit 2 of *06.03 Speed ctrl stat* (see page *75*).	1073874435
	At setpoint	Bit 3 of *06.03 Speed ctrl stat* (see page *75*).	1073939971
	Supervision1	Bit 0 of *06.13 Superv status* (see page *76*).	1073743373
	Supervision2	Bit 1 of *06.13 Superv status* (see page *76*).	1073808909
	Supervision3	Bit 2 of *06.13 Superv status* (see page *76*).	1073874445
	Const	Bit pointer setting (see *Terms and abbreviations* on page *63*).	-
	Pointer		
14.43	RO1 Ton	Defines the on (activation) delay for relay output RO1.	

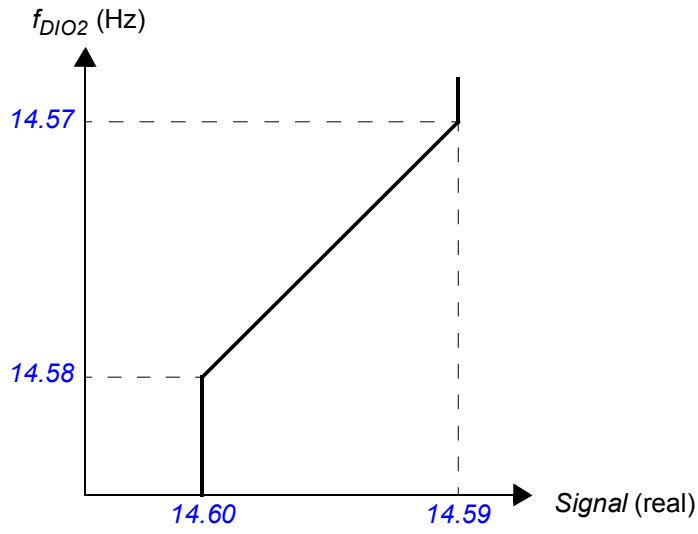


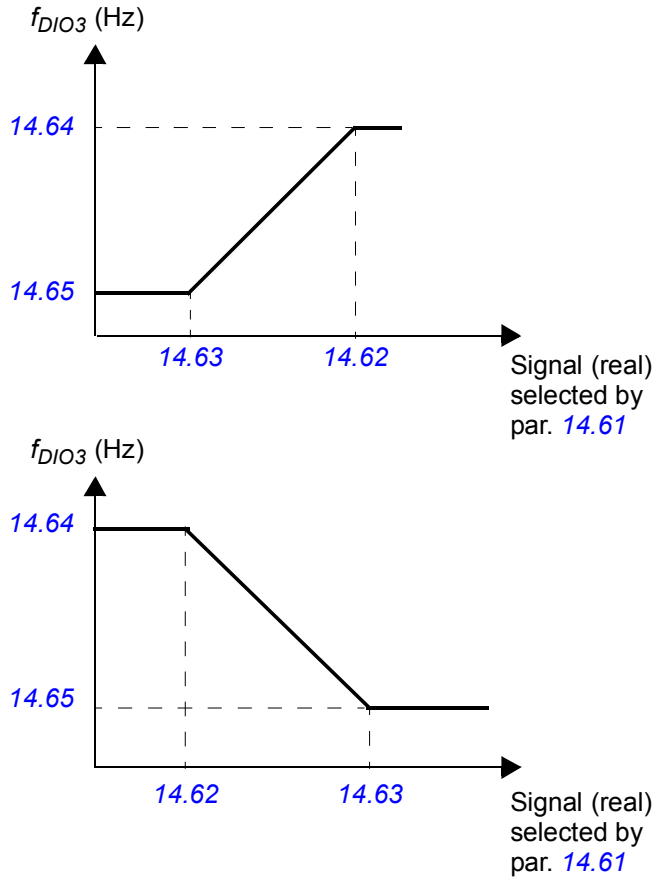
t_{On} *14.43 RO1 Ton*

t_{Off} *14.44 RO1 Toff*

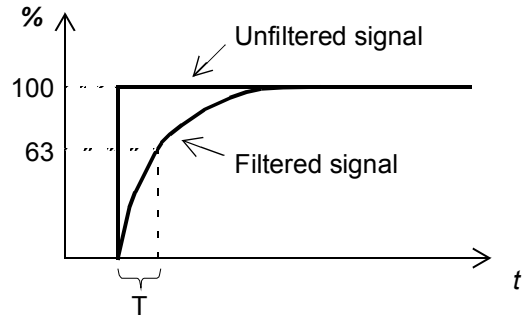
	0.0 … 3000.0 s	On (activation) delay for RO1.	10 = 1 s
14.44	RO1 Toff	Defines the off (deactivation) delay for relay output RO1. See parameter *14.43 RO1 Ton*.	
	0.0 … 3000.0 s	Off (deactivation) delay for RO1.	10 = 1 s

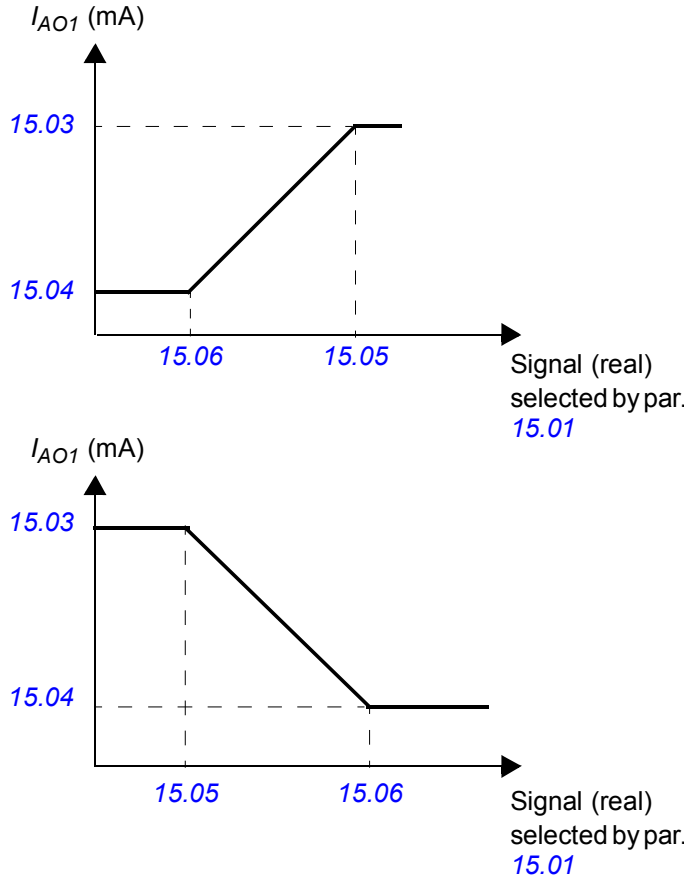
No.	Name/Value	Description	FbEq
14.45	RO2 src	Selects a drive signal to be connected to relay output RO2.	
	Brake cmd	*03.16 Brake command* (see page *71*).	1073742608
	Ready	Bit 0 of *06.01 Status word1* (see page *73*).	1073743361
	Enabled	Bit 1 of *06.01 Status word1* (see page *73*).	1073808897
	Started	Bit 2 of *06.01 Status word1* (see page *73*).	1073874433
	Running	Bit 3 of *06.01 Status word1* (see page *73*).	1073939969
	Alarm	Bit 7 of *06.01 Status word1* (see page *73*).	1074202113
	Ext2 active	Bit 8 of *06.01 Status word1* (see page *73*).	1074267649
	Fault	Bit 10 of *06.01 Status word1* (see page *73*).	1074398721
	Fault(-1)	Bit 12 of *06.01 Status word1* (see page *73*).	1074529793
	Ready relay	Bit 2 of *06.02 Status word2* (see page *74*).	1073874434
	RunningRelay	Bit 3 of *06.02 Status word2* (see page *74*).	1073939970
	Ref running	Bit 4 of *06.02 Status word2* (see page *74*).	1074005506
	Charge ready	Bit 9 of *06.02 Status word2* (see page *74*).	1074333186
	Neg speed	Bit 0 of *06.03 Speed ctrl stat* (see page *75*).	1073743363
	Zero speed	Bit 1 of *06.03 Speed ctrl stat* (see page *75*).	1073808899
	Above limit	Bit 2 of *06.03 Speed ctrl stat* (see page *75*).	1073874435
	At setpoint	Bit 3 of *06.03 Speed ctrl stat* (see page *75*).	1073939971
	Supervision1	Bit 0 of *06.13 Superv status* (see page *76*).	1073743373
	Supervision2	Bit 1 of *06.13 Superv status* (see page *76*).	1073808909
	Supervision3	Bit 2 of *06.13 Superv status* (see page *76*).	1073874445
	Const	Bit pointer setting (see *Terms and abbreviations* on page *63*).	-
	Pointer		
14.48	RO3 src	Selects a drive signal to be connected to relay output RO3.	
	Brake cmd	*03.16 Brake command* (see page *71*).	1073742608
	Ready	Bit 0 of *06.01 Status word1* (see page *73*).	1073743361
	Enabled	Bit 1 of *06.01 Status word1* (see page *73*).	1073808897
	Started	Bit 2 of *06.01 Status word1* (see page *73*).	1073874433
	Running	Bit 3 of *06.01 Status word1* (see page *73*).	1073939969
	Alarm	Bit 7 of *06.01 Status word1* (see page *73*).	1074202113
	Ext2 active	Bit 8 of *06.01 Status word1* (see page *73*).	1074267649
	Fault	Bit 10 of *06.01 Status word1* (see page *73*).	1074398721
	Fault(-1)	Bit 12 of *06.01 Status word1* (see page *73*).	1074529793
	Ready relay	Bit 2 of *06.02 Status word2* (see page *74*).	1073874434
	RunningRelay	Bit 3 of *06.02 Status word2* (see page *74*).	1073939970
	Ref running	Bit 4 of *06.02 Status word2* (see page *74*).	1074005506
	Charge ready	Bit 9 of *06.02 Status word2* (see page *74*).	1074333186
	Neg speed	Bit 0 of *06.03 Speed ctrl stat* (see page *75*).	1073743363
	Zero speed	Bit 1 of *06.03 Speed ctrl stat* (see page *75*).	1073808899
	Above limit	Bit 2 of *06.03 Speed ctrl stat* (see page *75*).	1073874435
	At setpoint	Bit 3 of *06.03 Speed ctrl stat* (see page *75*).	1073939971

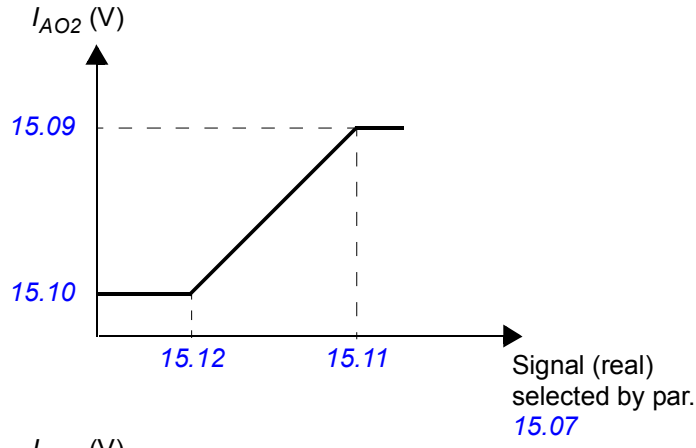
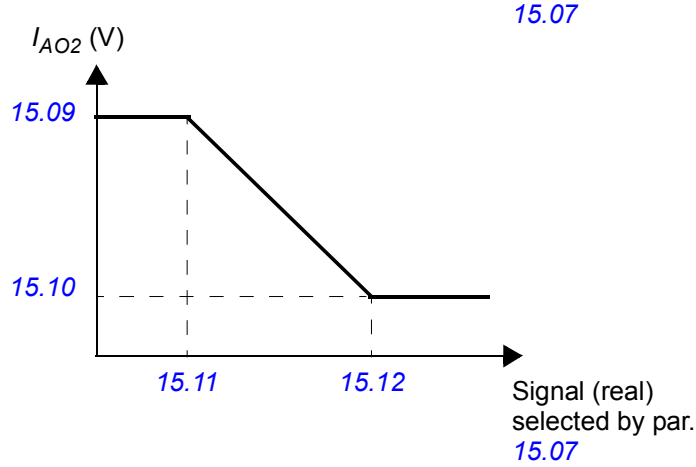
No.	Name/Value	Description	FbEq
	Supervision1	Bit 0 of *06.13 Superv status* (see page *76*).	1073743373
	Supervision2	Bit 1 of *06.13 Superv status* (see page *76*).	1073808909
	Supervision3	Bit 2 of *06.13 Superv status* (see page *76*).	1073874445
	Const	Bit pointer setting (see *Terms and abbreviations* on page *63*).	-
	Pointer		
14.51	RO4 src	Selects a drive signal to be connected to relay output RO4.	
	Const	Bit pointer setting (see *Terms and abbreviations* on page *63*).	-
	Pointer		
14.54	RO5 src	Selects a drive signal to be connected to relay output RO5.	
	Const	Bit pointer setting (see *Terms and abbreviations* on page *63*).	-
	Pointer		
14.57	Freq in max	Defines the maximum input frequency for DIO2 when parameter *14.06 DIO2 conf* is set to *Freq input*. 	
	3 … 32768 Hz	DIO2 maximum frequency.	1 = 1 Hz
14.58	Freq in min	Defines the minimum input frequency for DIO2 when parameter *14.06 DIO2 conf* is set to *Freq input*. (See diagram at parameter *14.57 Freq in max*.)	
	3 … 32768 Hz	DIO2 minimum frequency.	1 = 1 Hz
14.59	Freq in max scal	Defines the real value that corresponds to the maximum input frequency defined by parameter *14.57 Freq in max*. (See diagram at parameter *14.57 Freq in max*.)	
	-32768 … 32768	Real value corresponding to DIO2 maximum frequency.	1 = 1
14.60	Freq in min scal	Defines the real value that corresponds to the minimum input frequency defined by *14.58 Freq in min*. (See diagram at parameter *14.57 Freq in max*.)	
	-32768 … 32768	Real value corresponding to DIO2 minimum frequency.	1 = 1
14.61	Freq out src	Selects a drive signal to be connected to frequency output DIO3 (when *14.10 DIO3 conf* is set to *Freq output*).	
		Value pointer setting (see *Terms and abbreviations* on page *63*).	-

No.	Name/Value	Description	FbEq
14.62	Freq out max src	When *14.10 DIO3 conf* is set to *Freq output*, defines the real value of the signal (selected by parameter *14.61 Freq out src*) that corresponds to the maximum DIO3 frequency output value (defined by parameter *14.64 Freq out max sca*). 	
	0 … 32768	Real signal value corresponding to maximum DIO3 output frequency.	1 = 1
14.63	Freq out min src	When *14.10 DIO3 conf* is set to *Freq output*, defines the real value of the signal (selected by parameter *14.61 Freq out src*) that corresponds to the minimum DIO3 frequency output value (defined by parameter *14.65 Freq out min sca*).	
	0 … 32768	Real signal value corresponding to minimum DIO3 output frequency.	1 = 1
14.64	Freq out max sca	When *14.10 DIO3 conf* is set to *Freq output*, defines the maximum DIO3 output frequency.	
	3 … 32768 Hz	Maximum DIO3 output frequency.	1 = 1 Hz
14.65	Freq out min sca	When *14.10 DIO3 conf* is set to *Freq output*, defines the minimum DIO3 output frequency.	
	3 … 32768 Hz	Minimum DIO3 output frequency.	1 = 1 Hz

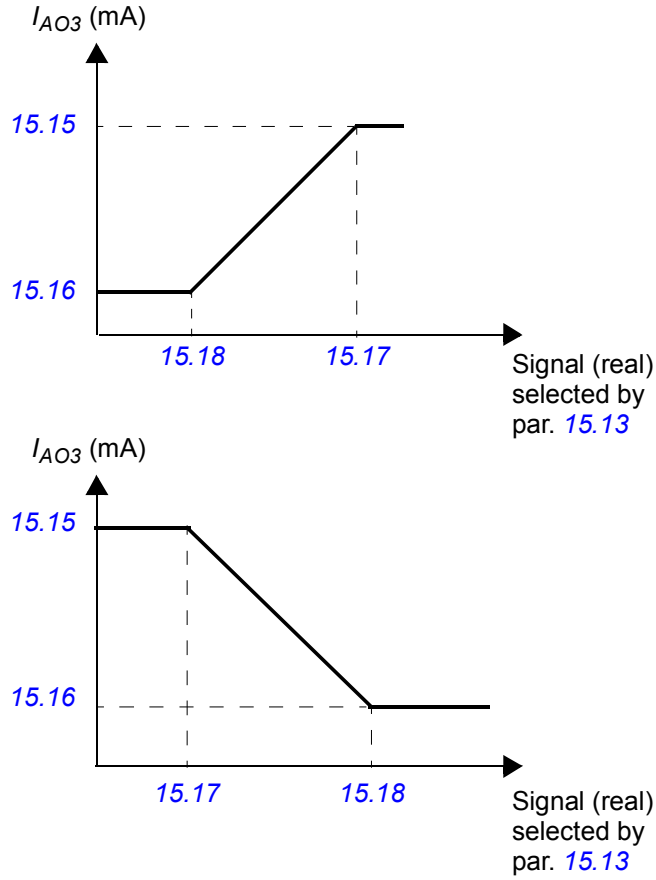
15 Analogue outputs	Selection and processing of actual signals to be indicated through the analogue outputs. See section *Programmable analog outputs* on page *42*.	
15.01	AO1 src	Selects a drive signal to be connected to analogue output AO1.	
	Speed rpm	*01.01 Motor speed rpm* (see page *64*).	1073742081

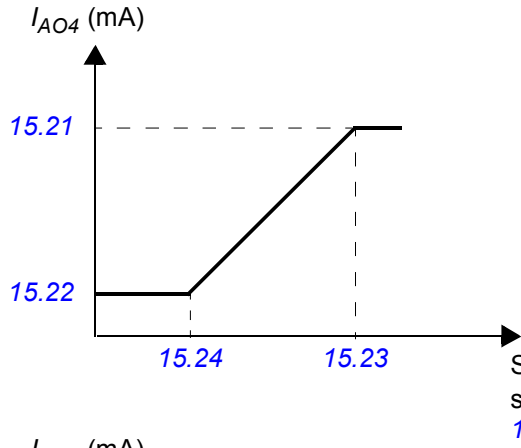
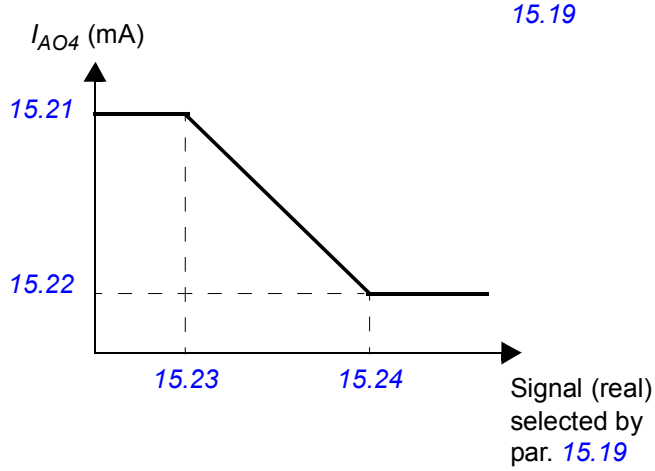
No.	Name/Value	Description	FbEq
	Speed %	*01.02 Motor speed %* (see page *64*).	1073742082
	Frequency	*01.03 Output frequency* (see page *64*).	1073742083
	Current	*01.04 Motor current* (see page *64*).	1073742084
	Current %	*01.05 Motor current %* (see page *64*).	1073742085
	Torque	*01.06 Motor torque* (see page *64*).	1073742086
	Dc-voltage	*01.07 Dc-voltage* (see page *64*).	1073742087
	Power inu	*01.22 Power inu out* (see page *64*).	1073742102
	Power motor	*01.23 Motor power* (see page *64*).	1073742103
	SpRef unramp	*03.03 SpeedRef unramp* (see page *71*).	1073742595
	SpRef ramped	*03.05 SpeedRef ramped* (see page *71*).	1073742597
	SpRef used	*03.06 SpeedRef used* (see page *71*).	1073742598
	TorqRef used	*03.14 Torq ref used* (see page *71*).	1073742606
	Process act	*04.03 Process act* (see page *72*).	1073742851
	Proc PID out	*04.05 Process PID out* (see page *72*).	1073742853
	Pointer	Value pointer setting (see *Terms and abbreviations* on page *63*).	-
15.02	AO1 filt time	Defines the filtering time constant for analogue output AO1.  $O = I \times (1 - e^{-t/T})$ I = filter input (step) O = filter output *t* = time T = filter time constant	
	0.000 … 30.000 s	Filter time constant.	1000 = 1 s
15.03	AO1 out max	Defines the maximum output value for analogue output AO1.	
	0.000 … 22.700 mA	Maximum AO1 output value.	1000 = 1 mA
15.04	AO1 out min	Defines the minimum output value for analogue output AO1.	
	0.000 … 22.700 mA	Minimum AO1 output value.	1000 = 1 mA

No.	Name/Value	Description	FbEq
15.05	AO1 src max	Defines the real value of the signal (selected by parameter *15.01 AO1 src*) that corresponds to the maximum AO1 output value (defined by parameter *15.03 AO1 out max*). 	
	-32768.000 … 32768.000	Real signal value corresponding to maximum AO1 output value.	1000 = 1
15.06	AO1 src min	Defines the real value of the signal (selected by parameter *15.01 AO1 src*) that corresponds to the minimum AO1 output value (defined by parameter *15.04 AO1 out min*). See parameter *15.05 AO1 src max*.	
	-32768.000 … 32768.000	Real signal value corresponding to minimum AO1 output value.	1000 = 1
15.07	AO2 src	Selects a drive signal to be connected to analogue output AO2.	
	Speed rpm	*01.01 Motor speed rpm* (see page *64*).	1073742081
	Speed %	*01.02 Motor speed %* (see page *64*).	1073742082
	Frequency	*01.03 Output frequency* (see page *64*).	1073742083
	Current	*01.04 Motor current* (see page *64*).	1073742084
	Current %	*01.05 Motor current %* (see page *64*).	1073742085
	Torque	*01.06 Motor torque* (see page *64*).	1073742086
	Dc-voltage	*01.07 Dc-voltage* (see page *64*).	1073742087
	Power inu	*01.22 Power inu out* (see page *64*).	1073742102
	Power motor	*01.23 Motor power* (see page *64*).	1073742103
	SpRef unramp	*03.03 SpeedRef unramp* (see page *71*).	1073742595

No.	Name/Value	Description	FbEq
	SpRef ramped	*03.05 SpeedRef ramped* (see page *71*).	1073742597
	SpRef used	*03.06 SpeedRef used* (see page *71*).	1073742598
	TorqRef used	*03.14 Torq ref used* (see page *71*).	1073742606
	Process act	*04.03 Process act* (see page *72*).	1073742851
	Proc PID out	*04.05 Process PID out* (see page *72*).	1073742853
	Pointer	Value pointer setting (see *Terms and abbreviations* on page *63*).	-
15.08	AO2 filt time	Defines the filtering time constant for analogue output AO2. See parameter *15.02 AO1 filt time*.	
	0.000 … 30.000 s	Filter time constant.	1000 = 1 s
15.09	AO2 out max	Defines the maximum output value for analogue output AO2.	
	-10.000 … 10.000 V	Maximum AO2 output value.	1000 = 1 V
15.10	AO2 out min	Defines the minimum output value for analogue output AO2.	
	-10.000 … 10.000 V	Minimum AO2 output value.	1000 = 1 mA
15.11	AO2 src max	Defines the real value of the signal (selected by parameter *15.07 AO2 src*) that corresponds to the maximum AO2 output value (defined by parameter *15.09 AO2 out max*).  	
	-32768.000 … 32768.000	Real signal value corresponding to maximum AO2 output value.	1000 = 1

No.	Name/Value	Description	FbEq
15.12	AO2 src min	Defines the real value of the signal (selected by parameter *15.07 AO2 src*) that corresponds to the minimum AO1 output value (defined by parameter *15.10 AO2 out min*). See parameter *15.11 AO2 src max*.	
	-32768.000 … 32768.000	Real signal value corresponding to minimum AO2 output value.	1000 = 1
15.13	AO3 src	Selects a drive signal to be connected to analogue output AO3.	
	Speed rpm	*01.01 Motor speed rpm* (see page *64*).	1073742081
	Speed %	*01.02 Motor speed %* (see page *64*).	1073742082
	Frequency	*01.03 Output frequency* (see page *64*).	1073742083
	Current	*01.04 Motor current* (see page *64*).	1073742084
	Current %	*01.05 Motor current %* (see page *64*).	1073742085
	Torque	*01.06 Motor torque* (see page *64*).	1073742086
	Dc-voltage	*01.07 Dc-voltage* (see page *64*).	1073742087
	Power inu	*01.22 Power inu out* (see page *64*).	1073742102
	Power motor	*01.23 Motor power* (see page *64*).	1073742103
	SpRef unramp	*03.03 SpeedRef unramp* (see page *71*).	1073742595
	SpRef ramped	*03.05 SpeedRef ramped* (see page *71*).	1073742597
	SpRef used	*03.06 SpeedRef used* (see page *71*).	1073742598
	TorqRef used	*03.14 Torq ref used* (see page *71*).	1073742606
	Process act	*04.03 Process act* (see page *72*).	1073742851
	Proc PID out	*04.05 Process PID out* (see page *72*).	1073742853
	Pointer	Value pointer setting (see *Terms and abbreviations* on page *63*).	-
15.14	AO3 filt time	Defines the filtering time constant for analogue output AO3. See parameter *15.02 AO1 filt time*.	
	0.000 … 30.000 s	Filter time constant.	1000 = 1 s
15.15	AO3 out max	Defines the maximum output value for analogue output AO3.	
	0.000 … 22.700 mA	Maximum AO3 output value.	1000 = 1 mA
15.16	AO3 out min	Defines the minimum output value for analogue output AO3.	
	0.000 … 22.700 mA	Minimum AO3 output value.	1000 = 1 mA

No.	Name/Value	Description	FbEq
15.17	AO3 src max	Defines the real value of the signal (selected by parameter *15.13 AO3 src*) that corresponds to the maximum AO3 output value (defined by parameter *15.15 AO3 out max*). 	
	-32768.000 … 32768.000	Real signal value corresponding to maximum AO3 output value.	1000 = 1
15.18	AO3 src min	Defines the real value of the signal (selected by parameter *15.13 AO3 src*) that corresponds to the minimum AO3 output value (defined by parameter *15.16 AO3 out min*). See parameter *15.17 AO3 src max*.	
	-32768.000 … 32768.000	Real signal value corresponding to minimum AO3 output value.	1000 = 1
15.19	AO4 src	Selects a drive signal to be connected to analogue output AO4.	
	Speed rpm	*01.01 Motor speed rpm* (see page *64*).	1073742081
	Speed %	*01.02 Motor speed %* (see page *64*).	1073742082
	Frequency	*01.03 Output frequency* (see page *64*).	1073742083
	Current	*01.04 Motor current* (see page *64*).	1073742084
	Current %	*01.05 Motor current %* (see page *64*).	1073742085
	Torque	*01.06 Motor torque* (see page *64*).	1073742086
	Dc-voltage	*01.07 Dc-voltage* (see page *64*).	1073742087
	Power inu	*01.22 Power inu out* (see page *64*).	1073742102
	Power motor	*01.23 Motor power* (see page *64*).	1073742103
	SpRef unramp	*03.03 SpeedRef unramp* (see page *71*).	1073742595

No.	Name/Value	Description	FbEq
	SpRef ramped	*03.05 SpeedRef ramped* (see page *71*).	1073742597
	SpRef used	*03.06 SpeedRef used* (see page *71*).	1073742598
	TorqRef used	*03.14 Torq ref used* (see page *71*).	1073742606
	Process act	*04.03 Process act* (see page *72*).	1073742851
	Proc PID out	*04.05 Process PID out* (see page *72*).	1073742853
	Pointer	Value pointer setting (see *Terms and abbreviations* on page *63*).	-
15.20	AO4 filt time	Defines the filtering time constant for analogue output AO4. See parameter *15.02 AO1 filt time*.	
	0.000 … 30.000 s	Filter time constant.	1000 = 1 s
15.21	AO4 out max	Defines the maximum output value for analogue output AO4.	
	0.000 … 22.700 mA	Maximum AO4 output value.	1000 = 1 mA
15.22	AO4 out min	Defines the minimum output value for analogue output AO4.	
	0.000 … 22.700 mA	Minimum AO4 output value.	1000 = 1 mA
15.23	AO4 src max	Defines the real value of the signal (selected by parameter *15.19 AO4 src*) that corresponds to the maximum AO4 output value (defined by parameter *15.21 AO4 out max*).  	
	-32768.000 … 32768.000	Real signal value corresponding to maximum AO4 output value.	1000 = 1

No.	Name/Value	Description	FbEq
15.24	AO4 src min	Defines the real value of the signal (selected by parameter *15.19 AO4 src*) that corresponds to the minimum AO4 output value (defined by parameter *15.22 AO4 out min*). See parameter *15.23 AO4 src max*.	
	-32768.000 … 32768.000	Real signal value corresponding to minimum AO4 output value.	1000 = 1
15.25	AO ctrl word	Defines how a signed source is processed before output.	

Bit	Name	Information
0	AO1 func	1 = AO1 is bipolar
		0 = AO1 is absolute value of source
1	AO2 func	1 = AO2 is bipolar
		0 = AO2 is absolute value of source

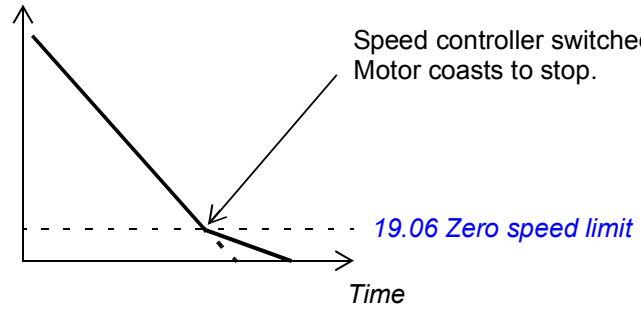
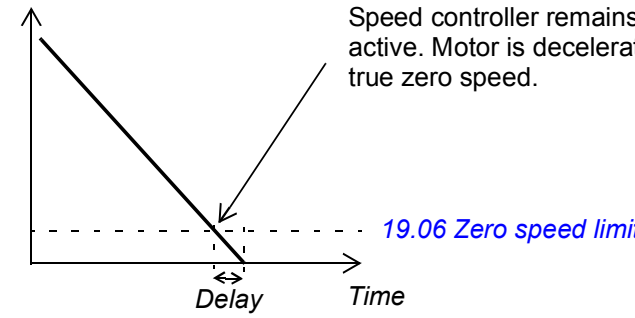
16 System		Parameter lock, parameter restore, user parameter sets etc.	
16.01	Local lock	Selects the source for disabling local control (Take/Release button in the PC tool, LOC/REM key of the panel). 0 = Local control enabled. 1 = Local control disabled. **WARNING!** Before activating, ensure that the control panel is not needed for stopping the drive!	
	Const	Bit pointer setting (see *Terms and abbreviations* on page *63*).	-
	Pointer		
16.02	Parameter lock	Selects the state of the parameter lock. The lock prevents parameter changing.	
	Locked	Locked. Parameter values cannot be changed from the control panel. The lock can be opened by entering the valid code into parameter *16.03 Pass code*.	0
	Open	The lock is open. Parameter values can be changed.	1
	Not saved	The lock is open. Parameter values can be changed, but the changes will not be stored at power switch-off.	2
16.03	Pass code	Selects the pass code for the parameter lock (see parameter *16.02 Parameter lock*). After entering 358 at this parameter, parameter *16.02 Parameter lock* can be adjusted. The value reverts back to 0 automatically.	
	0 … 2147483647	Pass code for parameter lock.	1 = 1
16.04	Param restore	Restores the original settings of the application, i.e. parameter factory default values. **Note:** This parameter cannot be changed while the drive is running.	
	Done	Restoring is completed.	0
	Restore defs	All parameter values are restored to default values, except motor data, ID run results, and fieldbus, drive-to-drive link and encoder configuration data.	1
	Clear all	All parameter values are restored to default values, including motor data, ID run results and fieldbus and encoder configuration data. PC tool communication is interrupted during the restoring. Drive CPU is re-booted after the restoring is completed.	2

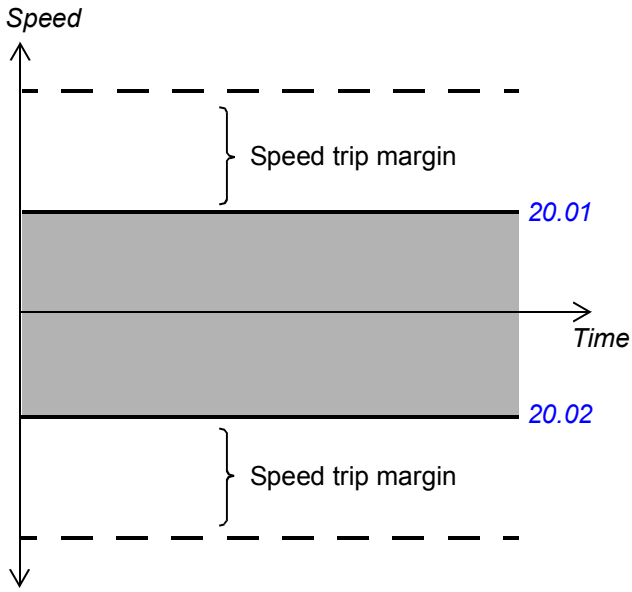
No.	Name/Value	Description	FbEq
16.07	Param save	Saves the valid parameter values to the permanent memory. **Note:** A new parameter value is saved automatically when changed from the PC tool or panel but not when altered through a fieldbus connection.	
	Done	Save completed.	0
	Save	Save in progress.	1
16.09	User set sel	Enables the saving and restoring of up to four custom sets of parameter settings. The set that was in use before powering down the drive is in use after the next power-up. **Note:** Any parameter changes made after loading a set are not automatically stored – they must be saved using this parameter.	
	No request	Load or save operation complete; normal operation.	1
	Load set 1	Load user parameter set 1.	2
	Load set 2	Load user parameter set 2.	3
	Load set 3	Load user parameter set 3.	4
	Load set 4	Load user parameter set 4.	5
	Save set 1	Save user parameter set 1.	6
	Save set 2	Save user parameter set 2.	7
	Save set 3	Save user parameter set 3.	8
	Save set 4	Save user parameter set 4.	9
	IO mode	Load user parameter set using parameters *16.11 User IO sel lo* and *16.12 User IO sel hi*.	10
16.10	User set log	Shows the status of the user parameter sets (see parameter *16.09 User set sel*). Read-only.	
	N/A	No user 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.	4
	Set1 IO act	User parameter set 1 has been selected by parameters *16.11 User IO sel lo* and *16.12 User IO sel hi*.	8
	Set2 IO act	User parameter set 2 has been selected by parameters *16.11 User IO sel lo* and *16.12 User IO sel hi*.	16
	Set3 IO act	User parameter set 3 has been selected by parameters *16.11 User IO sel lo* and *16.12 User IO sel hi*.	32
	Set4 IO act	User parameter set 4 has been selected by parameters *16.11 User IO sel lo* and *16.12 User IO sel hi*.	64
	Set1 par act	User parameter set 1 has been loaded using parameter *16.09 User set sel*.	128
	Set2 par act	User parameter set 2 has been loaded using parameter *16.09 User set sel*.	256
	Set3 par act	User parameter set 3 has been loaded using parameter *16.09 User set sel*.	512
	Set4 par act	User parameter set 4 has been loaded using parameter *16.09 User set sel*.	1024

<table>
<tr><th>No.</th><th>Name/Value</th><th>Description</th><th>FbEq</th></tr>
<tr><td>16.11</td><td>User IO sel lo</td><td>When parameter 16.09 User set sel is set to IO mode, selects the user parameter set together with parameter 16.12 User IO sel hi. The status of the source defined by this parameter and parameter 16.12 select the user parameter set as follows:<table><tr><th>Status of source defined by par. 16.11</th><th>Status of source defined by par. 16.12</th><th>User parameter set selected</th></tr><tr><td>FALSE</td><td>FALSE</td><td>Set 1</td></tr><tr><td>TRUE</td><td>FALSE</td><td>Set 2</td></tr><tr><td>FALSE</td><td>TRUE</td><td>Set 3</td></tr><tr><td>TRUE</td><td>TRUE</td><td>Set 4</td></tr></table></td><td></td></tr>
<tr><td></td><td>Const</td><td rowspan="2">Bit pointer setting (see Terms and abbreviations on page 63).</td><td rowspan="2">-</td></tr>
<tr><td></td><td>Pointer</td></tr>
<tr><td>16.12</td><td>User IO sel hi</td><td>See parameter 16.11 User IO sel lo.</td><td></td></tr>
<tr><td></td><td>Const</td><td rowspan="2">Bit pointer setting (see Terms and abbreviations on page 63).</td><td rowspan="2">-</td></tr>
<tr><td></td><td>Pointer</td></tr>
<tr><td>16.14</td><td>Reset ChgParLog</td><td>Resets the log of latest parameter changes.</td><td></td></tr>
<tr><td></td><td>Done</td><td>Reset not requested (normal operation).</td><td>0</td></tr>
<tr><td></td><td>Reset</td><td>Reset log of latest parameter changes. The value reverts automatically to Done.</td><td>1</td></tr>
<tr><td>16.15</td><td>Menu set sel</td><td>Loads a short, long or custom parameter list. By default, short parameter list is displayed by drive.</td><td></td></tr>
<tr><td></td><td>No request</td><td>No change has been requested.</td><td>0</td></tr>
<tr><td></td><td>Load short</td><td>Load short parameter list. Only a selective list of parameters will be displayed.</td><td>1</td></tr>
<tr><td></td><td>Load long</td><td>Load long parameter list. All parameters will be displayed.</td><td>2</td></tr>
<tr><td>16.16</td><td>Menu set active</td><td>Shows which parameter list is active. See parameter 16.15 Menu set sel.</td><td></td></tr>
<tr><td></td><td>None</td><td>No parameter list is active.</td><td>0</td></tr>
<tr><td></td><td>Short menu</td><td>Short parameter list is active.</td><td>1</td></tr>
<tr><td></td><td>Long menu</td><td>Long parameter list is active. All parameters are displayed.</td><td>2</td></tr>
<tr><td>16.17</td><td>Power unit</td><td>Selects the unit of power for parameters such as 01.22 Power inu out, 01.23 Motor power and 99.10 Mot nom power.</td><td></td></tr>
<tr><td></td><td>kW</td><td>Kilowatt.</td><td>0</td></tr>
<tr><td></td><td>hp</td><td>Horsepower.</td><td>1</td></tr>
</table>

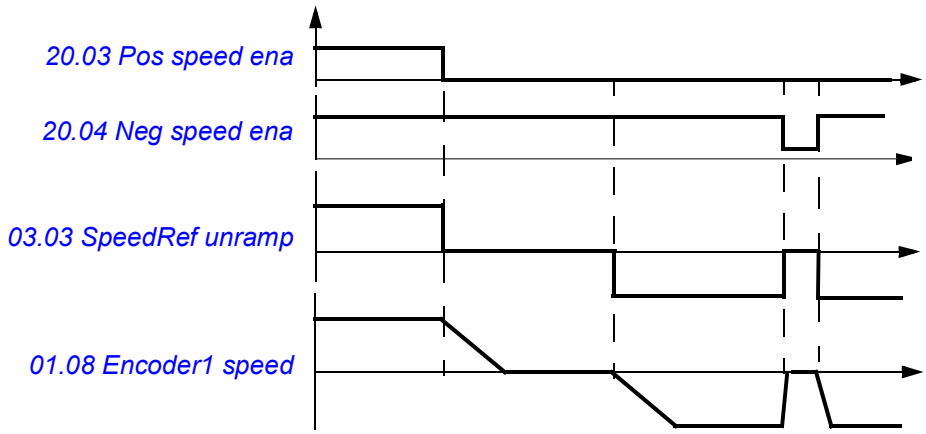
19 Speed calculation		Speed feedback, speed window, etc. settings.	
19.01	Speed scaling	Defines the terminal speed value used in acceleration and the initial speed value used in deceleration (see parameter group *22 Speed ref ramp*). Also defines the rpm value that corresponds to 20000 for fieldbus communication with ABB Drives communication profile.	
	0 … 30000 rpm	Acceleration/deceleration terminal/initial speed.	1 = 1 rpm
19.02	Speed fb sel	Selects the speed feedback value used in control.	
	Estimated	A calculated speed estimate is used.	0

No.	Name/Value	Description	FbEq
	Enc1 speed	Actual speed measured with encoder 1. The encoder is selected by parameter *90.01 Encoder 1 sel*.	1
	Enc2 speed	Actual speed measured with encoder 2. The encoder is selected by parameter *90.02 Encoder 2 sel*.	2
19.03	MotorSpeed filt	Defines the time constant of the actual speed filter, i.e. time within the actual speed has reached 63% of the nominal speed (filtered speed = *01.01 Motor speed rpm*). If the used speed reference remains constant, the possible interferences in the speed measurement can be filtered with the actual speed filter. Reducing the ripple with 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. If there are substantial interferences in the speed measurement, the filter time constant should be proportional to the total inertia of the load and motor, in this case 10…30% of the mechanical time constant $t_{mech} = (n_{nom} / T_{nom}) \times J_{tot} \times 2\pi / 60$, where J_{tot} = total inertia of the load and motor (the gear ratio between the load and motor must be taken into account) n_{nom} = motor nominal speed T_{nom} = motor nominal torque See also parameter *23.07 Speed err Ftime*.	
	0.000 … 10000.000 ms	Time constant of the actual speed filter.	1000 = 1 ms
19.06	Zero speed limit	Defines the zero speed limit. The motor is stopped along a speed ramp until the defined zero speed limit is reached. After the limit, the motor coasts to stop.	
	0.00 … 30000.00 rpm	Zero speed limit.	100 = 1 rpm

No.	Name/Value	Description	FbEq
19.07	Zero speed delay	Defines the delay for the zero speed delay function. The function is useful in applications where a smooth and quick restarting is essential. During the delay, the drive knows accurately the rotor position. **Without Zero Speed Delay:** The drive receives a stop command and decelerates along a ramp. When the motor actual speed falls below an internal limit (called Zero Speed Limit), the speed controller is switched off. The inverter modulation is stopped and the motor coasts to standstill. *Speed*  **With Zero Speed Delay:** The drive receives a stop command and decelerates along a ramp. When the actual motor speed falls below an internal limit (called Zero Speed Limit), the zero speed delay function activates. During the delay the function keeps the speed controller live: the inverter modulates, motor is magnetised and the drive is ready for a quick restart. Zero speed delay can be used e.g. with the jogging function. *Speed*  	
	0 … 30000 ms	Zero speed delay.	1 = 1 ms
19.08	Above speed lim	Defines the supervision limit for the actual speed.	
	0 … 30000 rpm	Actual speed supervision limit.	1 = 1 rpm

No.	Name/Value	Description	FbEq
19.09	Speed TripMargin	Defines, together with *20.01 Maximum speed* and *20.02 Minimum speed*, the maximum allowed speed of the motor (overspeed protection). If actual speed (*01.01 Motor speed rpm*) exceeds the speed limit defined by parameter *20.01* or *20.02* by more than the value of this parameter, the drive trips on the OVERSPEED fault. **Example:** If the maximum speed is 1420 rpm and speed trip margin is 300 rpm, the drive trips at 1720 rpm. 	
	0.0 … 10000.0 rpm	Overspeed trip margin.	10 = 1 rpm
19.10	Speed window	Defines the absolute value for the motor speed window supervision, i.e. the absolute value for the difference between the actual speed and the unramped speed reference (*01.01 Motor speed rpm* - *03.03 SpeedRef unramp*). When the motor speed is within the limits defined by this parameter, signal *02.24 FBA main sw* bit 8 (AT_SETPOINT) is 1. If the motor speed is not within the defined limits, bit 8 is 0.	
	0 … 30000 rpm	Absolute value for motor speed window supervision.	1 = 1 rpm

20 Limits		Drive operation limits. See also section *Speed controller tuning* on page *44*.	
20.01	Maximum speed	Defines the allowed maximum speed.	
	0 … 30000 rpm	Maximum speed.	1 = 1 rpm
20.02	Minimum speed	Defines the allowed minimum speed.	
	-30000 … 0 rpm	Minimum speed.	1 = 1 rpm

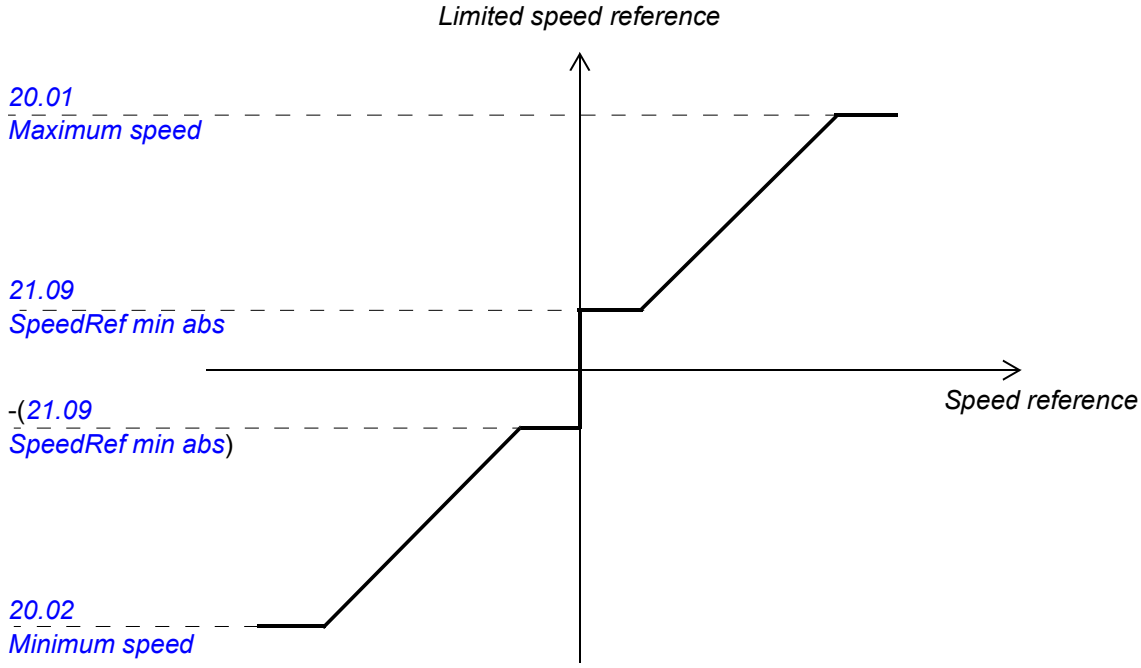
No.	Name/Value	Description	FbEq
20.03	Pos speed ena	Selects the source of the positive speed reference enable command. 1 = Positive speed reference is enabled. 0 = Positive speed reference is interpreted as zero speed reference (In the figure below *03.03 SpeedRef unramp* is set to zero after the positive speed enable signal has cleared). Actions in different control modes: Speed control: Speed reference is set to zero and the motor is stopped along the currently active deceleration ramp. Torque control: Torque limit is set to zero and the rush controller stops the motor.	
			
		Example: The motor is rotating in the forward direction. To stop the motor, the positive speed enable signal is deactivated by a hardware limit switch (e.g. via digital input). If the positive speed enable signal remains deactivated and the negative speed enable signal is active, only reverse rotation of the motor is allowed.	
	Const	Bit pointer setting (see *Terms and abbreviations* on page *63*).	-
	Pointer		
20.04	Neg speed ena	Selects the source of the negative speed reference enable command. See parameter *20.03 Pos speed ena*.	
	Const	Bit pointer setting (see *Terms and abbreviations* on page *63*).	-
	Pointer		
20.05	Maximum current	Defines the maximum allowed motor current.	
	0.00 … 30000.00 A	Maximum motor current.	100 = 1 A
20.06	Torq lim sel	Defines a source that selects between the two sets of torque limits defined by parameters *20.07…20.10*. 0 = The torque limits defined by parameters *20.07 Maximum torque1* and *20.08 Minimum torque1* are in force. 1 = The torque limits defined by parameters *20.09 Maximum torque2* and *20.10 Minimum torque2* are in force.	
	Const	Bit pointer setting (see *Terms and abbreviations* on page *63*).	-
	Pointer		
20.07	Maximum torque1	Defines maximum torque limit 1 for the drive (in percent of the motor nominal torque). See parameter *20.06 Torq lim sel*.	
	0.0 … 1600.0%	Maximum torque 1.	10 = 1%

No.	Name/Value	Description	FbEq
20.08	Minimum torque1	Defines minimum torque limit 1 for the drive (in percent of the motor nominal torque). See parameter *20.06 Torq lim sel*.	
	-1600.0 … 0.0%	Minimum torque 1.	10 = 1%
20.09	Maximum torque2	Defines maximum torque limit 2 for the drive (in percent of the motor nominal torque). See parameter *20.06 Torq lim sel*.	
	AI1 scaled	*02.05 AI1 scaled* (see page *65*).	1073742341
	AI2 scaled	*02.07 AI2 scaled* (see page *65*).	1073742343
	FBA ref1	*02.26 FBA main ref1* (see page *70*).	1073742362
	FBA ref2	*02.27 FBA main ref2* (see page *70*).	1073742363
	D2D ref1	*02.32 D2D ref1* (see page *71*).	1073742368
	D2D ref2	*02.33 D2D ref2* (see page *71*).	1073742369
	PID out	*04.05 Process PID out* (see page *72*).	1073742853
	Max torque1	*20.07 Maximum torque1* (see page *121*).	1073746951
	Pointer	Value pointer setting (see *Terms and abbreviations* on page *63*).	-
20.10	Minimum torque2	Defines minimum torque limit 2 for the drive (in percent of the motor nominal torque). See parameter *20.06 Torq lim sel*.	
	AI1 scaled	*02.05 AI1 scaled* (see page *65*).	1073742341
	AI2 scaled	*02.07 AI2 scaled* (see page *65*).	1073742343
	FBA ref1	*02.26 FBA main ref1* (see page *70*).	1073742362
	FBA ref2	*02.27 FBA main ref2* (see page *70*).	1073742363
	D2D ref1	*02.32 D2D ref1* (see page *71*).	1073742368
	D2D ref2	*02.33 D2D ref2* (see page *71*).	1073742369
	PID out	*04.05 Process PID out* (see page *72*).	1073742853
	Min torque1	*20.08 Minimum torque1* (see page *122*).	1073746952
	Pointer	Value pointer setting (see *Terms and abbreviations* on page *63*).	-
20.12	P motoring lim	Defines the maximum allowed power fed by the inverter to the motor in percent of the motor nominal power.	
	0.0 … 1600.0%	Maximum motoring power.	10 = 1%
20.13	P generating lim	Defines the maximum allowed power fed by the motor to the inverter in percent of the motor nominal power.	
	0.0 … 1600.0%	Maximum generating power.	10 = 1%

21 Speed ref		Speed reference source and scaling settings; motor potentiometer settings.	
21.01	Speed ref1 sel	Selects the source for speed reference 1. See also parameter *21.03 Speed ref1 func*.	
	Zero	Zero speed reference.	0
	AI1 scaled	*02.05 AI1 scaled* (see page *65*).	1073742341
	AI2 scaled	*02.07 AI2 scaled* (see page *65*).	1073742343
	Freq in	*02.20 Freq in* (see page *66*).	1073742356
	FBA ref1	*02.26 FBA main ref1* (see page *70*).	1073742362
	FBA ref2	*02.27 FBA main ref2* (see page *70*).	1073742363
	D2D ref1	*02.32 D2D ref1* (see page *71*).	1073742368

No.	Name/Value	Description	FbEq
	D2D ref2	*02.33 D2D ref2* (see page *71*).	1073742369
	Panel	*02.34 Panel ref* (see page *71*).	1073742370
	Mot pot	*03.18 Speed ref pot* (see page *71*).	1073742610
	PID out	*04.05 Process PID out* (see page *72*).	1073742853
	Pointer	Value pointer setting (see *Terms and abbreviations* on page *63*).	-
21.02	Speed ref2 sel	Selects the source for speed reference 2.	
	Zero	Zero speed reference.	0
	AI1 scaled	*02.05 AI1 scaled* (see page *65*).	1073742341
	AI2 scaled	*02.07 AI2 scaled* (see page *65*).	1073742343
	Freq in	*02.20 Freq in* (see page *66*).	1073742356
	FBA ref1	*02.26 FBA main ref1* (see page *70*).	1073742362
	FBA ref2	*02.27 FBA main ref2* (see page *70*).	1073742363
	D2D ref1	*02.32 D2D ref1* (see page *71*).	1073742368
	D2D ref2	*02.33 D2D ref2* (see page *71*).	1073742369
	Panel	*02.34 Panel ref* (see page *71*).	1073742370
	Mot pot	*03.18 Speed ref pot* (see page *71*).	1073742610
	PID out	*04.05 Process PID out* (see page *72*).	1073742853
	Pointer	Value pointer setting (see *Terms and abbreviations* on page *63*).	-
21.03	Speed ref1 func	Selects a mathematical function between the reference sources selected by parameters *21.01 Speed ref1 sel* and *21.02 Speed ref2 sel* to be used as speed reference 1.	
	Ref1	Signal selected by *21.01 Speed ref1 sel* is used as speed reference 1 as such.	0
	Add	The sum of the reference sources is used as speed reference 1.	1
	Sub	The subtraction ([*21.01 Speed ref1 sel*] - [*21.02 Speed ref2 sel*]) of the reference sources is used as speed reference 1.	2
	Mul	The multiplication of the reference sources is used as speed reference 1.	3
	Min	The smaller of the reference sources is used as speed reference 1.	4
	Max	The greater of the reference sources is used as speed reference 1.	5
21.04	Speed ref1/2 sel	Configures the selection between speed references 1 and 2. (The sources for the references are defined by parameters *21.01 Speed ref1 sel* and *21.02 Speed ref2 sel* respectively.) 0 = Speed reference 1 1 = Speed reference 2	
	DI1	Digital input DI1 (as indicated by *02.01 DI status*, bit 0).	1073742337
	DI2	Digital input DI2 (as indicated by *02.01 DI status*, bit 1).	1073807873
	DI3	Digital input DI3 (as indicated by *02.01 DI status*, bit 2).	1073873409
	DI4	Digital input DI4 (as indicated by *02.01 DI status*, bit 3).	1073938945
	DI5	Digital input DI5 (as indicated by *02.01 DI status*, bit 4).	1074004481
	DI6	Digital input DI6 (as indicated by *02.01 DI status*, bit 5).	1074070017

No.	Name/Value	Description	FbEq
	Const	Bit pointer setting (see *Terms and abbreviations* on page *63*).	-
	Pointer		
21.05	Speed share	Defines the scaling factor for speed reference 1/2 (speed reference 1 or 2 is multiplied by the defined value). Speed reference 1 or 2 is selected by parameter *21.04 Speed ref1/2 sel*.	
	-8.000 …8.000	Speed reference scaling factor.	1000 = 1
21.07	Speed ref jog1	Defines the speed reference for jogging function 1. For more information on jogging, see page *32*.	
	-30000 … 30000 rpm	Speed reference for jogging function 1.	1 = 1 rpm
21.08	Speed ref jog2	Defines the speed reference for jogging function 2. For more information on jogging, see page *32*.	
	-30000 … 30000 rpm	Speed reference for jogging function 2.	1 = 1 rpm
21.09	SpeedRef min abs	Defines the absolute minimum limit for the speed reference.	

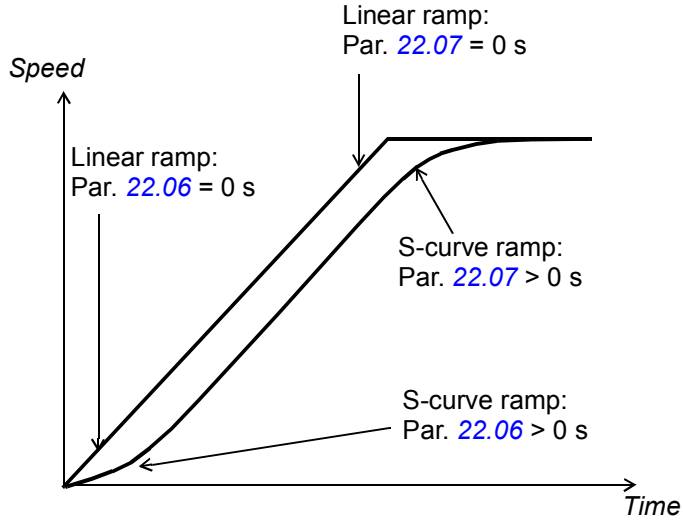
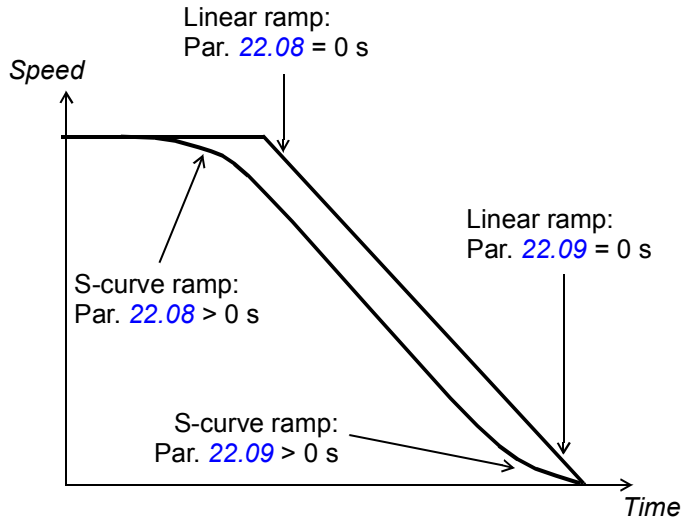


	0 … 30000 rpm	Absolute minimum limit for speed reference.	1 = 1 rpm
21.10	Mot pot func	Selects whether the value of the motor potentiometer is retained upon drive power-off.	
	Reset	Drive power-off resets the value of the motor potentiometer.	0
	Store	The value of the motor potentiometer is retained over drive power-off.	1
21.11	Mot pot up	Selects the source of motor potentiometer up signal.	
	DI4	Digital input DI4 (as indicated by *02.01 DI status*, bit 3).	1073938945
	DI5	Digital input DI5 (as indicated by *02.01 DI status*, bit 4).	1074004481
	DI6	Digital input DI6 (as indicated by *02.01 DI status*, bit 5).	1074070017
	Const	Bit pointer setting (see *Terms and abbreviations* on page *63*).	-
	Pointer		

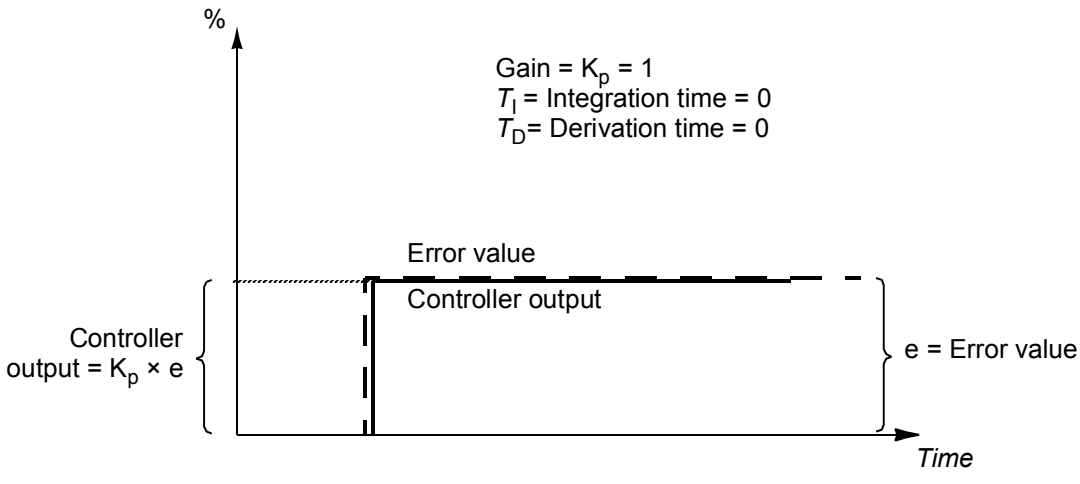
No.	Name/Value	Description	FbEq
21.12	Mot pot down	Selects the source of motor potentiometer down signal.	
	DI4	Digital input DI4 (as indicated by *02.01 DI status*, bit 3).	1073938945
	DI5	Digital input DI5 (as indicated by *02.01 DI status*, bit 4).	1074004481
	DI6	Digital input DI6 (as indicated by *02.01 DI status*, bit 5).	1074070017
	Const	Bit pointer setting (see *Terms and abbreviations* on page *63*).	-
	Pointer		

22 Speed ref ramp		Speed reference ramp settings.	
22.01	Acc/Dec sel	Selects the source that switches between the two sets of acceleration/deceleration times defined by parameters *22.02…22.05*. 0 = Acceleration time 1 and deceleration time 1 are in force 1 = Acceleration time 2 and deceleration time 2 are in force.	
	DI1	Digital input DI1 (as indicated by *02.01 DI status*, bit 0).	1073742337
	DI2	Digital input DI2 (as indicated by *02.01 DI status*, bit 1).	1073807873
	DI3	Digital input DI3 (as indicated by *02.01 DI status*, bit 2).	1073873409
	DI4	Digital input DI4 (as indicated by *02.01 DI status*, bit 3).	1073938945
	DI5	Digital input DI5 (as indicated by *02.01 DI status*, bit 4).	1074004481
	DI6	Digital input DI6 (as indicated by *02.01 DI status*, bit 5).	1074070017
	Const	Bit pointer setting (see *Terms and abbreviations* on page *63*).	-
	Pointer		
22.02	Acc time1	Defines acceleration time 1 as the time required for the speed to change from zero to the speed value defined by parameter *19.01 Speed scaling*. 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 signal. If the acceleration time is set too short, the drive will automatically prolong the acceleration in order not to exceed the drive torque limits.	
	0.000 … 1800.000 s	Acceleration time 1.	1000 = 1 s

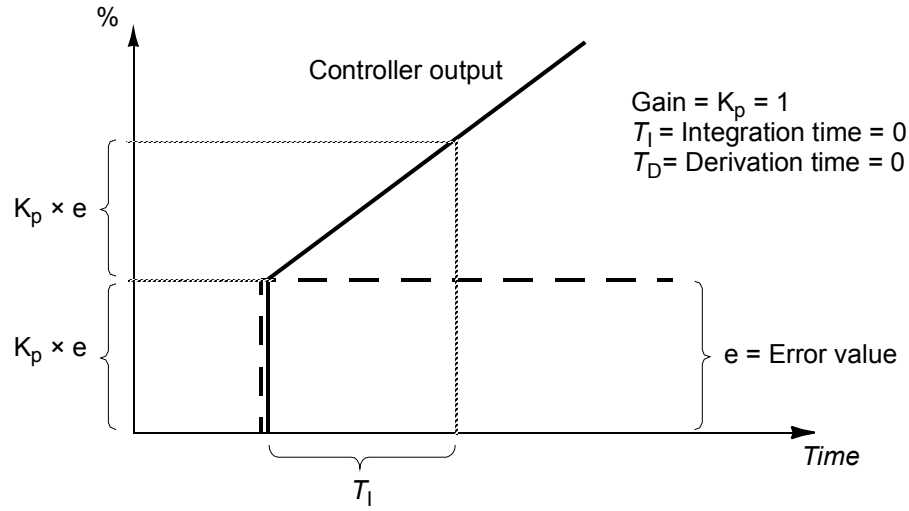
No.	Name/Value	Description	FbEq
22.03	Dec time1	Defines deceleration time 1 as the time required for the speed to change from the speed value defined by parameter *19.01 Speed scaling* to zero. If the speed reference decreases slower than the set deceleration rate, the motor speed will follow the reference signal. If the reference changes faster than the set deceleration rate, the motor speed will follow the deceleration rate. If the deceleration time is set too short, the drive will automatically prolong the deceleration in order not to exceed drive torque limits. If there is any doubt about the deceleration time being too short, ensure that the DC overvoltage control is on (parameter *47.01 Overvolt ctrl*). **Note:** If a short deceleration time is needed for a high inertia application, the drive should be equipped with an electric braking option e.g. with a brake chopper (built-in) and a brake resistor.	
	0.000 … 1800.000 s	Deceleration time 1.	1000 = 1 s
22.04	Acc time2	Defines acceleration time 2. See parameter *22.02 Acc time1*.	
	0.000 … 1800.000 s	Acceleration time 2.	1000 = 1 s
22.05	Dec time2	Defines deceleration time 2. See parameter *22.03 Dec time1*.	
	0.000 … 1800.000 s	Deceleration time 2.	1000 = 1 s

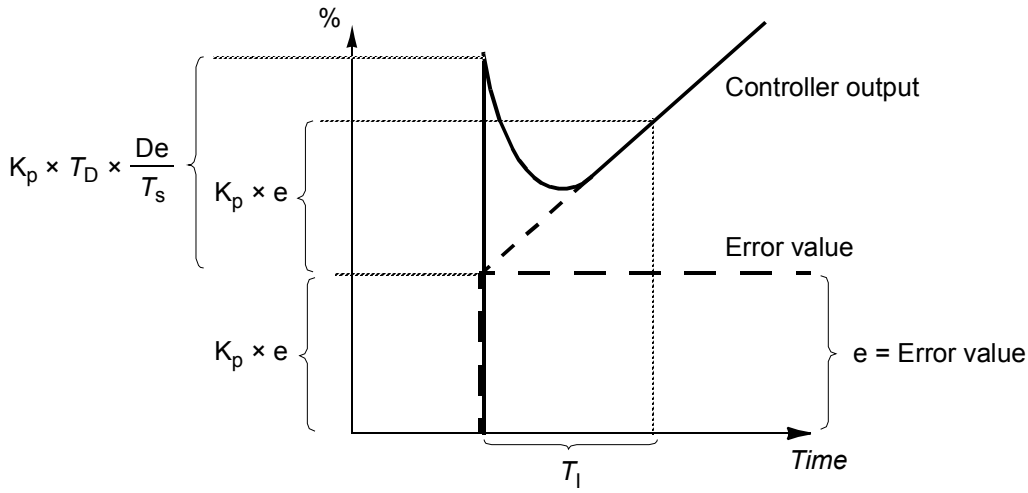
No.	Name/Value	Description	FbEq
22.06	Shape time acc1	Defines the shape of the acceleration ramp at the beginning of the acceleration. 0.000 s: Linear ramp. Suitable for steady acceleration or deceleration and for slow ramps. 0.001…1000.000 s: S-curve ramp. S-curve ramps are ideal for lifting applications. The S-curve consists of symmetrical curves at both ends of the ramp and a linear part in between. **Acceleration:**  **Deceleration:**  	
	0.000 … 1800.000 s	Ramp shape at start of acceleration.	1000 = 1 s
22.07	Shape time acc2	Defines the shape of the acceleration ramp at the end of the acceleration. See parameter *22.06 Shape time acc1*.	
	0.000 … 1800.000 s	Ramp shape at end of acceleration.	1000 = 1 s
22.08	Shape time dec1	Defines the shape of the deceleration ramp at the beginning of the deceleration. See parameter *22.06 Shape time acc1*.	
	0.000 … 1800.000 s	Ramp shape at start of deceleration.	1000 = 1 s

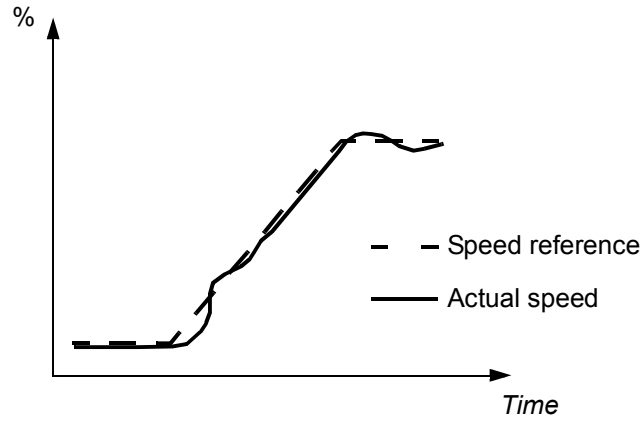
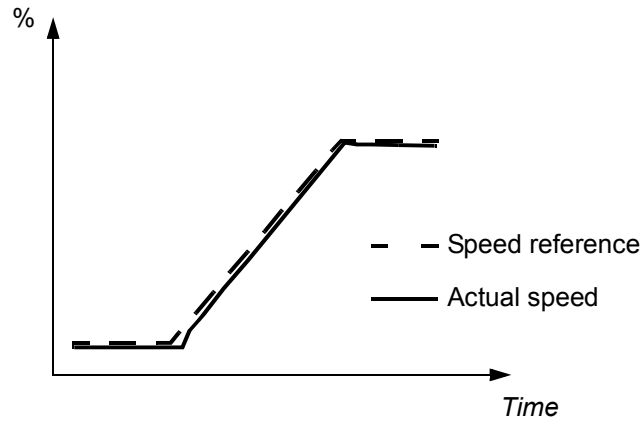
No.	Name/Value	Description	FbEq
22.09	Shape time dec2	Defines the shape of the deceleration ramp at the end of the deceleration. See parameter *22.06 Shape time acc1*.	
	0.000 … 1800.000 s	Ramp shape at end of deceleration.	1000 = 1 s
22.10	Acc time jogging	Defines the acceleration time for the jogging function i.e. the time required for the speed to change from zero to the speed value defined by parameter *19.01 Speed scaling*.	
	0.000 … 1800.000 s	Acceleration time for jogging.	1000 = 1 s
22.11	Dec time jogging	Defines the deceleration time for the jogging function i.e. the time required for the speed to change from the speed value defined by parameter *19.01 Speed scaling* to zero.	
	0.000 … 1800.000 s	Deceleration time for jogging.	1000 = 1 s
22.12	Em stop time	Defines the time inside which the drive is stopped if an emergency stop OFF3 is activated (i.e. the time required for the speed to change from the speed value defined by parameter *19.01 Speed scaling* to zero). Emergency stop activation source is selected by parameter *10.13 Em stop off3*. Emergency stop can also be activated through fieldbus (*02.22 FBA main cw*). **Note:** Emergency stop OFF1 uses the active ramp time.	
	0.000 … 1800.000 s	Emergency stop OFF3 deceleration time.	1000 = 1 s

23 Speed ctrl		Speed controller settings.	
23.01	Proport gain	Defines the proportional gain (K_p) of the speed controller. Too great a gain may cause speed oscillation. The figure below shows the speed controller output after an error step when the error remains constant.	
			
		If gain is set to 1, a 10% change in error value (reference - actual value) causes the speed controller output to change by 10%.	
	0.00 … 200.00	Proportional gain for speed controller.	100 = 1

No.	Name/Value	Description	FbEq
23.02	Integration time	Defines the integration time of the speed controller. The integration time defines the rate at which the controller output changes when the error value is constant and the proportional gain of the speed controller is 1. The shorter the integration time, the faster the continuous error value is corrected. Too short an integration time makes the control unstable. If parameter value is set to zero, the I-part of the controller is disabled. Anti-windup stops the integrator if the controller output is limited. See *06.05 Limit word1*. The figure below shows the speed controller output after an error step when the error remains constant.	
	0.00 … 600.00 s	Integration time for speed controller.	100 = 1 s



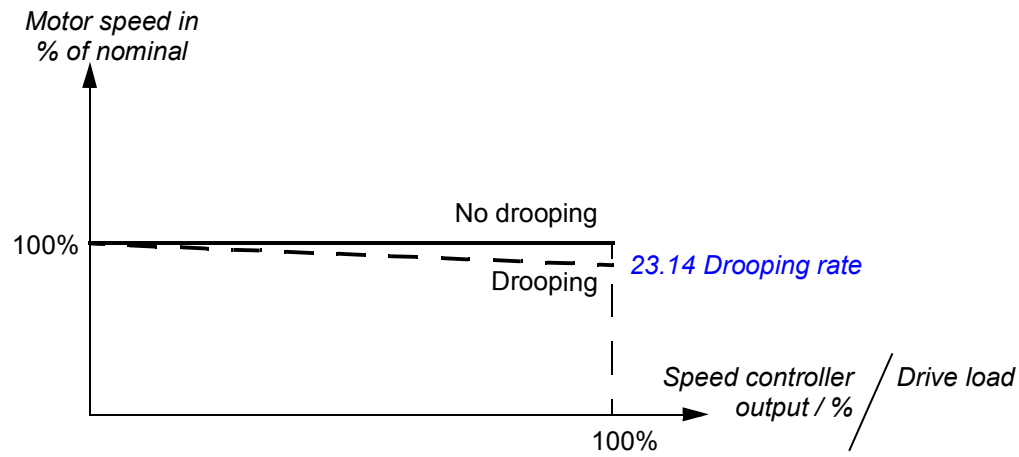
No.	Name/Value	Description	FbEq
23.03	Derivation time	Defines the derivation time of the speed controller. Derivative action boosts the controller output if the error value changes. The longer the derivation time, the more the speed controller output is boosted during the change. If the derivation time is set to zero, the controller works as a PI controller, otherwise as a PID controller. The derivation makes the control more responsive for disturbances. The speed error derivative must be filtered with a low pass filter to eliminate disturbances. The figure below shows the speed controller output after an error step when the error remains constant.  Gain = K_p = 1 T_I = Integration time > 0 T_D= Derivation time > 0 T_s= Sample time period = 250 µs ∆e = Error value change between two samples **Note:** Changing this parameter value is recommended only if a pulse encoder is used.	
	0.000 … 10.000 s	Derivation time for speed controller.	1000 = 1 s
23.04	Deriv filt time	Defines the derivation filter time constant. See parameter *23.03 Derivation time*.	
	0.0 … 1000.0 ms	Derivation filter time constant.	10 = 1 ms

No.	Name/Value	Description	FbEq
23.05	Acc comp DerTime	Defines the derivation time for acceleration/(deceleration) compensation. In order to compensate inertia during acceleration, a derivative of the reference is added to the output of the speed controller. The principle of a derivative action is described for parameter *23.03 Derivation time*. **Note:** As a general rule, set this parameter to the value between 50 and 100% of the sum of the mechanical time constants of the motor and the driven machine. The figure below shows the speed responses when a high inertia load is accelerated along a ramp. **No acceleration compensation:**  **Acceleration compensation:** 	
	0.00 … 600.00 s	Acceleration compensation derivation time.	100 = 1 s
23.06	Acc comp Ftime	Defines the derivation filter time constant for the acceleration(/deceleration) compensation. See parameters *23.03 Derivation time* and *23.05 Acc comp DerTime*.	
	0.0 … 1000.0 ms	Derivation filter time constant for acceleration compensation.	10 = 1 ms
23.07	Speed err Ftime	Defines the time constant of the speed error low pass filter. If the used speed reference changes rapidly (like in a servo application), the possible interferences in the speed measurement can be filtered with the speed error filter. Reducing the ripple with 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.	
	0.0 … 1000.0 ms	Speed error filtering time constant. 0 = filtering disabled.	10 = 1 ms

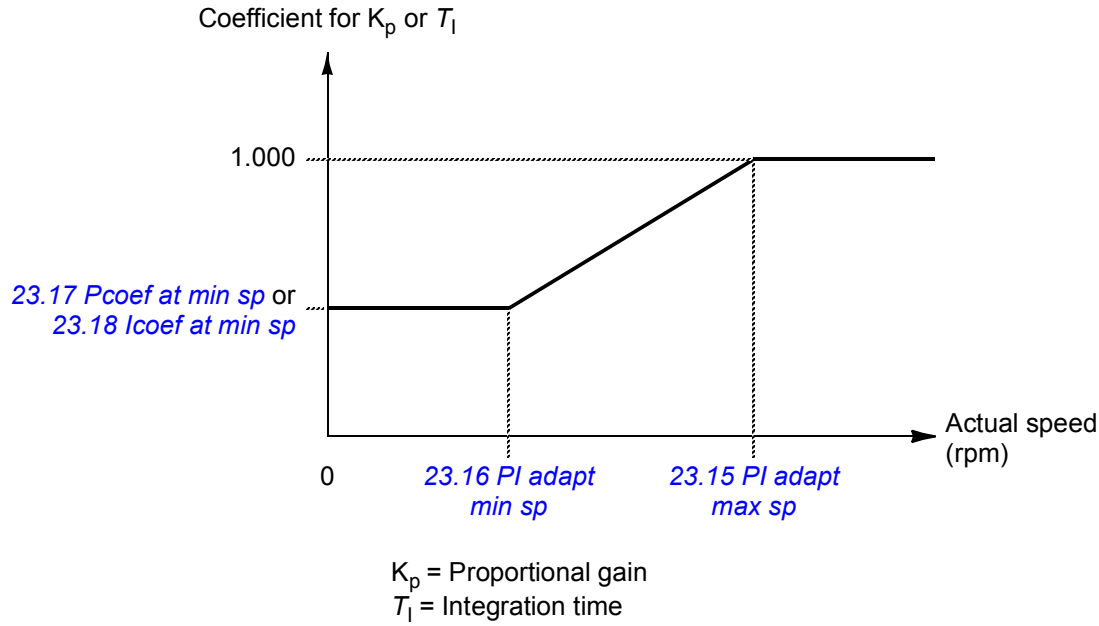
No.	Name/Value	Description	FbEq
23.08	Speed additive	Defines a speed reference to be added after ramping. **Note:** For safety reasons, the additive is not applied when stop functions are active.	
	Zero	Zero speed additive.	0
	AI1 scaled	*02.05 AI1 scaled* (see page *65*).	1073742341
	AI2 scaled	*02.07 AI2 scaled* (see page *65*).	1073742343
	FBA ref1	*02.26 FBA main ref1* (see page *70*).	1073742362
	FBA ref2	*02.27 FBA main ref2* (see page *70*).	1073742363
	D2D ref1	*02.32 D2D ref1* (see page *71*).	1073742368
	D2D ref2	*02.33 D2D ref2* (see page *71*).	1073742369
	PID out	*04.05 Process PID out* (see page *72*).	1073742853
	Pointer	Value pointer setting (see *Terms and abbreviations* on page *63*).	-
23.09	Max torq sp ctrl	Defines the maximum speed controller output torque.	
	-1600.0 … 1600.0%	Maximum speed controller output torque.	10 = 1%
23.10	Min torq sp ctrl	Defines the minimum speed controller output torque.	
	-1600.0 … 1600.0%	Minimum speed controller output torque.	10 = 1%
23.11	SpeedErr winFunc	Enables or disables speed error window control. Speed error window control forms a speed supervision function for a torque-controlled drive. It supervises the speed error value (speed reference – actual speed). In the normal operating range, window control keeps the speed controller input at zero. The speed controller is evoked only if • the speed error exceeds the upper boundary of the window (parameter *23.12 SpeedErr win hi*), or • the absolute value of the negative speed error exceeds the lower boundary of the window (*23.13 SpeedErr win lo*). When the speed error moves outside the window, the exceeding part of the error value is connected to the speed controller. The speed controller produces a reference term relative to the input and gain of the speed controller (parameter *23.01 Proport gain*) which the torque selector adds to the torque reference. The result is used as the internal torque reference for the drive. **Example:** In a load loss condition, the internal torque reference of the drive is decreased to prevent an excessive rise of the motor speed. If window control were inactive, the motor speed would rise until a speed limit of the drive were reached.	
	Disabled	Speed error window control inactive.	0
	Absolute	Speed error window control active. The boundaries defined by parameters *23.12 SpeedErr win hi* and *23.13 SpeedErr win lo* are absolute.	1
	Relative	Speed error window control active. The boundaries defined by parameters *23.12 SpeedErr win hi* and *23.13 SpeedErr win lo* are relative to speed reference.	2
23.12	SpeedErr win hi	Defines the upper boundary of the speed error window. Depending on setting of parameter *23.11 SpeedErr winFunc*, this is either an absolute value or relative to speed reference.	
	0 … 3000 rpm	Upper boundary of speed error window.	1 = 1 rpm

No.	Name/Value	Description	FbEq
23.13	SpeedErr win lo	Defines the lower boundary of the speed error window. Depending on setting of parameter *23.11 SpeedErr winFunc*, this is either an absolute value or relative to speed reference.	
	0 … 3000 rpm	Lower boundary of speed error window.	1 = 1 rpm
23.14	Drooping rate	Defines the droop rate (in percent of the motor nominal speed). The drooping slightly decreases the drive speed as the drive load increases. The actual speed decrease at a certain operating point depends on the droop rate setting and the drive load (= torque reference / speed controller output). At 100% speed controller output, drooping is at its nominal level, i.e. equal to the value of this parameter. The drooping effect decreases linearly to zero along with the decreasing load. Droop rate can be used e.g. to adjust the load sharing in a Master/Follower application run by several drives. In a Master/Follower application the motor shafts are coupled to each other. The correct droop rate for a process must be found out case by case in practice.	

Speed decrease = Speed controller output × Drooping × Max. speed
Example: Speed controller output is 50%, droop rate is 1%, maximum speed of the drive is 1500 rpm.
Speed decrease = 0.50 × 0.01 × 1500 rpm = 7.5 rpm.



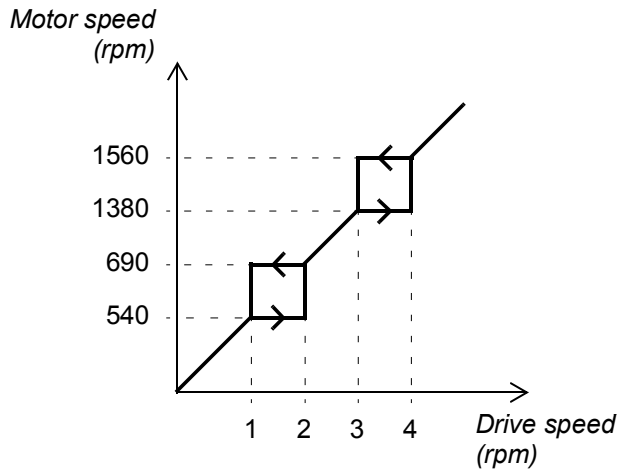
	0.00 … 100.00%	Droop rate.	100 = 1%

No.	Name/Value	Description	FbEq
23.15	PI adapt max sp	Maximum actual speed for speed controller adaptation. Speed controller gain and integration time can be adapted according to actual speed. This is done by multiplying the gain (*23.01 Proport gain*) and integration time (*23.02 Integration time*) by coefficients at certain speeds. The coefficients are defined individually for both gain and integration time. When the actual speed is below or equal to *23.16 PI adapt min sp*, *23.01 Proport gain* and *23.02 Integration time* are multiplied by *23.17 Pcoef at min sp* and *23.18 Icoef at min sp* respectively. When the actual speed is equal to or exceeds *23.15 PI adapt max sp*, no adaptation takes place; in other words, *23.01 Proport gain* and *23.02 Integration time* are used as such. Between *23.16 PI adapt min sp* and *23.15 PI adapt max sp*, the coefficients are calculated linearly on the basis of the breakpoints.	
		 K_p = Proportional gain T_I = Integration time	
	0 … 30000 rpm	Maximum actual speed for speed controller adaptation.	1 = 1 rpm
23.16	PI adapt min sp	Minimum actual speed for speed controller adaptation. See parameter *23.15 PI adapt max sp*.	
	0 … 30000 rpm	Minimum actual speed for speed controller adaptation.	1 = 1 rpm
23.17	Pcoef at min sp	Proportional gain coefficient at minimum actual speed. See parameter *23.15 PI adapt max sp*.	
	0.000 … 10.000	Proportional gain coefficient at minimum actual speed.	1000 = 1
23.18	Icoef at min sp	Integration time coefficient at minimum actual speed. See parameter *23.15 PI adapt max sp*.	
	0.000 … 10.000	Integration time coefficient at minimum actual speed.	1000 = 1
23.20	PI tune mode	Activates the speed controller autotune function.	
	Done	No tuning has been requested (normal operation)	0
	Smooth	Request speed controller autotune with preset settings for smooth operation.	1
	Middle	Request speed controller autotune with preset settings for medium-tight operation.	2

No.	Name/Value	Description	FbEq
	Tight	Request speed controller autotune with preset settings for tight operation.	3
	User	Request speed controller autotune with the settings defined by parameters *23.21 Tune bandwidth* and *23.22 Tune damping*.	4
23.21	Tune bandwidth	Speed controller bandwidth after autotune procedure in user mode. A larger bandwidth results in more restricted speed controller settings.	
	00.00 … 2000.00 Hz	Tune bandwidth for user PI tune mode.	100 = 1 Hz
23.22	Tune damping	Speed controller damping after autotune procedure in user mode. Higher damping results in safer and smoother operation.	
	0.0 … 200.0	Speed controller damping for user PI tune mode.	10 = 1

24 Torque ref		Torque reference selection, limitation and modification settings.	
24.01	Torq ref1 sel	Selects the source for torque reference 1.	
	Zero	No torque reference selected.	0
	AI1 scaled	*02.05 AI1 scaled* (see page *65*).	1073742341
	AI2 scaled	*02.07 AI2 scaled* (see page *65*).	1073742343
	FBA ref1	*02.26 FBA main ref1* (see page *70*).	1073742362
	FBA ref2	*02.27 FBA main ref2* (see page *70*).	1073742363
	D2D ref1	*02.32 D2D ref1* (see page *71*).	1073742368
	D2D ref2	*02.33 D2D ref2* (see page *71*).	1073742369
	PID out	*04.05 Process PID out* (see page *72*).	1073742853
	Pointer	Value pointer setting (see *Terms and abbreviations* on page *63*).	-
24.02	Torq ref add sel	Selects the source for the torque reference addition. Because the reference is added after the torque reference selection, this parameter can be used in speed and torque control modes. **Note:** For safety reasons, this reference addition is not applied when stop functions are active.	
	Zero	No torque reference addition selected.	0
	AI1 scaled	*02.05 AI1 scaled* (see page *65*).	1073742341
	AI2 scaled	*02.07 AI2 scaled* (see page *65*).	1073742343
	FBA ref1	*02.26 FBA main ref1* (see page *70*).	1073742362
	FBA ref2	*02.27 FBA main ref2* (see page *70*).	1073742363
	D2D ref1	*02.32 D2D ref1* (see page *71*).	1073742368
	D2D ref2	*02.33 D2D ref2* (see page *71*).	1073742369
	PID out	*04.05 Process PID out* (see page *72*).	1073742853
	Pointer	Value pointer setting (see *Terms and abbreviations* on page *63*).	-
24.03	Maximum torq ref	Defines the maximum torque reference.	
	0.0 … 1000.0%	Maximum torque reference.	10 = 1%

No.	Name/Value	Description	FbEq
24.04	Minimum torq ref	Defines the minimum torque reference.	
	-1000.0 … 0.0%	Minimum torque reference.	10 = 1%
24.05	Load share	Scales the torque reference to a required level (torque reference is multiplied by the selected value).	
	-8.000 … 8.000	Torque reference scaling.	1000 = 1
24.06	Torq ramp up	Defines the torque reference ramp-up time, i.e. the time for the reference to increase from zero to the nominal motor torque.	
	0.000 … 60.000 s	Torque reference ramp-up time.	1000 = 1 s
24.07	Torq ramp down	Defines the torque reference ramp-down time, i.e. the time for the reference to decrease from the nominal motor torque to zero.	
	0.000 … 60.000 s	Torque reference ramp-down time.	1000 = 1 s

25 Critical speed		Sets up critical speeds, or ranges of speeds, that are avoided due to, for example, mechanical resonance problems.	
25.01	Crit speed sel	Enables/disables the critical speeds function. **Example:** A fan has vibrations in the range of 540 to 690 rpm and 1380 to 1560 rpm. To make the drive to jump over the vibration speed ranges: • activate the critical speeds function, • set the critical speed ranges as in the figure below.  1 = Par. 25.02 = 540 rpm 2 = Par. 25.03 = 690 rpm 3 = Par. 25.04 = 1380 rpm 4 = Par. 25.05 = 1590 rpm	
	Disable	Critical speeds are disabled.	0
	Enable	Critical speeds are enabled.	1

No.	Name/Value	Description	FbEq
25.02	Crit speed1 lo	Defines the low limit for critical speed range 1. **Note:** This value must be less than or equal to the value of *25.03 Crit speed1 hi*.	
	-30000 … 30000 rpm	Low limit for critical speed 1.	1 = 1 rpm
25.03	Crit speed1 hi	Defines the high limit for critical speed range 1. **Note:** This value must be greater than or equal to the value of *25.02 Crit speed1 lo*.	
	-30000 … 30000 rpm	High limit for critical speed 1.	1 = 1 rpm
25.04	Crit speed2 lo	Defines the low limit for critical speed range 2. **Note:** This value must be less than or equal to the value of *25.05 Crit speed2 hi*.	
	-30000 … 30000 rpm	Low limit for critical speed 2.	1 = 1 rpm
25.05	Crit speed2 hi	Defines the high limit for critical speed range 2. **Note:** This value must be greater than or equal to the value of *25.04 Crit speed2 lo*.	
	-30000 … 30000 rpm	High limit for critical speed 2.	1 = 1 rpm
25.06	Crit speed3 lo	Defines the low limit for critical speed range 3. **Note:** This value must be less than or equal to the value of *25.07 Crit speed3 hi*.	
	-30000 … 30000 rpm	Low limit for critical speed 3.	1 = 1 rpm
25.07	Crit speed3 hi	Defines the high limit for critical speed range 3. **Note:** This value must be greater than or equal to the value of *25.06 Crit speed3 lo*.	
	-30000 … 30000 rpm	High limit for critical speed 3.	1 = 1 rpm

26 Constant speeds	Constant speed selection and values. An active constant speed overrides the drive speed reference. See section *Constant speeds* on page *31*.	
26.01	Const speed func	Determines how constant speeds are selected, and whether the rotation direction signal is considered or not when applying a constant speed.

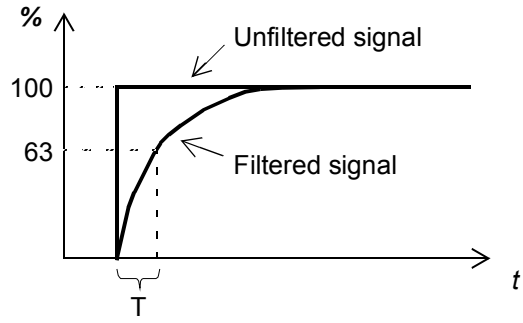
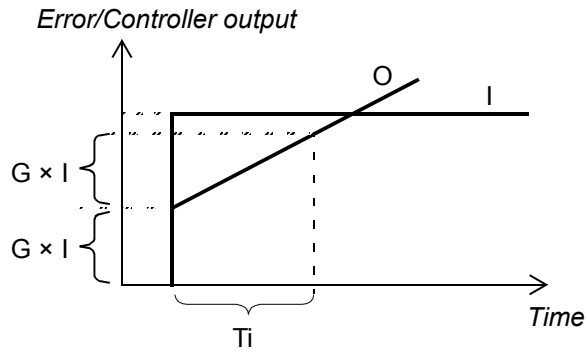
Bit	Name	Information
0	Const speed mode	1 = Packed: 7 constant speeds are selectable using the three sources defined by parameters *26.02*, *26.03* and *26.04*.
		0 = Separate: Constant speeds 1, 2 and 3 are separately activated by the sources defined by parameters *26.02*, *26.03* and *26.04* respectively. In case of conflict, the constant speed with the smaller number takes priority.
1	Dir ena	1 = Start dir: To determine running direction for a constant speed, the sign of the constant speed setting (parameters *26.06…26.12*) is multiplied by the direction signal (forward: +1, reverse: -1). For example, if the direction signal is reverse and the active constant speed is negative, the drive will run in the forward direction.
		0 = Accord Par: The running direction for the constant speed is determined by the sign of the constant speed setting (parameters *26.06…26.12*).

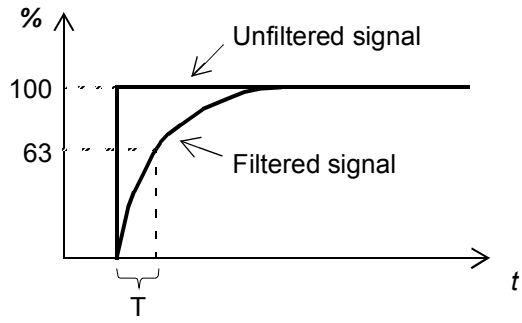
<table>
<tr><th>No.</th><th>Name/Value</th><th>Description</th><th>FbEq</th></tr>
<tr><td>26.02</td><td>Const speed sel1</td><td>When bit 0 of parameter 26.01 Const speed func is 0 (Separate), selects a source that activates constant speed 1. When bit 0 of parameter 26.01 Const speed func is 1 (Packed), this parameter and parameters 26.03 Const speed sel2 and 26.04 Const speed sel3 select three sources whose states activate constant speeds as follows:
<table>
<tr><th>Source defined by par. 26.02</th><th>Source defined by par. 26.03</th><th>Source defined by par. 26.04</th><th>Constant speed active</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>None</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>Constant speed 1</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>Constant speed 2</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>Constant speed 3</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>Constant speed 4</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>Constant speed 5</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>Constant speed 6</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>Constant speed 7</td></tr>
</table></td><td></td></tr>
<tr><td></td><td>DI1</td><td>Digital input DI1 (as indicated by 02.01 DI status, bit 0).</td><td>1073742337</td></tr>
<tr><td></td><td>DI2</td><td>Digital input DI2 (as indicated by 02.01 DI status, bit 1).</td><td>1073807873</td></tr>
<tr><td></td><td>DI3</td><td>Digital input DI3 (as indicated by 02.01 DI status, bit 2).</td><td>1073873409</td></tr>
<tr><td></td><td>DI4</td><td>Digital input DI4 (as indicated by 02.01 DI status, bit 3).</td><td>1073938945</td></tr>
<tr><td></td><td>DI5</td><td>Digital input DI5 (as indicated by 02.01 DI status, bit 4).</td><td>1074004481</td></tr>
<tr><td></td><td>DI6</td><td>Digital input DI6 (as indicated by 02.01 DI status, bit 5).</td><td>1074070017</td></tr>
<tr><td></td><td>Const</td><td rowspan="2">Bit pointer setting (see Terms and abbreviations on page 63).</td><td rowspan="2">-</td></tr>
<tr><td></td><td>Pointer</td></tr>
<tr><td>26.03</td><td>Const speed sel2</td><td>When bit 0 of parameter 26.01 Const speed func is 0 (Separate), selects a source that activates constant speed 2. When bit 0 of parameter 26.01 Const speed func is 1 (Packed), this parameter and parameters 26.02 Const speed sel1 and 26.04 Const speed sel3 select three sources that are used to activate constant speeds. See table at parameter 26.02 Const speed sel1.</td><td></td></tr>
<tr><td></td><td>DI1</td><td>Digital input DI1 (as indicated by 02.01 DI status, bit 0).</td><td>1073742337</td></tr>
<tr><td></td><td>DI2</td><td>Digital input DI2 (as indicated by 02.01 DI status, bit 1).</td><td>1073807873</td></tr>
<tr><td></td><td>DI3</td><td>Digital input DI3 (as indicated by 02.01 DI status, bit 2).</td><td>1073873409</td></tr>
<tr><td></td><td>DI4</td><td>Digital input DI4 (as indicated by 02.01 DI status, bit 3).</td><td>1073938945</td></tr>
<tr><td></td><td>DI5</td><td>Digital input DI5 (as indicated by 02.01 DI status, bit 4).</td><td>1074004481</td></tr>
<tr><td></td><td>DI6</td><td>Digital input DI6 (as indicated by 02.01 DI status, bit 5).</td><td>1074070017</td></tr>
<tr><td></td><td>Const</td><td rowspan="2">Bit pointer setting (see Terms and abbreviations on page 63).</td><td rowspan="2">-</td></tr>
<tr><td></td><td>Pointer</td></tr>
<tr><td>26.04</td><td>Const speed sel3</td><td>When bit 0 of parameter 26.01 Const speed func is 0 (Separate), selects a source that activates constant speed 3. When bit 0 of parameter 26.01 Const speed func is 1 (Packed), this parameter and parameters 26.02 Const speed sel1 and 26.03 Const speed sel2 select three sources that are used to activate constant speeds. See table at parameter 26.02 Const speed sel1.</td><td></td></tr>
<tr><td></td><td>DI1</td><td>Digital input DI1 (as indicated by 02.01 DI status, bit 0).</td><td>1073742337</td></tr>
</table>

No.	Name/Value	Description	FbEq
	DI2	Digital input DI2 (as indicated by *02.01 DI status*, bit 1).	1073807873
	DI3	Digital input DI3 (as indicated by *02.01 DI status*, bit 2).	1073873409
	DI4	Digital input DI4 (as indicated by *02.01 DI status*, bit 3).	1073938945
	DI5	Digital input DI5 (as indicated by *02.01 DI status*, bit 4).	1074004481
	DI6	Digital input DI6 (as indicated by *02.01 DI status*, bit 5).	1074070017
	Const	Bit pointer setting (see *Terms and abbreviations* on page *63*).	-
	Pointer		
26.06	Const speed1	Defines constant speed 1.	
	-30000 … 30000 rpm	Constant speed 1.	1 = 1 rpm
26.07	Const speed2	Defines constant speed 2.	
	-30000 … 30000 rpm	Constant speed 2.	1 = 1 rpm
26.08	Const speed3	Defines constant speed 3.	
	-30000 … 30000 rpm	Constant speed 3.	1 = 1 rpm
26.09	Const speed4	Defines constant speed 4.	
	-30000 … 30000 rpm	Constant speed 4.	1 = 1 rpm
26.10	Const speed5	Defines constant speed 5.	
	-30000 … 30000 rpm	Constant speed 5.	1 = 1 rpm
26.11	Const speed6	Defines constant speed 6.	
	-30000 … 30000 rpm	Constant speed 6.	1 = 1 rpm
26.12	Const speed7	Defines constant speed 7.	
	-30000 … 30000 rpm	Constant speed 7.	1 = 1 rpm

27 Process PID		Configuration of process PID control.	
27.01	PID setpoint sel	Selects the source of setpoint (reference) for the PID controller.	
	Zero	Zero reference.	0
	AI1 scaled	*02.05 AI1 scaled* (see page *65*).	1073742341
	AI2 scaled	*02.07 AI2 scaled* (see page *65*).	1073742343
	FBA ref1	*02.26 FBA main ref1* (see page *70*).	1073742362
	FBA ref2	*02.27 FBA main ref2* (see page *70*).	1073742363
	D2D ref1	*02.32 D2D ref1* (see page *71*).	1073742368
	D2D ref2	*02.33 D2D ref2* (see page *71*).	1073742369
	Pointer	Value pointer setting (see *Terms and abbreviations* on page *63*).	-
27.02	PID fbk func	Defines how the final process feedback is calculated from the two sources selected by parameters *27.03 PID fbk1 src* and *27.04 PID fbk2 src*.	
	Act1	Process feedback 1 used.	0

No.	Name/Value	Description	FbEq
	Add	Sum of feedback 1 and feedback 2.	1
	Sub	Feedback 2 subtracted from feedback 1.	2
	Mul	Feedback 1 multiplied by feedback 2.	3
	div	Feedback 1 divided by feedback 2.	4
	Max	Greater of the two feedback sources used.	5
	Min	Smaller of the two feedbacks sources used.	6
	Sqrt sub	Square root of (feedback 1 – feedback 2).	7
	Sqrt add	Square root of feedback 1 + square root of feedback 2.	8
27.03	PID fbk1 src	Selects the source of process feedback 1.	
	Zero	Zero feedback.	0
	AI1 scaled	*02.05 AI1 scaled* (see page *65*).	1073742341
	AI2 scaled	*02.07 AI2 scaled* (see page *65*).	1073742343
	FBA ref1	*02.26 FBA main ref1* (see page *70*).	1073742362
	FBA ref2	*02.27 FBA main ref2* (see page *70*).	1073742363
	D2D ref1	*02.32 D2D ref1* (see page *71*).	1073742368
	D2D ref2	*02.33 D2D ref2* (see page *71*).	1073742369
	Pointer	Value pointer setting (see *Terms and abbreviations* on page *63*).	-
27.04	PID fbk2 src	Selects the source of process feedback 2.	
	Zero	Zero feedback.	0
	AI1 scaled	*02.05 AI1 scaled* (see page *65*).	1073742341
	AI2 scaled	*02.07 AI2 scaled* (see page *65*).	1073742343
	FBA ref1	*02.26 FBA main ref1* (see page *70*).	1073742362
	FBA ref2	*02.27 FBA main ref2* (see page *70*).	1073742363
	D2D ref1	*02.32 D2D ref1* (see page *71*).	1073742368
	D2D ref2	*02.33 D2D ref2* (see page *71*).	1073742369
	Pointer	Value pointer setting (see *Terms and abbreviations* on page *63*).	-
27.05	PID fbk1 max	Maximum value for process feedback 1.	
	-32768.00 … 32768.00	Maximum value for process feedback 1.	100 = 1
27.06	PID fbk1 min	Minimum value for process feedback 1.	
	-32768.00 … 32768.00	Minimum value for process feedback 1.	100 = 1
27.07	PID fbk2 max	Maximum value for process feedback 2.	
	-32768.00 … 32768.00	Maximum value for process feedback 2.	100 = 1
27.08	PID fbk2 min	Minimum value for process feedback 2.	
	-32768.00 … 32768.00	Minimum value for process feedback 2.	100 = 1
27.09	PID fbk gain	Multiplier for scaling the final feedback value for process PID controller.	
	-32.768 … 32.767	PID feedback gain.	1000 = 1

No.	Name/Value	Description	FbEq
27.10	PID fbk ftime	Defines the time constant for the filter through which the process feedback is connected to the PID controller.	
	0.000 … 30.000 s	Filter time constant.  $O = I \times (1 - e^{-t/T})$ I = filter input (step) O = filter output *t* = time T = filter time constant	1000 = 1 s
27.12	PID gain	Defines the gain for the process PID controller. See parameter *27.13 PID integ time*.	
	0.00 … 100.00	Gain for PID controller.	100 = 1
27.13	PID integ time	Defines the integration time for the process PID controller.  I = controller input (error) O = controller output G = gain Ti = integration time	
	0.00 … 320.00 s	Integration time.	100 = 1 s
27.14	PID deriv time	Defines the derivation time of the process PID controller. The derivative component at the controller output is calculated on basis of two consecutive error values (E_{K-1} and E_K) according to the following formula: PID DERIV TIME × $(E_K - E_{K-1})/T_S$, in which T_S = 12 ms sample time E = Error = Process reference - process actual value.	
	0.00 … 10.00 s	Derivation time.	100 = 1 s

No.	Name/Value	Description	FbEq
27.15	PID deriv filter	Defines the time constant of the 1-pole filter used to smooth the derivative component of the process PID controller.  $O = I \times (1 - e^{-t/T})$ I = filter input (step) O = filter output *t* = time T = filter time constant	
	0.00 … 10.00 s	Filter time constant.	100 = 1 s
27.16	PID error inv	PID error inversion. When the source selected by this parameter is on, the error (process setpoint – process feedback) at the PID controller input is inverted.	
	Const	Bit pointer setting (see *Terms and abbreviations* on page *63*).	-
	Pointer		
27.18	PID maximum	Defines the maximum limit for the PID controller output. Using the minimum and maximum limits, it is possible to restrict the operation range.	
	-32768.0 … 32768.0	Maximum limit for PID controller output.	10 = 1
27.19	PID minimum	Defines the minimum limit for the PID controller output. See parameter *27.18 PID maximum*.	
	-32768.0 … 32768.0	Minimum limit for PID controller output.	10 = 1
27.22	Sleep mode	Activates the sleep function.	
	No	Sleep function inactive.	0
	Internal	The sleep function is activated and deactivated automatically as defined by parameters *27.23 Sleep level* and *27.24 Sleep delay*. The sleep and wake-up delays (*27.24 Sleep delay* and *27.26 Wake up delay*) are effective.	1
	External	The sleep function is activated by the source selected by parameter *27.27 Sleep ena*. The sleep and wake-up delays (*27.24 Sleep delay* and *27.26 Wake up delay*) are effective.	2
27.23	Sleep level	Defines the start limit for the sleep function. If the motor speed is below this value longer than the sleep delay (*27.24 Sleep delay*), the drive shifts to sleep mode.	
	-32768.0 … 32768.0	Sleep start level.	10 = 1

No.	Name/Value	Description	FbEq
27.24	Sleep delay	Defines the delay for the sleep start function. See parameter *27.23 Sleep level*. When the motor speed falls below the sleep level, the counter starts. When the motor speed exceeds the sleep level, the counter resets.	
	0.0 … 360.0 s	Sleep start delay.	10 = 1 s
27.25	Wake up level	Defines the wake-up limit for the sleep function. The drive wakes up if the process actual value is below a set level (*27.23 Sleep level*) longer than the wake-up delay (*27.24 Sleep delay*).	
	0.0 … 32768.0	Wake-up level.	10 = 1
27.26	Wake up delay	Defines the wake-up delay for the sleep function. See parameter *27.25 Wake up level*. When the process actual value falls below the wake-up level, the wake-up counter starts. When the process actual value exceeds the wake-up level, the counter resets.	
	0.0 … 360.0 s	Wake-up delay.	10 = 1 s
27.27	Sleep ena	Defines a source that can be used to activate sleep mode when parameter *27.22 Sleep mode* is set to *External*.	
	DI1	Digital input DI1 (as indicated by *02.01 DI status*, bit 0).	1073742337
	DI2	Digital input DI2 (as indicated by *02.01 DI status*, bit 1).	1073807873
	DI3	Digital input DI3 (as indicated by *02.01 DI status*, bit 2).	1073873409
	DI4	Digital input DI4 (as indicated by *02.01 DI status*, bit 3).	1073938945
	DI5	Digital input DI5 (as indicated by *02.01 DI status*, bit 4).	1074004481
	DI6	Digital input DI6 (as indicated by *02.01 DI status*, bit 5).	1074070017
	Const	Bit pointer setting (see *Terms and abbreviations* on page *63*).	-
	Pointer		

30 Fault functions		Selects the behavior of the drive upon various fault situations.	
30.01	External fault	Selects an source for an external fault signal. 0 = External fault trip 1 = No external fault	
	DI1	Digital input DI1 (as indicated by *02.01 DI status*, bit 0).	1073742337
	DI2	Digital input DI2 (as indicated by *02.01 DI status*, bit 1).	1073807873
	DI3	Digital input DI3 (as indicated by *02.01 DI status*, bit 2).	1073873409
	DI4	Digital input DI4 (as indicated by *02.01 DI status*, bit 3).	1073938945
	DI5	Digital input DI5 (as indicated by *02.01 DI status*, bit 4).	1074004481
	DI6	Digital input DI6 (as indicated by *02.01 DI status*, bit 5).	1074070017
	DIO4	Digital input/output DIO4 (as indicated by *02.03 DIO status*, bit 3).	1073938947
	DIO5	Digital input/output DIO5 (as indicated by *02.03 DIO status*, bit 4).	1074004483
	DIO6	Digital input/output DIO6 (as indicated by *02.03 DIO status*, bit 5).	1074070019
	Const	Bit pointer setting (see *Terms and abbreviations* on page *63*).	-
	Pointer		

No.	Name/Value	Description	FbEq
30.02	Speed ref safe	Defines the safe speed reference that is used with the *Spd ref Safe* setting of supervision parameters *13.32 AI superv func*, *30.03 Local ctrl loss* or *50.02 Comm loss func* upon an alarm. This speed is used when the parameter is set to *Spd ref Safe*.	
	-30000 … 30000 rpm	Safe speed reference.	1 = 1 rpm
30.03	Local ctrl loss	Selects how the drive reacts to a control panel or PC tool communication break.	
	No	No action taken.	0
	Fault	Drive trips on fault LOCAL CTRL LOSS.	1
	Spd ref Safe	The drive generates alarm LOCAL CTRL LOSS and sets the speed to the speed defined by parameter *30.02 Speed ref safe*.  **WARNING!** Make sure that it is safe to continue operation in case of a communication break.	2
	Last speed	The drive generates alarm LOCAL CTRL LOSS and freezes the speed to the level the drive was operating at. The speed is determined by the average speed over the previous 10 seconds.  **WARNING!** Make sure that it is safe to continue operation in case of a communication break.	3
30.04	Mot phase loss	Selects how the drive reacts when a motor phase loss is detected.	
	No	No action taken.	0
	Fault	The drive trips on fault MOTOR PHASE.	1
30.05	Earth fault	Selects how the drive reacts when an earth fault or current unbalance is detected in the motor or the motor cable.	
	No	No action taken.	0
	Warning	The drive generates alarm EARTH FAULT.	1
	Fault	The drive trips on fault EARTH FAULT.	2
30.06	Suppl phs loss	Selects how the drive reacts when a supply phase loss is detected.	
	No	No action taken.	0
	Fault	The drive trips on fault SUPPLY PHASE.	1
30.07	Sto diagnostic	Selects how the drive reacts when the drive detects that the Safe Torque Off function is active while the drive is stopped. The Safe Torque Off function disables the control voltage of the power semiconductors of the drive output stage, thus preventing the inverter from generating the voltage required to rotate the motor. For the wiring of the Safe Torque Off circuit, see the appropriate hardware manual. **Notes:** • This parameter is for supervision only. The Safe Torque Off function can activate even when this parameter is set to *No*. • Fault STO 1 LOST / STO 2 LOST is activated if safety circuit signal 1/2 is lost when the drive is in stopped state and this parameter is set to *Alarm* or *No*.	
	Fault	The drive trips on fault SAFE TORQUE OFF.	1

No.	Name/Value	Description	FbEq
	Alarm	The drive generates alarm SAFE TORQUE OFF.	2
	No	No action taken.	3
30.08	Cross connection	Selects how the drive reacts to incorrect input power and motor cable connection (i.e. input power cable is connected to drive motor connection).	
	No	No action taken.	0
	Fault	The drive trips on fault CABLE CROSS CON.	1
30.09	Stall function	Selects how the drive reacts to a motor stall condition. The protection wakes up if • the drive is at stall current limit (defined by parameter *30.10 Stall curr lim*) or *06.05 Limit word1* differs from 0 • the output frequency is below the level set by parameter *30.11 Stall freq hi*, and • the conditions above have been valid longer than the time set by parameter *30.12 Stall time*. See section *Stall protection (parameters 30.09…30.12)* on page *43*.	

Bit	Function
0	Ena sup (Enable supervision) 0 = Disabled: Supervision disabled. 1 = Enabled: Supervision enabled.
1	Ena warn (Enable warning) 0 = Disabled 1 = Enabled: Drive generates an alarm upon a stall condition.
2	Ena fault (Enable fault) 0 = Disabled 1 = Enabled: Drive trips on a fault upon a stall condition.

30.10	Stall curr lim	Stall current limit in percent of the nominal current of the motor. See parameter *30.09 Stall function*.	
	0.0 … 1600.0%	Stall current limit.	10 = 1%
30.11	Stall freq hi	Stall frequency limit. See parameter *30.09 Stall function*.	
	0.5 … 1000.0 Hz	Stall frequency limit.	10 = 1 Hz
30.12	Stall time	Stall time. See parameter *30.09 Stall function*.	
	0 … 3600 s	Stall time.	1 = 1 s

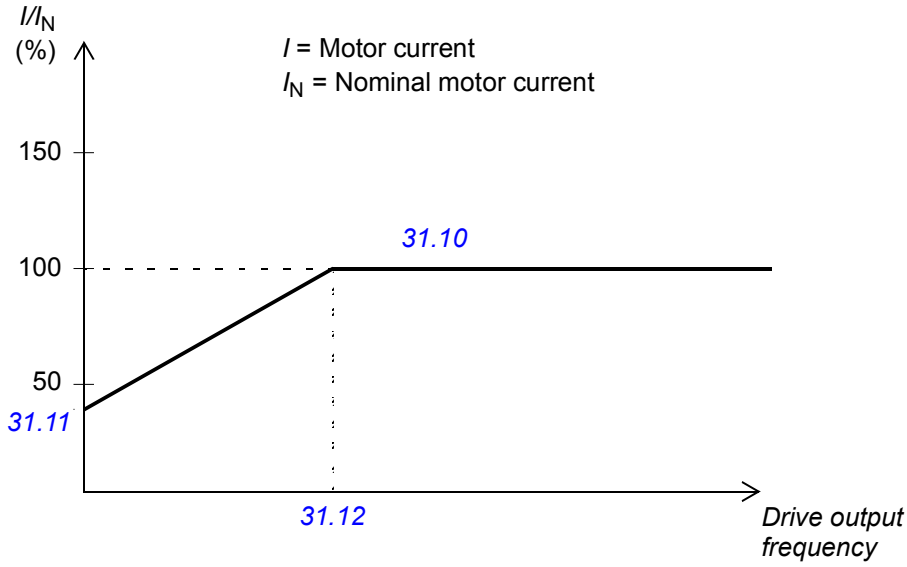
31 Mot therm prot		Motor temperature measurement and thermal protection settings.	
31.01	Mot temp1 prot	Selects how the drive reacts when motor overtemperature is detected by motor thermal protection 1.	
	No	Motor thermal protection 1 inactive.	0
	Alarm	The drive generates alarm MOTOR TEMPERATURE when the temperature exceeds the alarm level defined by parameter *31.03 Mot temp1 almLim*.	1
	Fault	The drive generates alarm MOTOR TEMPERATURE or trips on fault MOTOR OVERTEMP when the temperature exceeds the alarm/fault level defined by parameter *31.02 Mot temp1 almLim* / *31.03 Mot temp1 almLim* (whichever is lower).	2

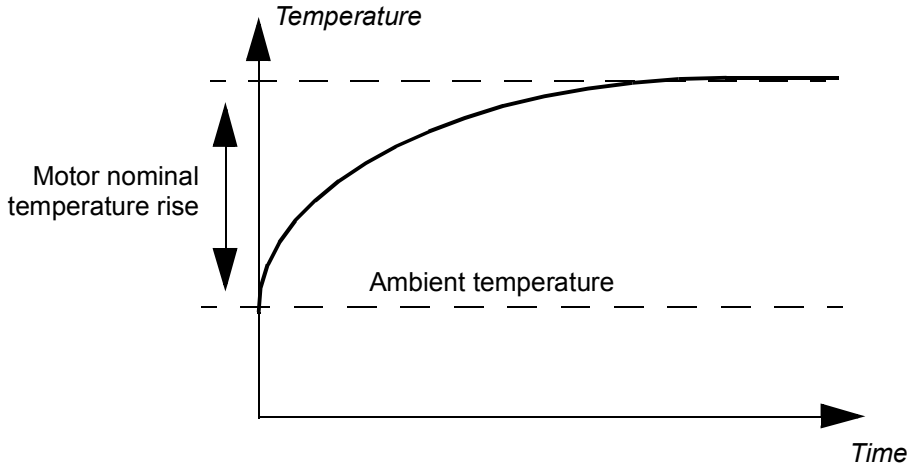
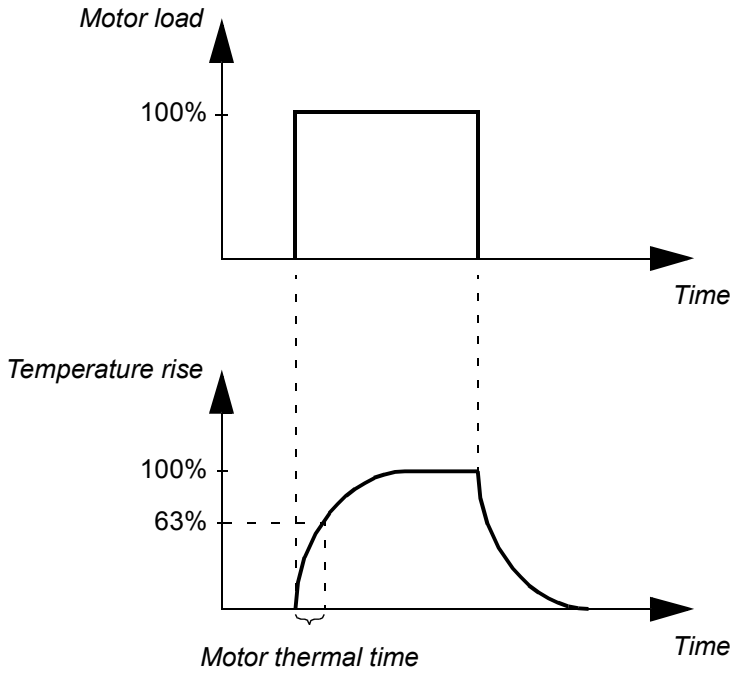
No.	Name/Value	Description	FbEq
31.02	Mot temp1 src	Selects the means of temperature measurement for motor thermal protection 1. When overtemperature is detected the drive reacts as defined by parameter *31.01 Mot temp1 prot*. **Note:** If one FEN-xx module is used, parameter setting must be either KTY 1st FEN or PTC 1st FEN. The FEN-xx module can be in either Slot 1 or Slot 2.	
	Estimated	The temperature is supervised based on the motor thermal protection model, which uses the motor thermal time constant (parameter *31.14 Mot therm time*) and the motor load curve (parameters *31.10*…*31.12*). User tuning is typically needed only if the ambient temperature differs from the normal operating temperature specified for the motor. The motor temperature increases if it operates in the region above the motor load curve. The motor temperature decreases if it operates in the region below the motor load curve (if the motor is overheated). **WARNING!** The model does not protect the motor if it does not cool properly due to dust and dirt.	0
	KTY JCU	The temperature is supervised using a KTY84 sensor connected to drive thermistor input TH.	1
	KTY 1st FEN	The temperature is supervised using a KTY84 sensor connected to encoder interface module FEN-xx installed in drive Slot 1/2. If two encoder interface modules are used, encoder module connected to Slot 1 is used for the temperature supervision. **Note:** This selection does not apply to FEN-01.	2
	KTY 2nd FEN	The temperature is supervised using a KTY84 sensor connected to encoder interface module FEN-xx installed in drive Slot 1/2. If two encoder interface modules are used, encoder module connected to Slot 2 is used for the temperature supervision. **Note:** This selection does not apply to FEN-01.	3
	PTC JCU	The temperature is supervised using 1…3 PTC sensors connected to drive thermistor input TH.	4
	PTC 1st FEN	The temperature is supervised using a PTC sensor connected to encoder interface module FEN-xx installed in drive Slot 1/2. If two encoder interface modules are used, encoder module connected to Slot 1 is used for the temperature supervision.	5
	PTC 2nd FEN	The temperature is supervised using a PTC sensor connected to encoder interface module FEN-xx installed in drive Slot 1/2. If two encoder interface modules are used, encoder module connected to Slot 2 is used for the temperature supervision.	6
	Pt100 JCU x1	The temperature is supervised using a Pt100 sensor connected to analog input AI1 and analog output AO1 on the JCU Control Unit of the drive.	7
	Pt100 JCU x2	The temperature is supervised using two Pt100 sensors connected to analog input AI1 and analog output AO1 on the JCU Control Unit of the drive.	8
	Pt100 JCU x3	The temperature is supervised using three Pt100 sensors connected to analog input AI1 and analog output AI1 on the JCU Control Unit of the drive.	9

No.	Name/Value	Description	FbEq
	Pt100 Ext x1	The temperature is supervised using a Pt100 sensor connected to the first available analog input and analog output on I/O extensions installed on the drive.	10
	Pt100 Ext x2	The temperature is supervised using two Pt100 sensors connected to the first available analog input and analog output on I/O extensions installed on the drive.	11
	Pt100 Ext x3	The temperature is supervised using three Pt100 sensors connected to the first available analog input and analog output on I/O extensions installed on the drive.	12
31.03	Mot temp1 almLim	Defines the alarm limit for motor thermal protection 1 (when parameter *31.01 Mot temp1 prot* is set to either *Alarm* or *Fault*).	
	0 … 200 °C	Motor overtemperature alarm limit.	1 = 1 °C
31.04	Mot temp1 fltLim	Defines the fault limit for the motor thermal protection 1 (when parameter *31.01 Mot temp1 prot* is set to *Fault*).	
	0 … 200 °C	Motor overtemperature fault limit.	1 = 1 °C
31.05	Mot temp2 prot	Selects how the drive reacts when motor overtemperature is detected by motor temperature protection 2.	
	No	Motor temperature protection 2 inactive.	0
	Alarm	The drive generates alarm MOTTEMPAL2 when the temperature exceeds the alarm level defined by parameter *31.07 Mot temp2 almLim*.	1
	Fault	The drive generates alarm MOTTEMPAL2 or trips on fault MOTTEMP2 when the temperature exceeds the alarm/fault level defined by parameter *31.07 Mot temp2 almLim* / *31.08 Mot temp2 fltLim* (whichever is lower).	2
31.06	Mot temp2 src	Selects the means of temperature measurement for motor thermal protection 2. When overtemperature is detected the drive reacts as defined by parameter *31.05 Mot temp2 prot*. **Note:** If one FEN-xx module is used, parameter setting must be either KTY 1st FEN or PTC 1st FEN. The FEN-xx module can be in either Slot 1 or Slot 2.	
	Estimated	The temperature is supervised based on the motor thermal protection model, which uses the motor thermal time constant (parameter *31.14 Mot therm time*) and the motor load curve (parameters *31.10*…*31.12*). User tuning is typically needed only if the ambient temperature differs from the normal operating temperature specified for the motor. The motor temperature increases if it operates in the region above the motor load curve. The motor temperature decreases if it operates in the region below the motor load curve (if the motor is overheated). **WARNING!** The model does not protect the motor if it does not cool properly due to dust and dirt.	0
	KTY JCU	The temperature is supervised using a KTY84 sensor connected to drive thermistor input TH.	1
	KTY 1st FEN	The temperature is supervised using a KTY84 sensor connected to encoder interface module FEN-xx installed in drive Slot 1/2. If two encoder interface modules are used, encoder module connected to Slot 1 is used for the temperature supervision. Note: This selection does not apply to FEN-01.	2

No.	Name/Value	Description	FbEq
	KTY 2nd FEN	The temperature is supervised using a KTY84 sensor connected to encoder interface module FEN-xx installed in drive Slot 1/2. If two encoder interface modules are used, encoder module connected to Slot 2 is used for the temperature supervision. **Note:** This selection does not apply to FEN-01.	3
	PTC JCU	The temperature is supervised using 1…3 PTC sensors connected to drive thermistor input TH.	4
	PTC 1st FEN	The temperature is supervised using a PTC sensor connected to encoder interface module FEN-xx installed in drive Slot 1/2. If two encoder interface modules are used, encoder module connected to Slot 1 is used for the temperature supervision.	5
	PTC 2nd FEN	The temperature is supervised using a PTC sensor connected to encoder interface module FEN-xx installed in drive Slot 1/2. If two encoder interface modules are used, encoder module connected to Slot 2 is used for the temperature supervision.	6
	Pt100 JCU x1	The temperature is supervised using a Pt100 sensor connected to analog input AI1 and analog output AO1 on the JCU Control Unit of the drive.	7
	Pt100 JCU x2	The temperature is supervised using two Pt100 sensors connected to analog input AI1 and analog output AO1 on the JCU Control Unit of the drive.	8
	Pt100 JCU x3	The temperature is supervised using three Pt100 sensors connected to analog input AI1 and analog output AI1 on the JCU Control Unit of the drive.	9
	Pt100 Ext x1	The temperature is supervised using a Pt100 sensor connected to the first available analog input and analog output on I/O extensions installed on the drive.	10
	Pt100 Ext x2	The temperature is supervised using two Pt100 sensors connected to the first available analog input and analog output on I/O extensions installed on the drive.	11
	Pt100 Ext x3	The temperature is supervised using three Pt100 sensors connected to the first available analog input and analog output on I/O extensions installed on the drive.	12
31.07	Mot temp2 almLim	Defines the alarm limit for the motor thermal protection 2 (when parameter *31.05 Mot temp2 prot* is set to either *Alarm* or *Fault*).	
	0 … 200 °C	Motor overtemperature alarm limit.	1 = 1 °C
31.08	Mot temp2 fltLim	Defines the fault limit for the motor thermal protection 2 (when parameter *31.05 Mot temp2 prot* is set to *Fault*).	
	0 … 200 °C	Motor overtemperature fault limit.	1 = 1 °C
31.09	Mot ambient temp	Defines the ambient temperature for the thermal protection mode.	
	-60 … 100 °C	Ambient temperature.	1 = 1 °C

No.	Name/Value	Description	FbEq
31.10	Mot load curve	Defines the load curve together with parameters *31.11 Zero speed load* and *31.12 Break point* When the parameter is set to 100%, the maximum load is equal to the value of parameter *99.06 Mot nom current* (higher loads heat up the motor). The load curve level should be adjusted if the ambient temperature differs from the nominal value. The load curve is used by the motor thermal protection model when parameter *31.02 Mot temp1 src* is set to *Estimated*.	
	50 … 150%	Maximum load for the motor load curve.	1 = 1%
31.11	Zero speed load	Defines the motor load curve together with parameters *31.10 Mot load curve* and *31.12 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 *31.10 Mot load curve*.	
	50 … 150%	Zero speed load for the motor load curve.	1 = 1%
31.12	Break point	Defines the motor load curve together with parameters *31.10 Mot load curve* and *31.11 Zero speed load*. Defines the break point frequency of the load curve i.e. the point at which the motor load curve begins to decrease from the value of parameter *31.10 Mot load curve* towards the value of parameter *31.11 Zero speed load*. See parameter *31.10 Mot load curve*.	
	0.01 … 500.00 Hz	Break point for the motor load curve.	100 = 1 Hz



No.	Name/Value	Description	FbEq
31.13	Mot nom tempRise	Defines the temperature rise of the motor when the motor is loaded with nominal current. See the motor manufacturer's recommendations. The temperature rise value is used by the motor thermal protection model when parameter *31.02 Mot temp1 src* is set to *Estimated*.  	
	0 … 300 °C	Temperature rise.	1 = 1 °C
31.14	Mot therm time	Defines the thermal time constant for the motor thermal protection model (i.e. time inside which the temperature has reached 63% of the nominal temperature). See the motor manufacturer's recommendations. The motor thermal protection model is used when parameter *31.02 Mot temp1 src* is set to *Estimated*.  	
	100 … 10000 s	Motor thermal time constant.	1 = 1 s

No.	Name/Value	Description	FbEq
32 Automatic reset		Defines conditions for automatic fault resets.	
32.01	Autoreset sel	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. The bits of the binary number correspond to the following faults:	

Bit	Fault
0	Overcurrent
1	Overvoltage
2	Undervoltage
3	AI min
4	Line converter
5	External fault

32.02	Number of trials	Defines the number of automatic fault resets the drive performs within the time defined by parameter *32.03 Trial time*.	
	0 … 5	Number of automatic resets.	1 = 1
32.03	Trial time	Defines the time for the automatic fault reset function. See parameter *32.02 Number of trials*.	
	1.0 … 600.0 s	Time for automatic resets.	10 = 1 s
32.04	Delay time	Defines the time that the drive will wait after a fault before attempting an automatic reset. See parameter *32.01 Autoreset sel*.	
	0.0 … 120.0 s	Resetting delay.	10 = 1 s
33 Supervision		Configuration of signal supervision.	
33.01	Superv1 func	Selects the mode of supervision 1.	
	Disabled	Supervision 1 not in use.	0
	Low	When the signal selected by parameter *33.02 Superv1 act* falls below the value of parameter *33.04 Superv1 lo*, bit 0 of *06.13 Superv status* is activated.	1
	High	When the signal selected by parameter *33.02 Superv1 act* exceeds the value of parameter *33.03 Superv1 hi*, bit 0 of *06.13 Superv status* is activated.	2
	Abs Low	When the absolute value of the signal selected by parameter *33.02 Superv1 act* falls below the value of parameter *33.04 Superv1 lo*, bit 0 of *06.13 Superv status* is activated.	3
	Abs High	When the absolute value of the signal selected by parameter *33.02 Superv1 act* exceeds the value of parameter *33.03 Superv1 hi*, bit 0 of *06.13 Superv status* is activated.	4
33.02	Superv1 act	Selects the signal to be monitored by supervision 1. See parameter *33.01 Superv1 func*.	
	Speed rpm	*01.01 Motor speed rpm* (see page *64*).	1073742081
	Speed %	*01.02 Motor speed %* (see page *64*).	1073742082
	Frequency	*01.03 Output frequency* (see page *64*).	1073742083
	Current	*01.04 Motor current* (see page *64*).	1073742084
	Current %	*01.05 Motor current %* (see page *64*).	1073742085

No.	Name/Value	Description	FbEq
	Torque	*01.06 Motor torque* (see page *64*).	1073742086
	Dc-voltage	*01.07 Dc-voltage* (see page *64*).	1073742087
	Power inu	*01.22 Power inu out* (see page *64*).	1073742102
	Power motor	*01.23 Motor power* (see page *64*).	1073742103
	SpRef unramp	*03.03 SpeedRef unramp* (see page *71*).	1073742595
	SpRef ramped	*03.05 SpeedRef ramped* (see page *71*).	1073742597
	SpRef used	*03.06 SpeedRef used* (see page *71*).	1073742598
	TorqRef used	*03.14 Torq ref used* (see page *71*).	1073742606
	Process act	*04.03 Process act* (see page *72*).	1073742851
	Proc PID out	*04.05 Process PID out* (see page *72*).	1073742853
	Pointer	Value pointer setting (see *Terms and abbreviations* on page *63*).	-
33.03	Superv1 hi	Selects the upper limit for supervision 1. See parameter *33.01 Superv1 func*.	
	-32768.00 … 32768.00	Upper limit for supervision 1.	100 = 1
33.04	Superv1 lo	Selects the lower limit for supervision 1. See parameter *33.01 Superv1 func*.	
	-32768.00 … 32768.00	Lower limit for supervision 1.	100 = 1
33.05	Superv2 func	Selects the mode of supervision 2.	
	Disabled	Supervision 2 not in use.	0
	Low	When the signal selected by parameter *33.06 Superv2 act* falls below the value of parameter *33.08 Superv2 lo*, bit 1 of *06.13 Superv status* is activated.	1
	High	When the signal selected by parameter *33.06 Superv2 act* exceeds the value of parameter *33.07 Superv2 hi*, bit 1 of *06.13 Superv status* is activated.	2
	Abs Low	When the absolute value of the signal selected by parameter *33.06 Superv2 act* falls below the value of parameter *33.08 Superv2 lo*, bit 1 of *06.13 Superv status* is activated.	3
	Abs High	When the absolute value of the signal selected by parameter *33.06 Superv2 act* exceeds the value of parameter *33.07 Superv2 hi*, bit 1 of *06.13 Superv status* is activated.	4
33.06	Superv2 act	Selects the signal to be monitored by supervision 2. See parameter *33.05 Superv2 func*.	
	Speed rpm	*01.01 Motor speed rpm* (see page *64*).	1073742081
	Speed %	*01.02 Motor speed %* (see page *64*).	1073742082
	Frequency	*01.03 Output frequency* (see page *64*).	1073742083
	Current	*01.04 Motor current* (see page *64*).	1073742084
	Current %	*01.05 Motor current %* (see page *64*).	1073742085
	Torque	*01.06 Motor torque* (see page *64*).	1073742086
	Dc-voltage	*01.07 Dc-voltage* (see page *64*).	1073742087
	Power inu	*01.22 Power inu out* (see page *64*).	1073742102
	Power motor	*01.23 Motor power* (see page *64*).	1073742103
	SpRef unramp	*03.03 SpeedRef unramp* (see page *71*).	1073742595

No.	Name/Value	Description	FbEq
	SpRef ramped	*03.05 SpeedRef ramped* (see page *71*).	1073742597
	SpRef used	*03.06 SpeedRef used* (see page *71*).	1073742598
	TorqRef used	*03.14 Torq ref used* (see page *71*).	1073742606
	Process act	*04.03 Process act* (see page *72*).	1073742851
	Proc PID out	*04.05 Process PID out* (see page *72*).	1073742853
	Pointer	Value pointer setting (see *Terms and abbreviations* on page *63*).	-
33.07	Superv2 hi	Selects the upper limit for supervision 2. See parameter *33.05 Superv2 func*.	
	-32768.00 … 32768.00	Upper limit for supervision 2.	100 = 1
33.08	Superv2 lo	Selects the lower limit for supervision 2. See parameter *33.05 Superv2 func*.	
	-32768.00 … 32768.00	Lower limit for supervision 2.	100 = 1
33.09	Superv3 func	Selects the mode of supervision 3.	
	Disabled	Supervision 3 not in use.	0
	Low	When the signal selected by parameter *33.10 Superv3 act* falls below the value of parameter *33.12 Superv3 lo*, bit 2 of *06.13 Superv status* is activated.	1
	High	When the signal selected by parameter *33.10 Superv2 act* exceeds the value of parameter *33.11 Superv3 hi*, bit 2 of *06.13 Superv status* is activated.	2
	Abs Low	When the absolute value of the signal selected by parameter *33.10 Superv3 act* falls below the value of parameter *33.12 Superv3 lo*, bit 2 of *06.13 Superv status* is activated.	3
	Abs High	When the absolute value of the signal selected by parameter *33.10 Superv2 act* exceeds the value of parameter *33.11 Superv3 hi*, bit 2 of *06.13 Superv status* is activated.	4
33.10	Superv3 act	Selects the signal to be monitored by supervision 3. See parameter *33.09 Superv3 func*.	
	Speed rpm	*01.01 Motor speed rpm* (see page *64*).	1073742081
	Speed %	*01.02 Motor speed %* (see page *64*).	1073742082
	Frequency	*01.03 Output frequency* (see page *64*).	1073742083
	Current	*01.04 Motor current* (see page *64*).	1073742084
	Current %	*01.05 Motor current %* (see page *64*).	1073742085
	Torque	*01.06 Motor torque* (see page *64*).	1073742086
	Dc-voltage	*01.07 Dc-voltage* (see page *64*).	1073742087
	Power inu	*01.22 Power inu out* (see page *64*).	1073742102
	Power motor	*01.23 Motor power* (see page *64*).	1073742103
	SpRef unramp	*03.03 SpeedRef unramp* (see page *71*).	1073742595
	SpRef ramped	*03.05 SpeedRef ramped* (see page *71*).	1073742597
	SpRef used	*03.06 SpeedRef used* (see page *71*).	1073742598
	TorqRef used	*03.14 Torq ref used* (see page *71*).	1073742606
	Process act	*04.03 Process act* (see page *72*).	1073742851
	Proc PID out	*04.05 Process PID out* (see page *72*).	1073742853

No.	Name/Value	Description	FbEq
	Pointer	Value pointer setting (see *Terms and abbreviations* on page *63*).	-
33.11	Superv3 hi	Selects the upper limit for supervision 3. See parameter *33.09 Superv3 func*.	
	-32768.00 … 32768.00	Upper limit for supervision 3.	100 = 1
33.12	Superv3 lo	Selects the lower limit for supervision 3. See parameter *33.09 Superv3 func*.	
	-32768.00 … 32768.00	Lower limit for supervision 3.	100 = 1

34 User load curve		Definition of user load curve. See also section *User load curve* on page *50*.	
34.01	Overload func	Configures the supervision of the upper boundary of the user load curve.	

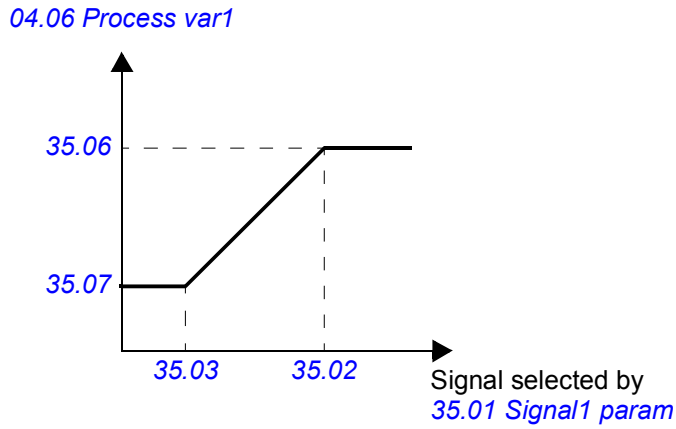
Bit	Function
0	Ena sup (Enable supervision) 0 = Disabled: Supervision disabled. 1 = Enabled: Supervision enabled.
1	Input value sel (Input value selection) 0 = Current: Current is supervised. 1 = Torque: Torque is supervised.
2	Ena warn (Enable warning) 0 = Disabled 1 = Enabled: Drive generates an alarm when the curve is exceeded.
3	Ena fault (Enable fault) 0 = Disabled 1 = Enabled: Drive trips on a fault when the curve is exceeded.
4	Ena lim integ (Enable limit integration) 0 = Disabled 1 = Enabled: Integration time defined by parameter *34.18 Load integ time* is used. After the supervision is evoked, the current or torque is limited by the upper boundary of the load curve.
5	Ena lim always (Enable limit always) 0 = Disabled 1 = Enabled: The current or torque is always limited by the upper boundary of the load curve.

No.	Name/Value	Description	FbEq
34.02	Underload func	Configures the supervision of the lower boundary of the user load curve.	

Bit	Function
0	Ena sup (Enable supervision) 0 = Disabled: Supervision disabled. 1 = Enabled: Supervision enabled.
1	Input value sel (Input value selection) 0 = Current: Current is supervised. 1 = Torque: Torque is supervised.
2	Ena warn (Enable warning) 0 = Disabled 1 = Enabled: Drive generates an alarm when the load remains below the curve for longer than the time defined by parameter *34.20 Underload time*.
3	Ena fault (Enable fault) 0 = Disabled 1 = Enabled: Drive trips on a fault when the load remains below the curve for longer than the time defined by parameter *34.20 Underload time*.

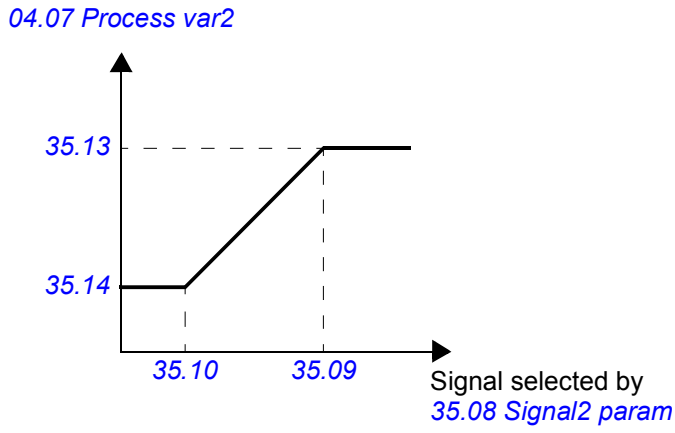
34.03	Load freq1	Drive output frequency at point 1 of user load curve.	
	1 … 500 Hz	Frequency at point 1.	1 = 1 Hz
34.04	Load freq2	Drive output frequency at point 2 of user load curve.	
	1 … 500 Hz	Frequency at point 2.	1 = 1 Hz
34.05	Load freq3	Drive output frequency at point 3 of user load curve.	
	1 … 500 Hz	Frequency at point 3.	1 = 1 Hz
34.06	Load freq4	Drive output frequency at point 4 of user load curve.	
	1 … 500 Hz	Frequency at point 4.	1 = 1 Hz
34.07	Load freq5	Drive output frequency at point 5 of user load curve.	
	1 … 500 Hz	Frequency at point 5.	1 = 1 Hz
34.08	Load low lim1	Minimum load (current or torque) at point 1 of user load curve.	
	0 … 1600%	Minimum load at point 1.	1 = 1%
34.09	Load low lim2	Minimum load (current or torque) at point 2 of user load curve.	
	0 … 1600%	Minimum load at point 2.	1 = 1%
34.10	Load low lim3	Minimum load (current or torque) at point 3 of user load curve.	
	0 … 1600%	Minimum load at point 3.	1 = 1%
34.11	Load low lim4	Minimum load (current or torque) at point 4 of user load curve.	
	0 … 1600%	Minimum load at point 4.	1 = 1%
34.12	Load low lim5	Minimum load (current or torque) at point 5 of user load curve.	
	0 … 1600%	Minimum load at point 5.	1 = 1%
34.13	Load high lim1	Maximum load (current or torque) at point 1 of user load curve.	
	0 … 1600%	Maximum load at point 1.	1 = 1%

No.	Name/Value	Description	FbEq
34.14	Load high lim2	Maximum load (current or torque) at point 2 of user load curve.	
	0 … 1600%	Maximum load at point 2.	1 = 1%
34.15	Load high lim3	Maximum load (current or torque) at point 3 of user load curve.	
	0 … 1600%	Maximum load at point 3.	1 = 1%
34.16	Load high lim4	Maximum load (current or torque) at point 4 of user load curve.	
	0 … 1600%	Maximum load at point 4.	1 = 1%
34.17	Load high lim5	Maximum load (current or torque) at point 5 of user load curve.	
	0 … 1600%	Maximum load at point 5.	1 = 1%
34.18	Load integ time	Integration time used in limit supervision whenever enabled by parameter *34.01*/*34.02*.	
	0 … 10000 s	Integration time.	1 = 1 s
34.19	Load cool time	Defines the cooling time. The output of the overload integrator is set to zero if the load stays continuously below the upper boundary of the user load curve.	
	0 … 10000 s	Load cooling time.	1 = 1 s
34.20	Underload time	Time for the underload function. See parameter *34.02 Underload func*.	
	0 … 10000 s	Underload time.	1 = 1 s
35 Process variable		Selection and modification of process variables for display as parameters *04.06* … *04.08*.	
35.01	Signal1 param	Selects a signal to be provided as parameter *04.06 Process var1*.	
	Speed rpm	*01.01 Motor speed rpm* (see page *64*).	1073742081
	Speed %	*01.02 Motor speed %* (see page *64*).	1073742082
	Frequency	*01.03 Output frequency* (see page *64*).	1073742083
	Current	*01.04 Motor current* (see page *64*).	1073742084
	Current %	*01.05 Motor current %* (see page *64*).	1073742085
	Torque	*01.06 Motor torque* (see page *64*).	1073742086
	Dc-voltage	*01.07 Dc-voltage* (see page *64*).	1073742087
	Power inu	*01.22 Power inu out* (see page *64*).	1073742102
	Power motor	*01.23 Motor power* (see page *64*).	1073742103
	SpRef unramp	*03.03 SpeedRef unramp* (see page *71*).	1073742595
	SpRef ramped	*03.05 SpeedRef ramped* (see page *71*).	1073742597
	SpRef used	*03.06 SpeedRef used* (see page *71*).	1073742598
	TorqRef used	*03.14 Torq ref used* (see page *71*).	1073742606
	Process act	*04.03 Process act* (see page *72*).	1073742851
	Proc PID out	*04.05 Process PID out* (see page *72*).	1073742853
	Pointer	Value pointer setting (see *Terms and abbreviations* on page *63*).	-

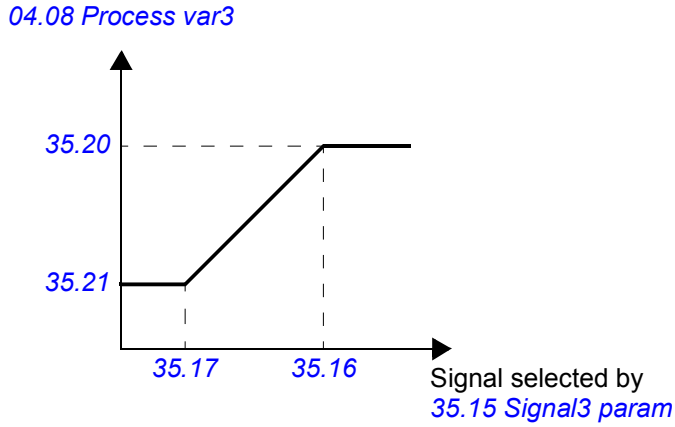
No.	Name/Value	Description	FbEq
35.02	Signal1 max	Defines the real value of the selected signal that corresponds to the maximum display value defined by parameter *35.06 Pros var1 max*.  	
	-32768…32768	Real signal value corresponding to maximum process variable 1 value.	1 = 1
35.03	Signal1 min	Defines the real value of the selected signal that corresponds to the minimum display value defined by parameter *35.07 Pros var1 min*. See diagram at parameter *35.02 Signal1 max*.	
	-32768…32768	Real signal value corresponding to minimum process variable 1 value.	1 = 1
35.04	Pros var1 dispf	Scaling for process variable 1. This setting also scales the value for fieldbus.	
	0	1 = 1	0
	1	10 = 1	1
	2	100 = 1	2
	3	1000 = 1	3
	4	10000 = 1	4
	5	100000 = 1	5
35.05	Pros var1 unit	Specifies the unit for parameter *04.06 Process var1* (process variable 1).	
	0	None	0
	1	A	1
	2	V	2
	3	Hz	3
	4	%	4
	5	s	5
	6	h	6
	7	rpm	7
	8	kh	8
	9	C	9
	10	lbft	10
	11	mA	11
	12	mV	12

No.	Name/Value	Description	FbEq
	13	kW	13
	14	W	14
	15	kWh	15
	16	F	16
	17	hp	17
	18	MWh	18
	19	m/s	19
	20	m3/h	20
	21	dm3/h	21
	22	bar	22
	23	kPa	23
	24	GPM	24
	25	PSI	25
	26	CFM	26
	27	ft	27
	28	MGD	28
	29	inHg	29
	30	FPM	30
	31	kbits	31
	32	kHz	32
	33	Ohm	33
	34	ppm	34
	35	pps	35
	36	l/s	36
	37	l/min	37
	38	l/h	38
	39	m3/s	39
	40	m3/m	40
	41	kg/s	41
	42	kg/m	42
	43	kg/h	43
	44	mbar	44
	45	Pa	45
	46	GPS	46
	47	gal/s	47
	48	gal/m	48
	49	gal/h	49
	50	ft3/s	50
	51	ft3/m	51
	52	ft3/h	52
	53	lb/s	53

No.	Name/Value	Description	FbEq
	54	lb/m	54
	55	lb/h	55
	56	FPS	56
	57	ft/s	57
	58	inH2O	58
	59	inwg	59
	60	ftwg	60
	61	lbsi	61
	62	ms	62
	63	Mrev	63
	64	days	64
	65	inWC	65
	66	mpmin	66
	67…69	[blank]	67…69
	70	rev	70
	71	deg	71
	72	m	72
	73	inch	73
	74	inc	74
	75…79	[blank]	75…79
	80	u/s	80
	81	u/min	81
	82	u/h	82
	83…84	[blank]	83…84
	85	u/s^2	85
	86	min-2	86
	87	u/h^2	87
	88…89	[blank]	88…89
	90	Vrms	90
	91	bits	91
	92	Nm	92
	93	p.u.	93
	94	1/s	94
	95	mH	95
	96	mOhm	96
	97	us	97
	98	C/W	98
35.06	Pros var1 max	Maximum value for process variable 1. See diagram at parameter *35.02 Signal1 max*.	
	-32768…32768	Maximum value for process variable 1.	1 = 1

No.	Name/Value	Description	FbEq
35.07	Pros var1 min	Minimum value for process variable 1. See diagram at parameter *35.02 Signal1 max*.	
	-32768…32768	Minimum value for process variable 1.	1 = 1
35.08	Signal2 param	Selects a signal to be provided as parameter *04.07 Process var2*.	
	Speed rpm	*01.01 Motor speed rpm* (see page *64*).	1073742081
	Speed %	*01.02 Motor speed %* (see page *64*).	1073742082
	Frequency	*01.03 Output frequency* (see page *64*).	1073742083
	Current	*01.04 Motor current* (see page *64*).	1073742084
	Current %	*01.05 Motor current %* (see page *64*).	1073742085
	Torque	*01.06 Motor torque* (see page *64*).	1073742086
	Dc-voltage	*01.07 Dc-voltage* (see page *64*).	1073742087
	Power inu	*01.22 Power inu out* (see page *64*).	1073742102
	Power motor	*01.23 Motor power* (see page *64*).	1073742103
	SpRef unramp	*03.03 SpeedRef unramp* (see page *71*).	1073742595
	SpRef ramped	*03.05 SpeedRef ramped* (see page *71*).	1073742597
	SpRef used	*03.06 SpeedRef used* (see page *71*).	1073742598
	TorqRef used	*03.14 Torq ref used* (see page *71*).	1073742606
	Process act	*04.03 Process act* (see page *72*).	1073742851
	Proc PID out	*04.05 Process PID out* (see page *72*).	1073742853
	Pointer	Value pointer setting (see *Terms and abbreviations* on page *63*).	-
35.09	Signal2 max	Defines the real value of the selected signal that corresponds to the maximum display value defined by parameter *35.13 Pros var2 max*. 	
	-32768…32768	Real signal value corresponding to maximum process variable 2 value.	1 = 1
35.10	Signal2 min	Defines the real value of the selected signal that corresponds to the minimum display value defined by parameter *35.14 Pros var2 min*. See diagram at parameter *35.09 Signal2 max*.	
	-32768…32768	Real signal value corresponding to minimum process variable 2 value.	1 = 1

No.	Name/Value	Description	FbEq
35.11	Pros var2 dispf	Scaling for process variable 2. This setting also scales the value for fieldbus.	
	0	1 = 1	0
	1	10 = 1	1
	2	100 = 1	2
	3	1000 = 1	3
	4	10000 = 1	4
	5	100000 = 1	5
35.12	Pros var2 unit	Specifies the unit for parameter *04.07 Process var2* (process variable 2).	
	0…98	See parameter *35.05 Pros var1 unit*.	1 = 1
35.13	Pros var2 max	Maximum value for process variable 2. See diagram at parameter *35.09 Signal2 max*.	
	-32768…32768	Maximum value for process variable 2.	1 = 1
35.14	Pros var2 min	Minimum value for process variable 2. See diagram at parameter *35.09 Signal2 max*.	
	-32768…32768	Minimum value for process variable 2.	1 = 1
35.15	Signal3 param	Selects a signal to be provided as parameter *04.08 Process var3*.	
	Speed rpm	*01.01 Motor speed rpm* (see page *64*).	1073742081
	Speed %	*01.02 Motor speed %* (see page *64*).	1073742082
	Frequency	*01.03 Output frequency* (see page *64*).	1073742083
	Current	*01.04 Motor current* (see page *64*).	1073742084
	Current %	*01.05 Motor current %* (see page *64*).	1073742085
	Torque	*01.06 Motor torque* (see page *64*).	1073742086
	Dc-voltage	*01.07 Dc-voltage* (see page *64*).	1073742087
	Power inu	*01.22 Power inu out* (see page *64*).	1073742102
	Power motor	*01.23 Motor power* (see page *64*).	1073742103
	SpRef unramp	*03.03 SpeedRef unramp* (see page *71*).	1073742595
	SpRef ramped	*03.05 SpeedRef ramped* (see page *71*).	1073742597
	SpRef used	*03.06 SpeedRef used* (see page *71*).	1073742598
	TorqRef used	*03.14 Torq ref used* (see page *71*).	1073742606
	Process act	*04.03 Process act* (see page *72*).	1073742851
	Proc PID out	*04.05 Process PID out* (see page *72*).	1073742853
	Pointer	Value pointer setting (see *Terms and abbreviations* on page *63*).	-

No.	Name/Value	Description	FbEq
35.16	Signal3 max	Defines the real value of the selected signal that corresponds to the maximum display value defined by parameter *35.20 Pros var3 max*.  	
	-32768…32768	Real signal value corresponding to maximum process variable 3 value.	1 = 1
35.17	Signal3 min	Defines the real value of the selected signal that corresponds to the minimum display value defined by parameter *35.21 Pros var3 min*. See diagram at parameter *35.16 Signal3 max*.	
	-32768…32768	Real signal value corresponding to minimum process variable 3 value.	1 = 1
35.18	Pros var3 dispf	Scaling for process variable 1. This setting also scales the value for fieldbus.	
	0	1 = 1	0
	1	10 = 1	1
	2	100 = 1	2
	3	1000 = 1	3
	4	10000 = 1	4
	5	100000 = 1	5
35.19	Pros var3 unit	Specifies the unit for parameter *04.08 Process var3* (process variable 3).	
	0…98	See parameter *35.05 Pros var1 unit*.	1 = 1
35.20	Pros var3 max	Maximum value for process variable 3. See diagram at parameter *35.16 Signal3 max*.	
	-32768…32768	Maximum value for process variable 3.	1 = 1
35.21	Pros var3 min	Minimum value for process variable 3. See diagram at parameter *35.16 Signal3 max*.	
	-32768…32768	Minimum value for process variable 3.	1 = 1

36 Timed functions	Configuration of timers. See also section *Timers* on page *48*.	
36.01 Timers enable	Enable/disable control for timers. Whenever the source selected by this parameter is off, timers are disabled; when the source is on, timers are enabled.	
DI1	Digital input DI1 (as indicated by *02.01 DI status*, bit 0).	1073742337
DI2	Digital input DI2 (as indicated by *02.01 DI status*, bit 1).	1073807873

No.	Name/Value	Description	FbEq
	DI3	Digital input DI3 (as indicated by *02.01 DI status*, bit 2).	1073873409
	DI4	Digital input DI4 (as indicated by *02.01 DI status*, bit 3).	1073938945
	DI5	Digital input DI5 (as indicated by *02.01 DI status*, bit 4).	1074004481
	DI6	Digital input DI6 (as indicated by *02.01 DI status*, bit 5).	1074070017
	DIO4	Digital input/output DIO4 (as indicated by *02.03 DIO status*, bit 3).	1073938947
	DIO5	Digital input/output DIO5 (as indicated by *02.03 DIO status*, bit 4).	1074004483
	DIO6	Digital input/output DIO6 (as indicated by *02.03 DIO status*, bit 5).	1074070019
	Const	Bit pointer setting (see *Terms and abbreviations* on page *63*).	-
	Pointer		
36.02	Timers mode	Specifies whether the time periods defined by parameters *36.03 Start time1* … *36.18 Stop day4* are valid daily or weekly.	

Bit	Function
0	Timer1 mode 0 = Daily 1 = Weekly
1	Timer2 mode 0 = Daily 1 = Weekly
2	Timer3 mode 0 = Daily 1 = Weekly
3	Timer4 mode 0 = Daily 1 = Weekly

36.03	Start time1	Defines the start time for time period 1.	
	00:00:00 … 24:00:00	Start time for time period 1.	1 = 1 s (24:00:00 = 86400)
36.04	Stop time1	Defines the stop time for time period 1.	
	00:00:00 … 24:00:00	Stop time for time period 1.	1 = 1 s (24:00:00 = 86400)
36.05	Start day1	Defines the week day on which time period 1 begins.	
	Monday	Time period 1 starts on Monday.	1
	Tuesday	Time period 1 starts on Tuesday.	2
	Wednesday	Time period 1 starts on Wednesday.	3
	Thursday	Time period 1 starts on Thursday.	4
	Friday	Time period 1 starts on Friday.	5
	Saturday	Time period 1 starts on Saturday.	6
	Sunday	Time period 1 starts on Sunday.	7
36.06	Stop day1	Defines the week day on which time period 1 ends.	
	Monday	Time period 1 ends on Monday.	1
	Tuesday	Time period 1 ends on Tuesday.	2

No.	Name/Value	Description	FbEq
	Wednesday	Time period 1 ends on Wednesday.	3
	Thursday	Time period 1 ends on Thursday.	4
	Friday	Time period 1 ends on Friday.	5
	Saturday	Time period 1 ends on Saturday.	6
	Sunday	Time period 1 ends on Sunday.	7
36.07	Start time2	Defines the start time for time period 2.	
	00:00:00 … 24:00:00	Start time for time period 2.	1 = 1 s (24:00:00 = 86400)
36.08	Stop time2	Defines the stop time for time period 2.	
	00:00:00 … 24:00:00	Stop time for time period 2.	1 = 1 s (24:00:00 = 86400)
36.09	Start day2	Defines the week day on which time period 2 begins.	
	Monday	Time period 2 starts on Monday.	1
	Tuesday	Time period 2 starts on Tuesday.	2
	Wednesday	Time period 2 starts on Wednesday.	3
	Thursday	Time period 2 starts on Thursday.	4
	Friday	Time period 2 starts on Friday.	5
	Saturday	Time period 2 starts on Saturday.	6
	Sunday	Time period 2 starts on Sunday.	7
36.10	Stop day2	Defines the week day on which time period 2 ends.	
	Monday	Time period 2 ends on Monday.	1
	Tuesday	Time period 2 ends on Tuesday.	2
	Wednesday	Time period 2 ends on Wednesday.	3
	Thursday	Time period 2 ends on Thursday.	4
	Friday	Time period 2 ends on Friday.	5
	Saturday	Time period 2 ends on Saturday.	6
	Sunday	Time period 2 ends on Sunday.	7
36.11	Start time3	Defines the start time for time period 3.	
	00:00:00 … 24:00:00	Start time for time period 3.	1 = 1 s (24:00:00 = 86400)
36.12	Stop time3	Defines the stop time for time period 3.	
	00:00:00 … 24:00:00	Stop time for time period 3.	1 = 1 s (24:00:00 = 86400)
36.13	Start day3	Defines the week day on which time period 3 begins.	
	Monday	Time period 3 starts on Monday.	1
	Tuesday	Time period 3 starts on Tuesday.	2
	Wednesday	Time period 3 starts on Wednesday.	3
	Thursday	Time period 3 starts on Thursday.	4
	Friday	Time period 3 starts on Friday.	5
	Saturday	Time period 3 starts on Saturday.	6

No.	Name/Value	Description	FbEq
	Sunday	Time period 3 starts on Sunday.	7
36.14	Stop day3	Defines the week day on which time period 3 ends.	
	Monday	Time period 3 ends on Monday.	1
	Tuesday	Time period 3 ends on Tuesday.	2
	Wednesday	Time period 3 ends on Wednesday.	3
	Thursday	Time period 3 ends on Thursday.	4
	Friday	Time period 3 ends on Friday.	5
	Saturday	Time period 3 ends on Saturday.	6
	Sunday	Time period 3 ends on Sunday.	7
36.15	Start time4	Defines the start time for time period 4.	
	00:00:00 … 24:00:00	Start time for time period 4.	1 = 1 s (24:00:00 = 86400)
36.16	Stop time4	Defines the stop time for time period 4.	
	00:00:00 … 24:00:00	Stop time for time period 4.	1 = 1 s (24:00:00 = 86400)
36.17	Start day4	Defines the week day on which time period 4 begins.	
	Monday	Time period 4 starts on Monday.	1
	Tuesday	Time period 4 starts on Tuesday.	2
	Wednesday	Time period 4 starts on Wednesday.	3
	Thursday	Time period 4 starts on Thursday.	4
	Friday	Time period 4 starts on Friday.	5
	Saturday	Time period 4 starts on Saturday.	6
	Sunday	Time period 4 starts on Sunday.	7
36.18	Stop day4	Defines the week day on which time period 4 ends.	
	Monday	Time period 4 ends on Monday.	1
	Tuesday	Time period 4 ends on Tuesday.	2
	Wednesday	Time period 4 ends on Wednesday.	3
	Thursday	Time period 4 ends on Thursday.	4
	Friday	Time period 4 ends on Friday.	5
	Saturday	Time period 4 ends on Saturday.	6
	Sunday	Time period 1 ends on Sunday.	7
36.19	Boost signal	Boosting can be used to extend the timer enable signal for the time defined by parameter *36.20 Boost time*. The boost time starts when the boost signal changes state from 1 to 0.	
	DI1	Digital input DI1 (as indicated by *02.01 DI status*, bit 0).	1073742337
	DI2	Digital input DI2 (as indicated by *02.01 DI status*, bit 1).	1073807873
	DI3	Digital input DI3 (as indicated by *02.01 DI status*, bit 2).	1073873409
	DI4	Digital input DI4 (as indicated by *02.01 DI status*, bit 3).	1073938945
	DI5	Digital input DI5 (as indicated by *02.01 DI status*, bit 4).	1074004481
	DI6	Digital input DI6 (as indicated by *02.01 DI status*, bit 5).	1074070017

No.	Name/Value	Description	FbEq
	DIO4	Digital input/output DIO4 (as indicated by *02.03 DIO status*, bit 3).	1073938947
	DIO5	Digital input/output DIO5 (as indicated by *02.03 DIO status*, bit 4).	1074004483
	DIO6	Digital input/output DIO6 (as indicated by *02.03 DIO status*, bit 5).	1074070019
	Const	Bit pointer setting (see *Terms and abbreviations* on page *63*).	-
	Pointer		
36.20	Boost time	Boost time. See parameter *36.19 Boost signal*.	
	00:00:00 … 24:00:00	Boost time.	1 = 1 s (24:00:00 = 86400)
36.21	Timed func1	Selects which time periods (1…4) are used with timed function 1. Also determines whether boost is used with timed function 1. The parameter is a 16-bit word with each bit corresponding to a function. Whenever a bit is set to 1, the corresponding function is in use. The bits of the binary number correspond to the following functions:	

Bit	Function
0	Timer1 ena (Time period 1 enable)
1	Timer2 ena (Time period 2 enable)
2	Timer3 ena (Time period 3 enable)
3	Timer4 ena (Time period 4 enable)
4	Boost ena (Boost enable)

36.22	Timed func2	Selects which time periods (1…4) are used with timed function 2. Also determines whether boost is used with timed function 2. The parameter is a 16-bit word with each bit corresponding to a function. Whenever a bit is set to 1, the corresponding function is in use. The bits of the binary number correspond to the following functions:	

Bit	Function
0	Timer1 ena (Time period 1 enable)
1	Timer2 ena (Time period 2 enable)
2	Timer3 ena (Time period 3 enable)
3	Timer4 ena (Time period 4 enable)
4	Boost ena (Boost enable)

No.	Name/Value	Description	FbEq
36.23	Timed func3	Selects which time periods (1…4) are used with timed function 3. Also determines whether boost is used with timed function 3. The parameter is a 16-bit word with each bit corresponding to a function. Whenever a bit is set to 1, the corresponding function is in use. The bits of the binary number correspond to the following functions:	

Bit	Function
0	Timer1 ena (Time period 1 enable)
1	Timer2 ena (Time period 2 enable)
2	Timer3 ena (Time period 3 enable)
3	Timer4 ena (Time period 4 enable)
4	Boost ena (Boost enable)

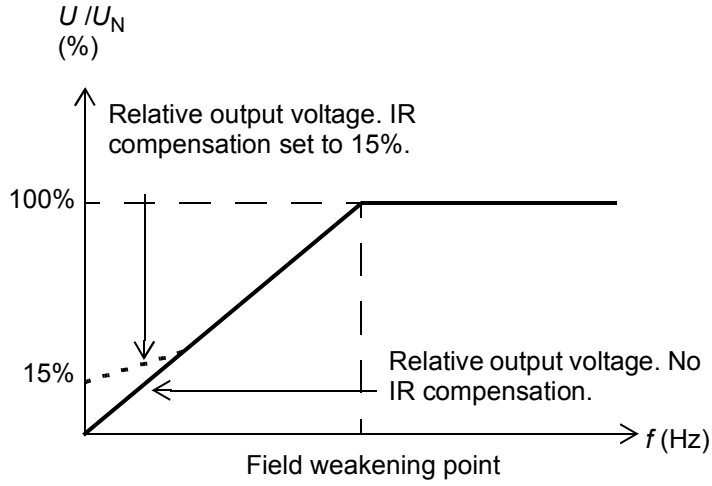
36.24	Timed func4	Selects which time periods (1…4) are used with timed function 4. Also determines whether boost is used with timed function 4. The parameter is a 16-bit word with each bit corresponding to a function. Whenever a bit is set to 1, the corresponding function is in use. The bits of the binary number correspond to the following functions:	

Bit	Function
0	Timer1 ena (Time period 1 enable)
1	Timer2 ena (Time period 2 enable)
2	Timer3 ena (Time period 3 enable)
3	Timer4 ena (Time period 4 enable)
4	Boost ena (Boost enable)

38 Flux ref		Flux reference and *U/f* curve settings. See also section *User U/f curve* on page *50*.	
38.01	Flux ref	Sets the flux reference (in percent of parameter *99.08 Mot nom freq*) at field weakening point.	
	0 … 200%	Flux reference at field weakening point.	1 = 1%
38.03	U/f curve func	Selects the form of the *U/f* (voltage/frequency) curve below the field weakening point.	
	Linear	Linear *U/f* curve. Recommended for constant-torque applications.	0
	Quadratic	Quadratic *U/f* curve. Recommended for centrifugal pump and fan applications.	1
	User	Custom *U/f* curve. The curve is formed by the points defined by parameters *38.04*…*38.13*.	2
38.04	U/f curve freq1	Defines the frequency at the 1st point on the custom *U/f* curve in percent of parameter *99.08 Mot nom freq*.	
	1 … 500%	1st point, frequency.	1 = 1%
38.05	U/f curve freq2	Defines the frequency at the 2nd point on the custom *U/f* curve in percent of parameter *99.08 Mot nom freq*.	
	1 … 500%	2nd point, frequency.	1 = 1%

No.	Name/Value	Description	FbEq
38.06	U/f curve freq3	Defines the frequency at the 3rd point on the custom *U/f* curve in percent of parameter *99.08 Mot nom freq*.	
	1 … 500%	3rd point, frequency.	1 = 1%
38.07	U/f curve freq4	Defines the frequency at the 4th point on the custom *U/f* curve in percent of parameter *99.08 Mot nom freq*.	
	1 … 500%	4th point, frequency.	1 = 1%
38.08	U/f curve freq5	Defines the frequency at the 5th point on the custom *U/f* curve in percent of parameter *99.08 Mot nom freq*.	
	1 … 500%	5th point, frequency.	1 = 1%
38.09	U/f curve volt1	Defines the voltage at the 1st point on the custom *U/f* curve in percent of parameter *99.07 Mot nom voltage*.	
	0 … 200%	1st point, voltage.	1 = 1%
38.10	U/f curve volt2	Defines the voltage at the 2nd point on the custom *U/f* curve in percent of parameter *99.07 Mot nom voltage*.	
	0 … 200%	2nd point, voltage.	1 = 1%
38.11	U/f curve volt3	Defines the voltage at the 3rd point on the custom *U/f* curve in percent of parameter *99.07 Mot nom voltage*.	
	0 … 200%	3rd point, voltage.	1 = 1%
38.12	U/f curve volt4	Defines the voltage at the 4th point on the custom *U/f* curve in percent of parameter *99.07 Mot nom voltage*.	
	0 … 200%	4th point, voltage.	1 = 1%
38.13	U/f curve volt5	Defines the voltage at the 5th point on the custom *U/f* curve in percent of parameter *99.07 Mot nom voltage*.	
	0 … 200%	5th point, voltage.	1 = 1%

40 Motor control		Motor control settings.	
40.01	Motor noise	An optimization setting for balancing between control performance and motor noise level.	
	Cyclic	Maximizes inverter overloadability.	0
	Low noise	Minimizes motor noise.	1
	Long cable	Control performance optimized for long motor cables.	2
40.03	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 of the 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 of the 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. At the 105% gain value, no static speed error exists (2 rpm / 40 rpm = 5%).	
	0 … 200%	Slip gain.	1 = 1%

No.	Name/Value	Description	FbEq
40.04	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. If the intermediate circuit DC voltage U_{dc} = 550 V and the voltage reserve is 5%, the RMS value of the maximum output voltage in steady-state operation is 0.95 × 550 V / sqrt(2) = 369 V The dynamic performance of the motor control in the field weakening area can be improved by increasing the voltage reserve value, but the drive enters the field weakening area earlier.	
	-4 … 50%	Voltage reserve.	1 = 1%
40.06	Force open loop	Defines the speed/position information used by the motor model.	
	False	Motor model uses the speed feedback selected by parameter *19.02 Speed fb sel*.	0
	True	Motor model uses the internal speed estimate (even when parameter *19.02 Speed fb sel* is set to *Enc1 speed* / *Enc2 speed*).	1
40.07	IR-compensation	Defines the relative output voltage boost at zero speed (IR compensation). The function is useful in applications with a high break-away torque where direct torque control (DTC mode) cannot be applied.  See also section *IR compensation for a scalar controlled drive* on page *44*.	
	0.00 … 50.00%	Voltage boost at zero speed in percent of nominal motor voltage.	100 = 1%

42 Mech brake ctrl		Mechanical brake control configuration. See also section *Mechanical brake control* on page *35*.	
42.01	Brake ctrl	Activates the brake control function with or without supervision. **Note:** This parameter cannot be changed while the drive is running.	
	No	Brake control disabled.	0
	With ack	Brake control enabled with supervision (supervision is activated by parameter *42.02 Brake acknowl*).	1

No.	Name/Value	Description	FbEq
	No ack	Brake control enabled without supervision.	2
42.02	Brake acknowl	Selects the source for the external brake on/off supervision activation (when parameter *42.01 Brake ctrl* is set to *With ack*). The use of the external on/off supervision signal is optional. 1 = The brake is open 0 = The brake is closed Brake supervision is usually controlled with a digital input. It can also be controlled with an external control system, e.g. fieldbus. When a brake control error is detected, the drive reacts as defined by parameter *42.12 Brake fault func*. **Note:** This parameter cannot be changed while the drive is running.	
	DI4	Digital input DI4 (as indicated by *02.01 DI status*, bit 3).	1073938945
	DI5	Digital input DI5 (as indicated by *02.01 DI status*, bit 4).	1074004481
	DI6	Digital input DI6 (as indicated by *02.01 DI status*, bit 5).	1074070017
	DIO4	Digital input/output DIO4 (as indicated by *02.03 DIO status*, bit 3).	1073938947
	DIO5	Digital input/output DIO5 (as indicated by *02.03 DIO status*, bit 4).	1074004483
	DIO6	Digital input/output DIO6 (as indicated by *02.03 DIO status*, bit 5).	1074070019
	Const	Bit pointer setting (see *Terms and abbreviations* on page *63*).	-
	Pointer		
42.03	Open delay	Defines the brake open delay (= the delay between the internal open brake command and the release of the motor speed control). The delay counter starts when the drive has magnetised the motor and risen the motor torque to the level required at the brake release (parameter *42.08 Brake open torq*). Simultaneously with the counter start, the brake function energises the relay output controlling the brake and the brake starts opening. Set the delay the same as the mechanical opening delay of the brake specified by the brake manufacturer.	
	0.00 … 5.00 s	Brake open delay.	100 = 1 s
42.04	Close delay	Defines the brake close delay. The delay counter starts when the motor actual speed has fallen below the set level (parameter *42.05 Close speed*) after the drive has received the stop command. Simultaneously with the counter start, the brake control function de-energises the relay output controlling the brake and the brake starts closing. During the delay, the brake function keeps the motor live preventing the motor speed from falling below zero. Set the delay time to the same value as the mechanical make-up time of the brake (= operating delay when closing) specified by the brake manufacturer.	
	0.00 … 60.00 s	Brake close delay.	100 = 1 s
42.05	Close speed	Defines the brake close speed (as an absolute value). See parameter *42.04 Close delay*.	
	0.0 … 1000.0 rpm	Brake close speed.	10 = 1 rpm

No.	Name/Value	Description	FbEq
42.06	Close cmd delay	Defines a close command delay, i.e. the time between when brake close conditions are met and when the close command is given.	
	0.00 … 10.00 s	Brake close command delay.	100 = 1 s
42.07	Reopen delay	Defines a reopen delay, i.e. the time between when the close command is given and when the brake can be reopened.	
	0.00 … 10.00 s	Brake reopen delay.	100 = 1 s
42.08	Brake open torq	Defines the motor starting torque at brake release (in percent of the motor nominal torque) when parameter *42.09 Open torq src* is set to *P.42.08*.	
	-1000.0 … 1000.0%	Motor starting torque at brake release.	10 = 1%
42.09	Open torq src	Selects the source for the “brake open” torque value (motor starting torque at brake release).	
	Zero	Zero speed reference.	0
	AI1 scaled	*02.05 AI1 scaled* (see page *65*).	1073742341
	AI2 scaled	*02.07 AI2 scaled* (see page *65*).	1073742343
	FBA ref1	*02.26 FBA main ref1* (see page *70*).	1073742362
	FBA ref2	*02.27 FBA main ref2* (see page *70*).	1073742363
	D2D ref1	*02.32 D2D ref1* (see page *71*).	1073742368
	D2D ref2	*02.33 D2D ref2* (see page *71*).	1073742369
	Brk torq mem	*03.15 Brake torq mem* (see page *71*).	1073742607
	P.42.08	Parameter *42.08 Brake open torq*.	1073752584
	Pointer	Value pointer setting (see *Terms and abbreviations* on page *63*).	-
42.10	Brake close req	Selects the source for the brake close/open request. 1 = Brake close request 0 = Brake open request **Note:** This parameter cannot be changed while the drive is running.	
	DI4	Digital input DI4 (as indicated by *02.01 DI status*, bit 3).	1073938945
	DI5	Digital input DI5 (as indicated by *02.01 DI status*, bit 4).	1074004481
	DI6	Digital input DI6 (as indicated by *02.01 DI status*, bit 5).	1074070017
	DIO4	Digital input/output DIO4 (as indicated by *02.03 DIO status*, bit 3).	1073938947
	DIO5	Digital input/output DIO5 (as indicated by *02.03 DIO status*, bit 4).	1074004483
	DIO6	Digital input/output DIO6 (as indicated by *02.03 DIO status*, bit 5).	1074070019
	Const	Bit pointer setting (see *Terms and abbreviations* on page *63*).	-
	Pointer		
42.11	Brake hold open	Selects the source for the activation of the brake open command hold. 1 = Hold active 0 = Normal operation **Note:** This parameter cannot be changed while the drive is running.	
	DI4	Digital input DI4 (as indicated by *02.01 DI status*, bit 3).	1073938945

No.	Name/Value	Description	FbEq
	DI5	Digital input DI5 (as indicated by *02.01 DI status*, bit 4).	1074004481
	DI6	Digital input DI6 (as indicated by *02.01 DI status*, bit 5).	1074070017
	DIO4	Digital input/output DIO4 (as indicated by *02.03 DIO status*, bit 3).	1073938947
	DIO5	Digital input/output DIO5 (as indicated by *02.03 DIO status*, bit 4).	1074004483
	DIO6	Digital input/output DIO6 (as indicated by *02.03 DIO status*, bit 5).	1074070019
	Const	Bit pointer setting (see *Terms and abbreviations* on page *63*).	-
	Pointer		
42.12	Brake fault func	Defines how the drive reacts in case of mechanical brake control error. If brake control supervision has not been activated by parameter *42.01 Brake ctrl*, this parameter is disabled.	
	Fault	The drive trips on fault BRAKE NOT CLOSED / BRAKE NOT OPEN if the status of the optional external brake acknowledgement signal does not meet the status presumed by the brake control function. The drive trips on fault BRAKE START TORQUE if the required motor starting torque at brake release is not achieved.	0
	Alarm	The drive generates alarm BRAKE NOT CLOSED / BRAKE NOT OPEN if the status of the optional external brake acknowledgement signal does not meet the status presumed by the brake control function. The drive generates alarm BRAKE START TORQUE if the required motor starting torque at brake release is not achieved.	1
	Open flt	The drive trips on fault BRAKE NOT CLOSED / BRAKE NOT OPEN if the status of the optional external brake acknowledgement signal does not meet the status presumed by the brake control function during the opening of the brake. Other brake function errors generate alarm BRAKE NOT CLOSED / BRAKE NOT OPEN.	2
42.13	Close flt delay	Defines a close fault delay, i.e. the time between when the brake is closed and when a brake close fault is generated.	
	0.00 … 60.00 s	Brake close fault delay.	100 = 1 s

No.	Name/Value	Description	FbEq
44 Maintenance		Maintenance counter configuration. See also section *Maintenance counters* on page *35*.	
44.01	Ontime1 func	Configures on-time counter 1. This counter runs whenever the signal selected by parameter *44.02 Ontime1 src* is on. After the limit set by parameter *44.03 Ontime1 limit* is reached, an alarm specified by parameter *44.04 Ontime1 alm sel* is given, and the counter reset. The current value of the counter is readable from parameter *04.09 Counter ontime1*. Bit 0 of *06.15 Counter status* indicates that the count has exceeded the limit.	

Bit	Function
0	Counter mode 0 = Loop: If alarm is enabled by bit 1, the alarm stays active only for 10 seconds. 1 = Saturate: If alarm is enabled by bit 1, the alarm stays active until reset.
1	Alarm ena (Alarm enable) 0 = Disable: No alarm is given when limit is reached. 1 = Enable: Alarm is given when limit is reached.

44.02	Ontime1 src	Selects the signal to be monitored by on-time counter 1. See parameter *44.01 Ontime1 func*.	
	RO1	Relay output RO1 (as indicated by *02.02 RO status*, bit 0).	1073742338
	Running	Bit 3 of *06.01 Status word1* (see page *73*).	1073939969
	Charged	Bit 9 of *06.02 Status word2* (see page *74*).	1074333186
	Const	Bit pointer setting (see *Terms and abbreviations* on page *63*).	-
	Pointer		
44.03	Ontime1 limit	Sets the alarm limit for on-time counter 1. See parameter *44.01 Ontime1 func*.	
	0…2147483647 s	Alarm limit for on-time counter 1.	
44.04	Ontime1 alm sel	Selects the alarm for on-time counter 1. See parameter *44.01 Ontime1 func*.	
	On-time1	Pre-selectable alarm for on-time counter 1.	0
	Device clean	Pre-selectable alarm for on-time counter 1.	1
	Add cool fan	Pre-selectable alarm for on-time counter 1.	2
	Cabinet fan	Pre-selectable alarm for on-time counter 1.	3
	Dc-capacitor	Pre-selectable alarm for on-time counter 1.	4
	Mot bearing	Pre-selectable alarm for on-time counter 1.	5

No.	Name/Value	Description	FbEq
44.05	Ontime2 func	Configures on-time counter 2. This counter runs whenever the signal selected by parameter *44.06 Ontime2 src* is on. After the limit set by parameter *44.07 Ontime2 limit* is reached, an alarm specified by parameter *44.08 Ontime2 alm sel* is given, and the counter reset. The current value of the counter is readable from parameter *04.10 Counter ontime2*. Bit 1 of *06.15 Counter status* indicates that the count has exceeded the limit.	

Bit	Function
0	Counter mode 0 = Loop: If alarm is enabled by bit 1, the alarm stays active only for 10 seconds. 1 = Saturate: If alarm is enabled by bit 1, the alarm stays active until reset.
1	Alarm ena (Alarm enable) 0 = Disable: No alarm is given when limit is reached. 1 = Enable: Alarm is given when limit is reached.

44.06	Ontime2 src	Selects the signal to be monitored by on-time counter 2. See parameter *44.05 Ontime2 func*.	
	RO1	Relay output RO1 (as indicated by *02.02 RO status*, bit 0).	1073742338
	Running	Bit 3 of *06.01 Status word1* (see page *73*).	1073939969
	Charged	Bit 9 of *06.02 Status word2* (see page *74*).	1074333186
	Const	Bit pointer setting (see *Terms and abbreviations* on page *63*).	-
	Pointer		
44.07	Ontime2 limit	Sets the alarm limit for on-time counter 2. See parameter *44.05 Ontime2 func*.	
	0 … 2147483647 s	Alarm limit for on-time counter 2.	1 = 1 s
44.08	Ontime2 alm sel	Selects the alarm for on-time counter 2. See parameter *44.05 Ontime2 func*.	
	On-time2	Pre-selectable alarm for on-time counter 2.	0
	Device clean	Pre-selectable alarm for on-time counter 2.	1
	Add cool fan	Pre-selectable alarm for on-time counter 2.	2
	Cabinet fan	Pre-selectable alarm for on-time counter 2.	3
	Dc-capacitor	Pre-selectable alarm for on-time counter 2.	4
	Mot bearing	Pre-selectable alarm for on-time counter 2.	5

No.	Name/Value	Description	FbEq
44.09	Edge count1 func	Configures rising edge counter 1. This counter is incremented every time the signal selected by parameter *44.10 Edge count1 src* switches on (unless a divisor value is applied – see parameter *44.12 Edge count1 div*). After the limit set by parameter *44.11 Edge count1 lim* is reached, an alarm specified by parameter *44.13 Edg cnt1 alm sel* is given, and the counter reset. The current value of the counter is readable from parameter *04.11 Counter edge1*. Bit 2 of *06.15 Counter status* indicates that the count has exceeded the limit.	

Bit	Function
0	Counter mode 0 = Loop: If alarm is enabled by bit 1, the alarm stays active only for 10 seconds. 1 = Saturate: If alarm is enabled by bit 1, the alarm stays active until reset.
1	Alarm ena (Alarm enable) 0 = Disable: No alarm is given when limit is reached. 1 = Enable: Alarm is given when limit is reached.

44.10	Edge count1 src	Selects the signal to be monitored by rising edge counter 1. See parameter *44.09 Edge count1 func*.	
	RO1	Relay output RO1 (as indicated by *02.02 RO status*, bit 0).	1073742338
	Running	Bit 3 of *06.01 Status word1* (see page *73*).	1073939969
	Charged	Bit 9 of *06.02 Status word2* (see page *74*).	1074333186
	Const	Bit pointer setting (see *Terms and abbreviations* on page *63*).	-
	Pointer		
44.11	Edge count1 lim	Sets the alarm limit for rising edge counter 1. See parameter *44.09 Edge count1 func*.	
	0 … 2147483647	Alarm limit for rising edge counter 1.	1 = 1
44.12	Edge count1 div	Divisor for rising edge counter 1. Determines how many rising edges increment the counter by 1.	
	1 … 2147483647	Divisor for rising edge counter 1.	1 = 1
44.13	Edg cnt1 alm sel	Selects the alarm for rising edge counter 1. See parameter *44.09 Edge count1 func*.	
	Edge count1	Pre-selectable alarm for rising edge counter 1.	0
	Main cntactr	Pre-selectable alarm for rising edge counter 1.	1
	Output relay	Pre-selectable alarm for rising edge counter 1.	2
	Motor starts	Pre-selectable alarm for rising edge counter 1.	3
	Power ups	Pre-selectable alarm for rising edge counter 1.	4
	Dc-charge	Pre-selectable alarm for rising edge counter 1.	5

No.	Name/Value	Description	FbEq
44.14	Edge count2 func	Configures rising edge counter 2. The counter is incremented every time the signal selected by parameter *44.15 Edge count2 src* switches on (unless a divisor value is applied – see parameter *44.17 Edge count2 div*). After the limit set by parameter *44.16 Edge count2 lim* is reached, an alarm specified by parameter *44.22 Edg cnt2 alm sel* is given and the counter is reset. The current value of the counter is readable from parameter *04.12 Counter edge2*. Bit 3 of *06.15 Counter status* indicates that the count has exceeded the limit.	

Bit	Function
0	Counter mode 0 = Loop: If alarm is enabled by bit 1, the alarm stays active only for 10 seconds. 1 = Saturate: If alarm is enabled by bit 1, the alarm stays active until reset.
1	Alarm ena (Alarm enable) 0 = Disable: No alarm is given when limit is reached. 1 = Enable: Alarm is given when limit is reached.

44.15	Edge count2 src	Selects the signal to be monitored by rising edge counter 2. See parameter *44.14 Edge count2 func*.	
	RO1	Relay output RO1 (as indicated by *02.02 RO status*, bit 0).	1073742338
	Running	Bit 3 of *06.01 Status word1* (see page *73*).	1073939969
	Charged	Bit 9 of *06.02 Status word2* (see page *74*).	1074333186
	Const	Bit pointer setting (see *Terms and abbreviations* on page *63*).	-
	Pointer		
44.16	Edge count2 lim	Sets the alarm limit for rising edge counter 1. See parameter *44.14 Edge count2 func*.	
	0 … 2147483647	Alarm limit for rising edge counter 2.	1 = 1
44.17	Edge count2 div	Divisor for rising edge counter 2. Determines how many rising edges increment the counter by 1.	
	1 … 2147483647	Divisor for rising edge counter 2.	1 = 1
44.18	Edg cnt2 alm sel	Selects the alarm for rising edge counter 2. See parameter *44.14 Edge count2 func*.	
	Edge count2	Pre-selectable alarm for rising edge counter 2.	0
	Main cntactr	Pre-selectable alarm for rising edge counter 2.	1
	Output relay	Pre-selectable alarm for rising edge counter 2.	2
	Motor starts	Pre-selectable alarm for rising edge counter 2.	3
	Power ups	Pre-selectable alarm for rising edge counter 2.	4
	Dc-charge	Pre-selectable alarm for rising edge counter 2.	5

No.	Name/Value	Description	FbEq
44.19	Val count1 func	Configures value counter 1. This counter measures, by integration, the area below the signal selected by parameter *44.20 Val count1 src*. When the total area exceeds the limit set by parameter *44.21 Val count1 lim*, an alarm is given (if enabled by bit 1 of this parameter). The signal is sampled at 1-second intervals. Note that the scaled (see the "FbEq" column at the signal in question) value of the signal is used. The current value of the counter is readable from parameter *04.13 Counter value1*. Bit 4 of *06.15 Counter status* indicates that the counter has exceeded the limit.	

Bit	Function
0	Counter mode 0 = Loop: If alarm is enabled by bit 1, the alarm stays active only for 10 seconds. 1 = Saturate: If alarm is enabled by bit 1, the alarm stays active until reset.
1	Alarm ena (Alarm enable) 0 = Disable: No alarm is given when limit is reached. 1 = Enable: Alarm is given when limit is reached.

44.20	Val count1 src	Selects the signal to be monitored by value counter 1. See parameter *44.19 Val count1 func*.	
	Speed rpm	*01.01 Motor speed rpm* (see page *64*).	1073742081
	Pointer	Value pointer setting (see *Terms and abbreviations* on page *63*).	-
44.21	Val count1 lim	Sets the alarm limit for value counter 1. See parameter *44.19 Val count1 func*.	
	0 … 2147483647	Alarm limit for value counter 1.	1 = 1
44.22	Val count1 div	Divisor for value counter 1. The value of the monitored signal is divided by this value before integration.	
	1 … 2147483647	Divisor for value counter 1.	1 = 1
44.23	Val cnt1 alm sel	Selects the alarm for value counter 1. See parameter *44.19 Val count1 func*.	
	Value1	Pre-selectable alarm for value counter 1.	0
	Mot bearing	Pre-selectable alarm for value counter 1.	1

No.	Name/Value	Description	FbEq
44.24	Val count2 func	Configures value counter 2. This counter measures, by integration, the area below the signal selected by parameter *44.25 Val count2 src*. When the total area exceeds the limit set by parameter *44.26 Val count2 lim*, an alarm is given (if enabled by bit 1 of this parameter). The signal is sampled at 1-second intervals. Note that the scaled (see the "FbEq" column at the signal in question) value of the signal is used. The current value of the counter is readable from parameter *04.14 Counter value2*. Bit 5 of *06.15 Counter status* indicates that the counter has exceeded the limit.	

Bit	Function
0	Counter mode 0 = Loop: If alarm is enabled by bit 1, the alarm stays active only for 10 seconds. 1 = Saturate: If alarm is enabled by bit 1, the alarm stays active until reset.
1	Alarm ena (Alarm enable) 0 = Disable: No alarm is given when limit is reached. 1 = Enable: Alarm is given when limit is reached.

44.25	Val count2 src	Selects the signal to be monitored by value counter 2. See parameter *44.24 Val count2 func*.	
	Speed rpm	*01.01 Motor speed rpm* (see page *64*).	1073742081
	Pointer	Value pointer setting (see *Terms and abbreviations* on page *63*).	-
44.26	Val count2 lim	Sets the alarm limit for value counter 2. See parameter *44.24 Val count2 func*.	
	0 … 2147483647	Alarm limit for value counter 2.	1 = 1
44.27	Val count2 div	Divisor for value counter 2. The value of the monitored signal is divided by this value before integration.	
	1 … 2147483647	Divisor for value counter 2.	1 = 1
44.28	Val cnt2 alm sel	Selects the alarm for value counter 2. See parameter *44.24 Val count2 func*.	
	Value2	Pre-selectable alarm for value counter 2.	0
	Mot bearing	Pre-selectable alarm for value counter 2.	1
44.29	Fan ontime lim	Sets the limit for the cooling fan on-time counter. The counter monitors signal *01.28 Fan on-time* (see page *64*). When the signal reaches the limit, alarm *2056 COOLING FAN (0x5081)* is given.	
	0…35791394.1	Alarm limit for cooling fan on-time.	1 = 1 min
44.30	Runtime lim	Sets the limit for the drive run-time counter. The counter monitors signal *01.27 Run-time counter* (see page *64*). When the signal reaches the limit, the alarm specified by parameter *44.31 Runtime alm sel* is given.	
	0…35791394.1	Alarm limit for the drive run-time counter.	1 = 1 min
44.31	Runtime alm sel	Selects the alarm for the drive run time counter.	
	Device clean	Pre-selectable alarm for the drive run time counter.	1
	Add cool fan	Pre-selectable alarm for the drive run time counter.	2
	Cabinet fan	Pre-selectable alarm for the drive run time counter.	3
	Dc-capacitor	Pre-selectable alarm for the drive run time counter.	4

No.	Name/Value	Description	FbEq
	Mot bearing	Pre-selectable alarm for the drive run time counter.	5
44.32	kWh inv lim	Sets the limit for the energy counter. The counter monitors signal *01.24 kWh inverter* (see page *64*). When the signal reaches the limit, the alarm specified by parameter *44.33 kWh inv alm sel* is given.	
	0 … 2147483647	Alarm limit for the energy counter.	1 = 1 kWh
44.33	kWh inv alm sel	Selects the alarm for the energy counter.	
	Device clean	Pre-selectable alarm for the energy counter.	1
	Add cool fan	Pre-selectable alarm for the energy counter.	2
	Cabinet fan	Pre-selectable alarm for the energy counter.	3
	Dc-capacitor	Pre-selectable alarm for the energy counter.	4
	Mot bearing	Pre-selectable alarm for the energy counter.	5

45 Energy optimising		Energy optimization settings.	
45.01	Energy optim	Enables/disables energy optimization function. The function optimizes the 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…10% depending on load torque and speed.	
	Disable	Energy optimization disabled.	0
	Enable	Energy optimization enabled.	1
45.02	Energy tariff1	Price of energy per kWh. Used for reference when savings are calculated. See parameters *01.35 Saved energy*, *01.36 Saved amount* and *01.37 Saved CO2*.	
	0.00 … 21474836.47	Price of energy per kWh.	1 = 1
45.06	E tariff unit	Specifies the currency used for the savings calculation.	
	Local	The currency is determined by the setting of parameter *99.01 Language*.	0
	Eur	Euro.	1
	Usd	US dollar.	2
45.08	Pump ref power	Pump power when connected directly to supply. Used for reference when energy savings are calculated. See parameters *01.35 Saved energy*, *01.36 Saved amount* and *01.37 Saved CO2*.	
	00.0… 1000.0%	Pump power in percent of nominal motor power.	1 = 1
45.09	Energy reset	Resets the energy counters *01.35 Saved energy*, *01.36 Saved amount* and *01.37 Saved CO2*.	
	Done	Reset not requested (normal operation).	0
	Reset	Reset energy counters. The value reverts automatically to *Done*.	1

No.	Name/Value	Description	FbEq
47 Voltage ctrl		Overvoltage and undervoltage control settings.	
47.01	Overvolt ctrl	Enables the overvoltage control of the intermediate DC link. Fast braking of a high inertia load causes the voltage to rise to the overvoltage control limit. To prevent the DC voltage from exceeding the limit, the overvoltage controller automatically decreases the braking torque. **Note:** If a brake chopper and resistor or a regenerative supply section are included in the drive, the controller must be disabled.	
	Disable	Overvoltage control disabled.	0
	Enable	Overvoltage control enabled.	1
47.02	Undervolt ctrl	Enables the undervoltage control of the intermediate DC link. If the DC voltage drops due to input power cut off, the undervoltage controller will automatically decrease the motor torque in order to keep the voltage above the lower limit. By decreasing the motor torque, the inertia of the load will cause regeneration back to the drive, keeping the DC link charged and preventing an undervoltage trip until the motor coasts to stop. This will act as a power-loss ride-through functionality in systems with high inertia, such as a centrifuge or a fan.	
	Disable	Undervoltage control disabled.	0
	Enable	Undervoltage control enabled.	1
48 Brake chopper		Control of the brake chopper.	
48.01	Bc enable	Enables the brake chopper control. **Note:** Before enabling the brake chopper control, ensure that a brake resistor is connected and the overvoltage control is switched off (parameter *47.01 Overvolt ctrl*).	
	Disable	Brake chopper control disabled.	0
	EnableTherm	Brake chopper control enabled with resistor overload protection.	1
	Enable	Brake chopper control enabled without resistor overload protection. This setting can be used, for example, if the resistor is equipped with a thermal circuit breaker that is wired to stop the drive if the resistor overheats.	2
48.02	Bc run-time ena	Selects the source for quick run-time brake chopper control. 0 = Brake chopper IGBT pulses are cut off 1 = Normal brake chopper IGBT modulation. The overvoltage control is automatically switched off This parameter can be used to program the chopper control to function only when the drive is operating in the generator mode.	
	Const	Bit pointer setting (see *Terms and abbreviations* on page *63*).	-
	Pointer		
48.03	BrThermTimeConst	Defines the thermal time constant of the brake resistor for overload protection.	
	0 … 10000 s	Brake resistor thermal time constant.	1 = 1 s
48.04	Br power max cnt	Defines the maximum continuous braking power which will raise the resistor temperature to the maximum allowed value. The value is used in the overload protection.	

No.	Name/Value	Description	FbEq
	0.0000 … 10000.0000 kW	Maximum continuous braking power.	10000 = 1 kW
48.05	R br	Defines the resistance value of the brake resistor. The value is used for brake chopper protection.	
	0.1000 … 1000.0000 ohm	Brake resistor resistance value.	10000 = 1 ohm
48.06	Br temp faultlim	Selects the fault limit for the brake resistor temperature supervision. The value is given in percent of the temperature the resistor reaches when loaded with the power defined by parameter *48.04 Br power max cnt*. When the limit is exceeded the drive trips on fault BR OVERHEAT.	
	0 … 150%	Brake resistor temperature fault limit.	1 = 1%
48.07	Br temp alarmlim	Selects the alarm limit for the brake resistor temperature supervision. The value is given in percent of the temperature the resistor reaches when loaded with the power defined by parameter *48.04 Br power max cnt*. When the limit is exceeded, the drive generates a BR OVERHEAT alarm.	
	0 … 150%	Brake resistor temperature alarm limit.	1 = 1%

49 Data storage		Data storage parameters reserved for the user. These parameters can be written to and read from using other parameters' pointer settings. Four 16-bit and four 32-bit storage parameters are available.	
49.01	Data storage1	Data storage parameter 1.	
	-32768 … 32767	16-bit data.	1 = 1
49.02	Data storage2	Data storage parameter 2.	
	-32768 … 32767	16-bit data.	1 = 1
49.03	Data storage3	Data storage parameter 3.	
	-32768 … 32767	16-bit data.	1 = 1
49.04	Data storage4	Data storage parameter 4.	
	-32768 … 32767	16-bit data.	1 = 1
49.05	Data storage5	Data storage parameter 5.	
	-2147483647 … 2147483647	32-bit data.	1 = 1
49.06	Data storage6	Data storage parameter 6.	
	-2147483647 … 2147483647	32-bit data.	1 = 1
49.07	Data storage7	Data storage parameter 7.	
	-2147483647 … 2147483647	32-bit data.	1 = 1
49.08	Data storage8	Data storage parameter 8.	
	-2147483647 … 2147483647	32-bit data.	1 = 1

No.	Name/Value	Description	FbEq
50 Fieldbus		Settings for configuration of communication via a fieldbus adapter.	
50.01	Fba enable	Enables communication between the drive and fieldbus adapter.	
	Disable	Communication between the drive and fieldbus adapter disabled.	0
	Enable	Communication between the drive and fieldbus adapter enabled.	1
50.02	Comm loss func	Selects how the drive reacts in a fieldbus communication break. The time delay is defined by parameter *50.03 Comm loss t out*.	
	No	Communication break detection disabled.	0
	Fault	Communication break detection active. Upon a communication break, the drive trips on fault FIELDBUS COMM and coasts to stop.	1
	Spd ref Safe	Communication break detection active. Upon a communication break, the drive generates alarm FIELDBUS COMM and sets the speed to the value defined by parameter *30.02 Speed ref safe*. **WARNING**! Make sure that it is safe to continue operation in case of a communication break.	2
	Last speed	Communication break detection active. The drive generates alarm FIELDBUS COMM and freezes the speed to the level the drive was operating at. The speed is determined by the average speed over the previous 10 seconds. **WARNING**! Make sure that it is safe to continue operation in case of a communication break.	3
50.03	Comm loss t out	Defines the time delay before the action defined by parameter *50.02 Comm loss func* is taken. Time count starts when the link fails to update the message.	
	0.3 … 6553.5 s	Time delay.	10 = 1 s
50.04	Fba ref1 modesel	Selects the fieldbus reference FBA REF1 scaling and the actual value, which is sent to the fieldbus (FBA ACT1).	
	Raw data	No scaling (i.e. data is transmitted without scaling). Source for the actual value, which is sent to the fieldbus, is selected by parameter *50.06 Fba act1 tr src*.	0
	Torque	Fieldbus adapter module uses torque reference scaling. Torque reference scaling is defined by the used fieldbus profile (e.g. with ABB Drives Profile integer value 10000 corresponds to 100% torque value). Signal *01.06 Motor torque* is sent to the fieldbus as an actual value. See the User's Manual of the appropriate fieldbus adapter module.	1
	Speed	Fieldbus adapter module uses speed reference scaling. Speed reference scaling is defined by the used fieldbus profile (e.g. with ABB Drives Profile integer value 20000 corresponds to parameter *19.01 Speed scaling* value). Signal *01.01 Motor speed rpm* is sent to the fieldbus as an actual value. See the User's Manual of the appropriate fieldbus adapter module.	2

No.	Name/Value	Description	FbEq
50.05	Fba ref2 modesel	Selects the fieldbus reference FBA REF2 scaling. See parameter *50.04 Fba ref1 modesel*.	
	Raw data	See parameter *50.04 Fba ref1 modesel*.	0
	Torque	See parameter *50.04 Fba ref1 modesel*.	1
	Speed	See parameter *50.04 Fba ref1 modesel*.	2
50.06	Fba act1 tr src	Selects the source for fieldbus actual value 1 when parameter *50.04 Fba ref1 modesel* / *50.05 Fba ref2 modesel* is set to *Raw data*.	
	Pointer	Value pointer setting (see *Terms and abbreviations* on page *63*).	-
50.07	Fba act2 tr src	Selects the source for fieldbus actual value 2 when parameter *50.04 Fba ref1 modesel* / *50.05 Fba ref2 modesel* is set to *Raw data*.	
	Pointer	Value pointer setting (see *Terms and abbreviations* on page *63*).	-
50.08	Fba sw b12 src	Selects the source for freely programmable fieldbus status word bit 28 (*02.24 FBA main sw* bit 28 SW B28).	
	Const	Bit pointer setting (see *Terms and abbreviations* on page *63*).	-
	Pointer		
50.09	Fba sw b13 src	Selects the source for freely programmable fieldbus status word bit 29 (*02.24 FBA main sw* bit 29 SW B29).	
	Const	Bit pointer setting (see *Terms and abbreviations* on page *63*).	-
	Pointer		
50.10	Fba sw b14 src	Selects the source for freely programmable fieldbus status word bit 30 (*02.24 FBA main sw* bit 30 SW B30).	
	Const	Bit pointer setting (see *Terms and abbreviations* on page *63*).	-
	Pointer		
50.11	Fba sw b15 src	Selects the source for freely programmable fieldbus status word bit 31 (*02.24 FBA main sw* bit 31 SW B31).	
	Const	Bit pointer setting (see *Terms and abbreviations* on page *63*).	-
	Pointer		

51 FBA settings		Fieldbus adapter-specific settings.	
51.01	FBA type	Displays the type of the connected fieldbus adapter module. 0 = Fieldbus module is not found, or it is not properly connected, or parameter *50.01 Fba enable* is set to *Disable*, 1 = FPBA-xx PROFIBUS-DP adapter module, 32 = FCAN-xx CANopen adapter module, 37 = FDNA-xx DeviceNet adapter module	
51.02	FBA par2	Parameters *51.02*…*51.26* are adapter module-specific. For more information, see the User's Manual of the fieldbus adapter module. Note that not all of these parameters are necessarily visible.	-
…	…	…	…
51.26	FBA par26	See parameter *51.02 FBA par2*.	-

No.	Name/Value	Description	FbEq
51.27	FBA par refresh	Validates any changed adapter module configuration parameter settings. After refreshing, the value reverts automatically to *Done*. **Note:** This parameter cannot be changed while the drive is running.	
	Done	Refreshing done.	0
	Refresh	Refreshing.	1
51.28	Par table ver	Displays the parameter table revision of the fieldbus adapter module mapping file stored in the memory of the drive. In format xyz, where x = major revision number; y = minor revision number; z = correction number.	
	0x0000 … 0xFFFF	Parameter table revision.	1 = 1
51.29	Drive type code	Displays the drive type code of the fieldbus adapter module mapping file stored in the memory of the drive.	
	0 … 65535	Drive type code of fieldbus adapter module mapping file.	1 = 1
51.30	Mapping file ver	Displays the fieldbus adapter module mapping file revision stored in the memory of the drive in decimal format. Example: 1 = revision 1.	
	0 … 65535	Mapping file revision.	1 = 1
51.31	D2FBA comm sta	Displays the status of the fieldbus adapter module communication.	
	Idle	Adapter is not configured.	0
	Exec.init	Adapter is initializing.	1
	Time out	A timeout has occurred in the communication between the adapter and the drive.	2
	Conf.err	Adapter configuration error: The major or minor revision code of the common program revision in the fieldbus adapter module is not the revision required by the module (see parameter *51.32 FBA comm sw ver*) or mapping file upload has failed more than three times.	3
	Off-line	Adapter is off-line.	4
	On-line	Adapter is on-line.	5
	Reset	Adapter is performing a hardware reset.	6
51.32	FBA comm sw ver	Displays the common program revision of the adapter module in format axyz, where a = major revision number, xy = minor revision numbers. z = correction letter. Example: 190A = revision 1.90A.	
		Common program version of adapter module.	1 = 1
51.33	FBA appl sw ver	Displays the application program revision of the adapter module in format axyz, where: a = major revision number, xy = minor revision numbers, z = correction letter. Example: 190A = revision 1.90A.	
		Application program revision of adapter module.	1 = 1

No.	Name/Value	Description	FbEq
52 FBA data in		Selection of data to be transferred from drive to fieldbus controller.	
52.01	FBA data in1	Parameters *52.01*…*52.12* select data to be transferred from the drive to the fieldbus controller.	
	4	Status Word (16 bits)	4
	5	Actual value 1 (16 bits)	5
	6	Actual value 2 (16 bits)	6
	14	Status Word (32 bits)	14
	15	Actual value 1 (32 bits)	15
	16	Actual value 2 (32 bits)	16
	101…9999	Parameter index	1 = 1
…	…	…	…
52.12	FBA data in12	See parameter *52.01 FBA data in1*.	
53 FBA data out		Selection of data to be transferred from fieldbus controller to drive.	
53.01	FBA data out1	Parameters *53.01*…*53.12* select data to be transferred from the fieldbus controller to the drive.	
	1	Control Word (16 bits)	1
	2	Reference REF1 (16 bits)	2
	3	Reference REF2 (16 bits)	3
	11	Control Word (32 bits)	11
	12	Reference REF1 (32 bits)	12
	13	Reference REF2 (32 bits)	13
	101…9999	Parameter index	1 = 1
…	…	…	…
53.12	FBA data out12	See parameter *53.01 FBA data out1*.	
56 Panel display		Selection of signals to be displayed on control panel.	
56.01	Signal1 param	Selects the first signal to be displayed on the optional control panel. The default signal is *01.03 Output frequency*.	
	00.00 … 255.255	1st signal to be displayed.	-
56.02	Signal2 param	Selects the second signal to be displayed on the optional control panel. The default signal is *01.04 Motor current*.	
	00.00 … 255.255	2nd signal to be displayed.	-
56.03	Signal3 param	Selects the third signal to be displayed on the optional control panel. The default signal is *01.06 Motor torque*.	
	00.00 … 255.255	3rd signal to be displayed.	-
56.04	Signal1 mode	Defines the way the signal selected by parameter *56.01 Signal1 param* is displayed on the optional control panel.	
	Disabled	Signal not displayed. Any other signals that are not disabled are shown together with their respective signal name.	-1
	Normal	Shows the signal as a numerical value followed by unit.	0
	Bar	Shows the signal as a horizontal bar.	1

No.	Name/Value	Description	FbEq
	Drive name	Shows the drive name. (The drive name can be set using the DriveStudio PC tool.)	2
	Drive type	Shows the drive type.	3
56.05	Signal2 mode	Defines the way the signal selected by parameter *56.02 Signal2 param* is displayed on the optional control panel.	
	Disabled	Signal not displayed. Any other signals that are not disabled are shown together with their respective signal name.	-1
	Normal	Shows the signal as a numerical value followed by unit.	0
	Bar	Shows the signal as a horizontal bar.	1
	Drive name	Shows the drive name. (The drive name can be set using the DriveStudio PC tool.)	2
	Drive type	Shows the drive type.	3
56.06	Signal3 mode	Defines the way the signal selected by parameter *56.03 Signal3 param* is displayed on the optional control panel.	
	Disabled	Signal not displayed. Any other signals that are not disabled are shown together with their respective signal name.	-1
	Normal	Shows the signal as a numerical value followed by unit.	0
	Bar	Shows the signal as a horizontal bar.	1
	Drive name	Shows the drive name. (The drive name can be set using the DriveStudio PC tool.)	2
	Drive type	Shows the drive type.	3
57 D2D communication		Configuration of drive-to-drive communication. See also section *Drive-to-drive link* on page *31*.	
57.01	Link mode	Activates the drive-to-drive connection.	
	Disabled	Drive-to-drive connection disabled.	0
	Follower	The drive is a follower on the drive-to-drive link.	1
	Master	The drive is the master on the drive-to-drive link. Only one drive can be the master at a time.	2
57.02	Comm loss func	Selects how the drive acts when an erroneous drive-to-drive configuration or a communication break is detected.	
	No	Protection not active.	0
	Alarm	The drive generates an alarm.	1
	Fault	The drive trips on a fault.	2
57.03	Node address	Sets the node address for a follower drive. Each follower must have a dedicated node address. **Note:** If the drive is set to be the master on the drive-to-drive link, this parameter has no effect (the master is automatically assigned node address 0).	
	1 … 62	Node address.	1 = 1
57.04	Follower mask 1	On the master drive, selects the followers to be polled. If no response is received from a polled follower, the action selected by parameter *57.02 Comm loss func* is taken. The least significant bit represents follower with node address 1, while the most significant bit represents follower 31. When a bit is set to 1, the corresponding node address is polled. For example, followers 1 and 2 are polled when this parameter is set to the value of 0x3.	

No.	Name/Value	Description	FbEq
	0h00000000 … 0h7FFFFFFF	Follower mask 1.	1 = 1
57.05	Follower mask 2	On the master drive, selects the followers to be polled. If no response is received from a polled follower, the action selected by parameter *57.02 Comm loss func* is taken. The least significant bit represents follower with node address 32, while the most significant bit represents follower 62. When a bit is set to 1, the corresponding node address is polled. For example, followers 32 and 33 are polled when this parameter is set to the value of 0x3.	
	0h00000000 … 0h7FFFFFFF	Follower mask 2.	1 = 1
57.06	Ref 1 src	Selects the source of D2D reference 1 sent to the followers. The parameter is effective on the master drive, as well as intermediate followers in a multicast message chain (see parameter *57.11 Ref1 msg type*)..	
	Pointer	Value pointer setting (see *Terms and abbreviations* on page *63*).	-
57.07	Ref 2 src	On the master drive, selects the source of D2D reference 2 broadcast to all followers.	
	Pointer	Value pointer setting (see *Terms and abbreviations* on page *63*).	-
57.08	Follower cw src	Selects the source of the D2D control word sent to the followers. The parameter is effective on the master drive, as well as intermediate followers in a multicast message chain (see parameter *57.11 Ref1 msg type*)..	
	Pointer	Value pointer setting (see *Terms and abbreviations* on page *63*).	-
57.11	Ref1 msg type	By default, in drive-to-drive communication, the master broadcasts the drive-to-drive control word and references 1 and 2 to all followers. This parameter enables multicasting, i.e. sending the drive-to-drive control word and reference 1 to a certain drive or group of drives. The message can then be further relayed to another group of drives to form a multicast chain. In the master, as well as any intermediate followers (i.e. followers relaying the message to other followers), the sources for the control word and reference 1 are selected by parameters *57.08 Follower cw src* and *57.06 Ref 1 src* respectively. **Note:** Reference 2 is broadcast to all followers.	
	Broadcast	The control word and reference 1 are sent by the master to all followers. If the master has this setting, the parameter has no effect in the followers.	0
	Ref1 MC Grps	The drive-to-drive control word and reference 1 are only sent to the drives in the multicast group specified by parameter *57.13 Next ref1 mc grp*. This setting can also used in intermediate followers to form a multicast chain.	1
57.12	Ref1 mc group	Selects the multicast group the drive belongs to. See parameter *57.11 Ref1 msg type*.	
	0…62	Multicast group.	1 = 1

No.	Name/Value	Description	FbEq
57.13	Next ref1 mc grp	Specifies the next multicast group of drives the multicast message is relayed to. See parameter *57.11 Ref1 msg type*. This parameter is effective only in the master or intermediate followers (i.e. followers relaying the message to other followers).	
	0	No group selected.	0
	1…62	Next multicast group in the chain.	1 = 1
57.14	Nr ref1 mc grps	In the master drive, sets the total number of links (followers or groups of followers) in the multicast message chain. See parameter *57.11 Ref1 msg type*. **Notes:** • This parameter has no effect if the drive is a follower. • The master counts as a member of the chain if acknowledgement from the last drive to the master is desired.	
	1…62	Number of links in the multicast chain.	1 = 1
57.15	D2D com port	Defines the hardware to which the drive-to-drive link is connected. In special cases (such as harsh operating conditions), the galvanic isolation provided by the RS-485 interface of the FMBA module may make for more robust communication than the standard drive-to-drive connection.	
	on-board	Connector X5 on the JCU Control Unit is used.	0
	Slot 1	An FMBA module installed in JCU option slot 1 is used.	1
	Slot 2	An FMBA module installed in JCU option slot 2 is used.	2
	Slot 3	An FMBA module installed in JCU option slot 3 is used.	3

64 Load analyzer		Peak value and amplitude logger settings. See also section *Load analyzer* on page *34*.	
64.01	PVL signal	Selects the signal to be monitored by the peak value logger. The signal is filtered using the filtering time specified by parameter *64.02 PVL filt time*. The peak value is stored, along with other pre-selected signals at the time, into parameters *64.06*…*64.11*. Parameter *64.03 Reset loggers* resets both the peak value logger and amplitude logger 2. The latest time the loggers were reset is stored into parameter *64.13*.	
	Speed rpm	*01.01 Motor speed rpm* (see page *64*).	1073742081
	Speed %	*01.02 Motor speed %* (see page *64*).	1073742082
	Frequency	*01.03 Output frequency* (see page *64*).	1073742083
	Current	*01.04 Motor current* (see page *64*).	1073742084
	Current %	*01.05 Motor current %* (see page *64*).	1073742085
	Torque	*01.06 Motor torque* (see page *64*).	1073742086
	Dc-voltage	*01.07 Dc-voltage* (see page *64*).	1073742087
	Power inu	*01.22 Power inu out* (see page *64*).	1073742102
	Power motor	*01.23 Motor power* (see page *64*).	1073742103
	Process act	*04.03 Process act* (see page *72*).	1073742851
	Proc PID out	*04.05 Process PID out* (see page *72*).	1073742853
	Pointer	Value pointer setting (see *Terms and abbreviations* on page *63*).	-

No.	Name/Value	Description	FbEq
64.02	PVL filt time	Peak value logger filtering time. See parameter *64.01 PVL signal*.	
	0.00 … 120.00 s	Peak value logger filtering time.	100 = 1 s
64.03	Reset loggers	Selects the signal to reset the peak value logger and amplitude logger 2. (Amplitude logger 1 cannot be reset.)	
	Const	Bit pointer setting (see *Terms and abbreviations* on page *63*).	-
	Pointer		
64.04	AL signal	Selects the signal to be monitored by amplitude logger 2. The signal is sampled at 200 ms intervals when the drive is running. The results are displayed by parameters *64.24*…*64.33*. 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 *64.05 AL signal base*. Parameter *64.03 Reset loggers* resets both the peak value logger and amplitude logger 2. The latest time the loggers were reset is stored into parameter *64.13*. **Note:** Amplitude logger 1 is fixed to monitor motor current (*01.04 Motor current*). The results are displayed by parameters *64.14*…*64.23*. 100% of the signal value corresponds to the nominal output current of the drive (see the appropriate *Hardware Manual)*.	
	Speed rpm	*01.01 Motor speed rpm* (see page *64*).	1073742081
	Speed %	*01.02 Motor speed %* (see page *64*).	1073742082
	Frequency	*01.03 Output frequency* (see page *64*).	1073742083
	Current	*01.04 Motor current* (see page *64*).	1073742084
	Current %	*01.05 Motor current %* (see page *64*).	1073742085
	Torque	*01.06 Motor torque* (see page *64*).	1073742086
	Dc-voltage	*01.07 Dc-voltage* (see page *64*).	1073742087
	Power inu	*01.22 Power inu out* (see page *64*).	1073742102
	Power motor	*01.23 Motor power* (see page *64*).	1073742103
	Process act	*04.03 Process act* (see page *72*).	1073742851
	Proc PID out	*04.05 Process PID out* (see page *72*).	1073742853
	Pointer	Value pointer setting (see *Terms and abbreviations* on page *63*).	-
64.05	AL signal base	Defines the signal value that corresponds to 100% amplitude.	
	0.00 … 32768.00	Signal value corresponding to 100%.	100 = 1
64.06	PVL peak value1	Peak value recorded by the peak value logger.	
	-32768.00 … 32768.00	Peak value.	100 = 1
64.07	Date of peak	The date on which the peak value was recorded.	
	01.01.80 …	Peak occurrence date (dd.mm.yy).	1 = 1 d
64.08	Time of peak	The time at which the peak value was recorded.	
	00:00:00 … 23:59:59	Peak occurrence time.	1 = 1 s

No.	Name/Value	Description	FbEq
64.09	Current at peak	Motor current at the moment the peak value was recorded.	
	-32768.00 … 32768.00 A	Motor current at peak.	100 = 1 A
64.10	Dc volt at peak	Voltage in the intermediate DC circuit of the drive at the moment the peak value was recorded.	
	0.00 … 2000.00 V	DC voltage at peak.	100 = 1 V
64.11	Speed at peak	Motor speed at the moment the peak value was recorded.	
	-32768.00 … 32768.00 rpm	Motor speed at peak.	100 = 1 rpm
64.12	Date of reset	The date the peak value logger and amplitude logger 2 were last reset.	
	01.01.80 …	Last reset date of loggers (dd.mm.yy).	1 = 1 d
64.13	Time of reset	The time the peak value logger and amplitude logger 2 were last reset.	
	00:00:00 … 23:59:59	Last reset time of loggers.	1 = 1 s
64.14	AL1 0 to 10%	Percentage of samples recorded by amplitude logger 1 that fall between 0 and 10%.	
	0.00 … 100.00%	Amplitude logger 1 samples between 0 and 10%.	100 = 1%
64.15	AL1 10 to 20%	Percentage of samples recorded by amplitude logger 1 that fall between 10 and 20%.	
	0.00 … 100.00%	Amplitude logger 1 samples between 10 and 20%.	100 = 1%
64.16	AL1 20 to 30%	Percentage of samples recorded by amplitude logger 1 that fall between 20 and 30%.	
	0.00 … 100.00%	Amplitude logger 1 samples between 20 and 30%.	100 = 1%
64.17	AL1 30 to 40%	Percentage of samples recorded by amplitude logger 1 that fall between 30 and 40%.	
	0.00 … 100.00%	Amplitude logger 1 samples between 30 and 40%.	100 = 1%
64.18	AL1 40 to 50%	Percentage of samples recorded by amplitude logger 1 that fall between 40 and 50%.	
	0.00 … 100.00%	Amplitude logger 1 samples between 40 and 50%.	100 = 1%
64.19	AL1 50 to 60%	Percentage of samples recorded by amplitude logger 1 that fall between 50 and 60%.	
	0.00 … 100.00%	Amplitude logger 1 samples between 50 and 60%.	100 = 1%
64.20	AL1 60 to 70%	Percentage of samples recorded by amplitude logger 1 that fall between 60 and 70%.	
	0.00 … 100.00%	Amplitude logger 1 samples between 60 and 70%.	100 = 1%
64.21	AL1 70 to 80%	Percentage of samples recorded by amplitude logger 1 that fall between 70 and 80%.	
	0.00 … 100.00%	Amplitude logger 1 samples between 70 and 80%.	100 = 1%
64.22	AL1 80 to 90%	Percentage of samples recorded by amplitude logger 1 that fall between 80 and 90%.	
	0.00 … 100.00%	Amplitude logger 1 samples between 80 and 90%.	100 = 1%
64.23	AL1 over 90%	Percentage of samples recorded by amplitude logger 1 that exceed 90%.	
	0.00 … 100.00%	Amplitude logger 1 samples over 90%.	100 = 1%

No.	Name/Value	Description	FbEq
64.24	AL2 0 to 10%	Percentage of samples recorded by amplitude logger 2 that fall between 0 and 10%.	
	0.00 … 100.00%	Amplitude logger 2 samples between 0 and 10%.	100 = 1%
64.25	AL2 10 to 20%	Percentage of samples recorded by amplitude logger 2 that fall between 10 and 20%.	
	0.00 … 100.00%	Amplitude logger 2 samples between 10 and 20%.	100 = 1%
64.26	AL2 20 to 30%	Percentage of samples recorded by amplitude logger 2 that fall between 20 and 30%.	
	0.00 … 100.00%	Amplitude logger 2 samples between 20 and 30%.	100 = 1%
64.27	AL2 30 to 40%	Percentage of samples recorded by amplitude logger 2 that fall between 30 and 40%.	
	0.00 … 100.00%	Amplitude logger 2 samples between 30 and 40%.	100 = 1%
64.28	AL2 40 to 50%	Percentage of samples recorded by amplitude logger 2 that fall between 40 and 50%.	
	0.00 … 100.00%	Amplitude logger 2 samples between 40 and 50%.	100 = 1%
64.29	AL2 50 to 60%	Percentage of samples recorded by amplitude logger 2 that fall between 50 and 60%.	
	0.00 … 100.00%	Amplitude logger 2 samples between 50 and 60%.	100 = 1%
64.30	AL2 60 to 70%	Percentage of samples recorded by amplitude logger 2 that fall between 60 and 70%.	
	0.00 … 100.00%	Amplitude logger 2 samples between 60 and 70%.	100 = 1%
64.31	AL2 70 to 80%	Percentage of samples recorded by amplitude logger 2 that fall between 70 and 80%.	
	0.00 … 100.00%	Amplitude logger 2 samples between 70 and 80%.	100 = 1%
64.32	AL2 80 to 90%	Percentage of samples recorded by amplitude logger 2 that fall between 80 and 90%.	
	0.00 … 100.00%	Amplitude logger 2 samples between 80 and 90%.	100 = 1%
64.33	AL2 over 90%	Percentage of samples recorded by amplitude logger 2 that exceed 90%.	
	0.00 … 100.00%	Amplitude logger 2 samples over 90%.	100 = 1%

90 Enc module sel		Activation of encoder/resolver interfaces. See also section *Encoder support* on page *31*.	
90.01	Encoder 1 sel	Activates the communication to optional encoder/resolver interface 1. **Note:** It is recommended that encoder interface 1 is used whenever possible since the data received through that interface is fresher than the data received through interface 2. On the other hand, when position values used in emulation are determined by the drive software, the use of encoder interface 2 is recommended as the values are transmitted earlier through interface 2 than through interface 1.	
	None	Inactive.	0
	FEN-01 TTL+	Communication active. Module type: FEN-01 TTL Encoder interface. Input: TTL encoder input with commutation support (X32).	1
	FEN-01 TTL	Communication active. Module type: FEN-01 TTL Encoder Interface. Input: TTL encoder input (X31).	2

No.	Name/Value	Description	FbEq
	FEN-11 ABS	Communication active. Module type: FEN-11 Absolute Encoder Interface. Input: Absolute encoder input (X42).	3
	FEN-11 TTL	Communication active. Module type: FEN-11 Absolute Encoder Interface. Input: TTL encoder input (X41).	4
	FEN-21 RES	Communication active. Module type: FEN-21 Resolver Interface. Input: Resolver input (X52).	5
	FEN-21 TTL	Communication active. Module type: FEN-21 Resolver Interface. Input: TTL encoder input (X51).	6
	FEN-31 HTL	Communication active. Module type: FEN-31 HTL Encoder Interface. Input: HTL encoder input (X82).	7
90.02	Encoder 2 sel	Activates the communication to the optional encoder/resolver interface 2. **Note:** The counting of shaft revolutions is not supported for encoder 2.	
	None	Inactive.	0
	FEN-01 TTL+	See parameter *90.01 Encoder 1 sel*.	1
	FEN-01 TTL	See parameter *90.01 Encoder 1 sel*.	2
	FEN-11 ABS	See parameter *90.01 Encoder 1 sel*.	3
	FEN-11 TTL	See parameter *90.01 Encoder 1 sel*.	4
	FEN-21 RES	See parameter *90.01 Encoder 1 sel*.	5
	FEN-21 TTL	See parameter *90.01 Encoder 1 sel*.	6
	FEN-31 HTL	See parameter *90.01 Encoder 1 sel*.	7
90.04	TTL echo sel	Enables and selects the interface for the TTL encoder signal echo. **Note:** If encoder emulation and echo are enabled for the same FEN-xx TTL output, the emulation overrides the echo.	
	Disabled	Signal echo interface disabled.	0
	FEN-01 TTL+	Module type: FEN-01 TTL Encoder interface Module. Echo: TTL encoder input (X32) pulses are echoed to the TTL encoder output.	1
	FEN-01 TTL	Module type: FEN-01 TTL Encoder interface Module. Echo: TTL encoder input (X31) pulses are echoed to the TTL encoder output.	2
	FEN-11 TTL	Module type: FEN-11 Absolute Encoder Interface. Echo: TTL encoder input (X41) pulses are echoed to the TTL encoder output.	3
	FEN-21 TTL	Module type: FEN-21 Resolver Interface. Echo: TTL encoder input (X51) pulses are echoed to the TTL encoder output.	4
	FEN-31 HTL	Module type: FEN-31 HTL Encoder Interface. Echo: TTL encoder input (X51) pulses are echoed to the TTL encoder output.	5
90.05	Enc cable fault	Selects the action in case an encoder cable fault is detected by the FEN-xx encoder interface.	
	No	Cable fault detection inactive.	0
	Fault	The drive trips on an ENCODER 1/2 CABLE fault.	1

No.	Name/Value	Description	FbEq
	Warning	The drive generates an ENCODER 1/2 CABLE warning. This is the recommended setting if the maximum pulse frequency of sine/cosine incremental signals exceeds 100 kHz; at high frequencies, the signals may attenuate enough to invoke the function. The maximum pulse frequency can be calculated as follows: Max. pulse frequency $= \frac{\text{Pulses per rev.} \times \text{Max. speed in rpm}}{60}$	2
90.10	Enc par refresh	Setting this parameter to 1 forces a reconfiguration of the FEN-xx interfaces, which is needed for any parameter changes in groups 90…93 to take effect. **Note:** The parameter cannot be changed while the drive is running.	
	Done	Reconfiguration done.	0
	Configure	Reconfigure. The value will automatically revert to *Done*.	1

91 Absol enc conf		Absolute encoder configuration. See also section *Encoder support* on page *31*.	
91.01	Sine cosine nr	Defines the number of sine/cosine wave cycles within one revolution. **Note:** This parameter does not need to be set when EnDat or SSI encoders are used in continuous mode. See parameter *91.25 SSI mode* / *91.30 Endat mode*.	
	0…65535	Number of sine/cosine wave cycles.	1 = 1
91.02	Abs enc interf	Selects the source for the encoder position (zero position).	
	None	Not selected.	0
	Commut sig	Commutation signals.	1
	EnDat	Serial interface: EnDat encoder.	2
	Hiperface	Serial interface: HIPERFACE encoder.	3
	SSI	Serial interface: SSI encoder.	4
	Tamag. 17/33b	Serial interface: Tamagawa 17/33-bit encoder.	5
91.03	Rev count bits	Defines the number of bits used in revolution count (for multiturn encoders). Used with serial interfaces, i.e. when parameter *91.02 Abs enc interf* setting is *EnDat*, *Hiperface*, *SSI* or *Tamag. 17/33b*.	
	0…32	Number of bits. For example, 4096 revolutions corresponds to 12 bits.	1 = 1
91.04	Pos data bits	Defines the number of bits used within one revolution. Used with serial interfaces, i.e. when parameter *91.02 Abs enc interf* setting is *EnDat*, *Hiperface*, *SSI* or *Tamag. 17/33b*.	
	0…32	Number of bits. For example, 32768 positions per revolution corresponds to 15 bits.	1 = 1
91.05	Refmark ena	Enables the encoder zero pulse (if used). Zero pulse can be used for position latching. **Note:** With serial interfaces (i.e. when parameter *91.02 Abs enc interf* setting is *EnDat*, *Hiperface*, *SSI* or *Tamag. 17/33b*), zero pulse must be disabled.	
	False	Zero pulse disabled.	0
	True	Zero pulse enabled.	1

No.	Name/Value	Description	FbEq
91.10	Hiperface parity	Defines the use of parity and stop bits for HIPERFACE encoder (i.e. when parameter *91.02 Abs enc interf* setting is *Hiperface*). Typically, this parameter does not need to be set.	
	Odd	Odd parity indication bit, one stop bit.	0
	Even	Even parity indication bit, one stop bit.	1
91.11	Hiperf baudrate	Defines the transfer rate of the link for HIPERFACE encoder (i.e. when parameter *91.02 Abs enc interf* setting is *Hiperface*). Typically, this parameter does not need to be set.	
	4800	4800 bit/s	0
	9600	9600 bit/s	1
	19200	19200 bit/s	2
	38400	38400 bit/s	3
91.12	Hiperf node addr	Defines the node address for HIPERFACE encoder (i.e. when parameter *91.02 Abs enc interf* setting is *Hiperface*). Typically, this parameter does not need to be set.	
	0…255	HIPERFACE encoder node address.	1 = 1
91.20	SSI clock cycles	Defines the length of the SSI message. The length is defined as the number of clock cycles. The number of cycles can be calculated by adding 1 to the number of bits in an SSI message frame. Used with SSI encoders, i.e. when parameter *91.02 Abs enc interf* setting is *SSI*.	
	2…127	Length of SSI message.	1 = 1
91.21	SSI position msb	Defines the location of the MSB (most significant bit) of the position data within an SSI message. Used with SSI encoders, i.e. when parameter *91.02 Abs enc interf* setting is *SSI*.	
	1…126	Location of MSB (bit number) in SSI position data.	1 = 1
91.22	SSI revol msb	Defines the location of the MSB (most significant bit) of the revolution count within an SSI message. Used with SSI encoders, i.e. when parameter *91.02 Abs enc interf* setting is *SSI*.	
	1…126	Location of MSB (bit number) in SSI revolution count.	1 = 1
91.23	SSI data format	Selects the data format for SSI encoder (i.e. when parameter *91.02 Abs enc interf* setting is *SSI*).	
	binary	Binary data format.	0
	gray	Gray data format.	1
91.24	SSI baud rate	Selects the baud rate for SSI encoder (i.e. when parameter *91.02 Abs enc interf* setting is *SSI*).	
	10 kbit/s	10 kbit/s baud rate.	0
	50 kbit/s	50 kbit/s baud rate.	1
	100 kbit/s	100 kbit/s baud rate.	2
	200 kbit/s	200 kbit/s baud rate.	3
	500 kbit/s	500 kbit/s baud rate.	4
	1000 kbit/s	1000 kbit/s baud rate.	5

No.	Name/Value	Description	FbEq
91.25	SSI mode	Selects the SSI encoder mode. **Note:** This parameter needs to be set only when an SSI encoder is used in continuous mode, i.e. without incremental sin/cos signals (supported only as encoder 1). SSI encoder is selected by setting parameter *91.02 Abs enc interf* to *SSI*.	
	Initial pos.	Single position transfer mode (initial position).	0
	Continuous	Continuous position transfer mode.	1
91.26	SSI transmit cyc	Selects the transmission cycle for SSI encoder. **Note:** This parameter needs to be set only when an SSI encoder is used in continuous mode, i.e. without incremental sin/cos signals (supported only as encoder 1). SSI encoder is selected by setting parameter *91.02 Abs enc interf* to *SSI*.	
	50 µs	50 µs transmission cycle.	0
	100 µs	100 µs transmission cycle.	1
	200 µs	200 µs transmission cycle.	2
	500 µs	500 µs transmission cycle.	3
	1 ms	1 ms transmission cycle.	4
	2 ms	2 ms transmission cycle.	5
91.27	SSI zero phase	Defines the phase angle within one sine/cosine signal period that corresponds to the value of zero on the SSI serial link data. The parameter is used to adjust the synchronization of the SSI position data and the position based on sine/cosine incremental signals. Incorrect synchronization may cause an error of ±1 incremental period. **Note:** This parameter needs only be set when an SSI encoder with sine/cosine incremental signals is used in initial position mode.	
	315-45 deg	315…45° phase angle.	0
	45-135 deg	45…135° phase angle.	1
	135-225 deg	135…225° phase angle.	2
	225-315 deg	225…315° phase angle.	3
91.30	Endat mode	Selects the EnDat encoder mode. **Note:** This parameter needs to be set only when an EnDat encoder is used in continuous mode, i.e. without incremental sin/cos signals (supported only as encoder 1). EnDat encoder is selected by setting parameter *91.02 Abs enc interf* to *EnDat*.	
	Initial pos.	Single position data transfer (initial position).	0
	Continuous	Continuous position data transfer mode.	1
91.31	Endat max calc	Selects the maximum encoder calculation time for EnDat encoder. **Note:** This parameter needs to be set only when an EnDat encoder is used in continuous mode, i.e. without incremental sin/cos signals (supported only as encoder 1). EnDat encoder is selected by setting parameter *91.02 Abs enc interf* to *EnDat*.	
	10 µs	10 µs maximum calculation time.	0
	100 µs	100 µs maximum calculation time.	1
	1 ms	1 ms maximum calculation time.	2
	50 ms	50 ms maximum calculation time.	3

No.	Name/Value	Description	FbEq
92 Resolver conf		Resolver configuration.	
92.01	Resolv polepairs	Selects the number of pole pairs.	
	1 … 32	Number of pole pairs.	1 = 1
92.02	Exc signal ampl	Defines the amplitude of the excitation signal.	
	4.0 … 12.0 Vrms	Amplitude of excitation signal.	10 = 1 Vrms
92.03	Exc signal freq	Defines the frequency of the excitation signal.	
	1 … 20 kHz	Frequency of excitation signal.	1 = 1 kHz

93 Pulse enc conf		Pulse encoder configuration.	
93.01	Enc1 pulse nr	Defines the pulse number per revolution for encoder 1.	
	0 … 65535	Number of pulses for encoder 1.	1 = 1
93.02	Enc1 type	Selects the type of the encoder 1.	
	Quadrature	Quadrature encoder (has two TTL channels, channels A and B)	0
	Single track	Single track encoder (has one TTL channel, channel A)	1
93.03	Enc1 sp CalcMode	Selects the speed calculation mode for encoder 1.	
	A&B all	Channels A and B: Rising and falling edges are used for speed calculation. Channel B: Defines the direction of rotation. **Notes:** • When single track mode has been selected by parameter *93.02 Enc1 type*, this setting acts like the setting *A all*. • When single track mode has been selected by parameter *93.02 Enc1 type*, the speed is always positive.	0
	A all	Channel A: Rising and falling edges are used for speed calculation. Channel B: Defines the direction of rotation. **Note:** When single track mode has been selected by parameter *93.02 Enc1 type*, the speed is always positive.	1
	A rising	Channel A: Rising edges are used for speed calculation. Channel B: Defines the direction of rotation. **Note:** When single track mode has been selected by parameter *93.02 Enc1 type*, the speed is always positive.	2
	A falling	Channel A: Falling edges are used for speed calculation. Channel B: Defines the direction of rotation. **Note:** When single track mode has been selected by parameter *93.02 Enc1 type*, the speed is always positive.	3
	Auto rising	One of the above modes is selected automatically depending on the TTL pulse frequency as follows: **Pulse frequency of the channel(s) / Mode used** < 2442 Hz — *A&B all* 2442…4884 Hz — *A all* > 4884 Hz — *A rising*	4

<table>
<tr><th>No.</th><th>Name/Value</th><th>Description</th><th>FbEq</th></tr>
<tr><td></td><td>Auto falling</td><td>One of the above modes is selected automatically depending on the TTL pulse frequency as follows:
<table><tr><th>Pulse frequency of the channel(s)</th><th>Mode used</th></tr><tr><td>< 2442 Hz</td><td>A&B all</td></tr><tr><td>2442…4884 Hz</td><td>A all</td></tr><tr><td>> 4884 Hz</td><td>A falling</td></tr></table></td><td>5</td></tr>
<tr><td>93.11</td><td>Enc2 pulse nr</td><td>Defines the pulse number per revolution for encoder 2.</td><td></td></tr>
<tr><td></td><td>0 … 65535</td><td>Number of pulses for encoder 2.</td><td>1 = 1</td></tr>
<tr><td>93.12</td><td>Enc2 type</td><td>Selects the type of the encoder 2.</td><td></td></tr>
<tr><td></td><td>Quadrature</td><td>Quadrature encoder (has two TTL channels, channels A and B)</td><td>0</td></tr>
<tr><td></td><td>Single track</td><td>Single track encoder (has one TTL channel, channel A)</td><td>1</td></tr>
<tr><td>93.13</td><td>Enc2 sp CalcMode</td><td>Selects the speed calculation mode for encoder 2.</td><td></td></tr>
<tr><td></td><td>A&B all</td><td>See parameter 93.03 Enc1 sp CalcMode.</td><td>0</td></tr>
<tr><td></td><td>A all</td><td>See parameter 93.03 Enc1 sp CalcMode.</td><td>1</td></tr>
<tr><td></td><td>A rising</td><td>See parameter 93.03 Enc1 sp CalcMode.</td><td>2</td></tr>
<tr><td></td><td>A falling</td><td>See parameter 93.03 Enc1 sp CalcMode.</td><td>3</td></tr>
<tr><td></td><td>Auto rising</td><td>See parameter 93.03 Enc1 sp CalcMode.</td><td>4</td></tr>
<tr><td></td><td>Auto falling</td><td>See parameter 93.03 Enc1 sp CalcMode.</td><td>5</td></tr>
<tr><td colspan="2">94 Ext IO conf</td><td>I/O extension configuration.</td><td></td></tr>
<tr><td>94.01</td><td>Ext IO1 sel</td><td>Activates an I/O extension installed into Slot 1.</td><td></td></tr>
<tr><td></td><td>None</td><td>No extension installed into Slot 1.</td><td>0</td></tr>
<tr><td></td><td>FIO-01</td><td>FIO-01 extension installed into Slot 1.</td><td>1</td></tr>
<tr><td></td><td>FIO-11</td><td>FIO-11 extension installed into Slot 1.</td><td>2</td></tr>
<tr><td></td><td>FIO-21</td><td>FIO-21 extension installed into Slot 1.</td><td>3</td></tr>
<tr><td>94.02</td><td>Ext IO2 sel</td><td>Activates an I/O extension installed into Slot 2.</td><td></td></tr>
<tr><td></td><td>None</td><td>No 2nd extension installed into Slot 2.</td><td>0</td></tr>
<tr><td></td><td>FIO-01</td><td>FIO-01 extension installed into Slot 2.</td><td>1</td></tr>
<tr><td></td><td>FIO-11</td><td>FIO-11 extension installed into Slot 2.</td><td>2</td></tr>
<tr><td></td><td>FIO-21</td><td>FIO-21 extension installed into Slot 2.</td><td>3</td></tr>
<tr><td colspan="2">95 Hw configuration</td><td>Diverse hardware-related settings.</td><td></td></tr>
<tr><td>95.01</td><td>Ctrl boardSupply</td><td>Selects how the drive control unit is powered.</td><td></td></tr>
<tr><td></td><td>Internal 24V</td><td>The drive control unit is powered from the drive power unit it is mounted on. This is the default setting.</td><td>0</td></tr>
<tr><td></td><td>External 24V</td><td>The drive control unit is powered from an external power supply.</td><td>1</td></tr>
</table>

No.	Name/Value	Description	FbEq
97 User motor par		Motor values supplied by the user that are used in the motor model.	
97.01	Use given params	Activates the motor model parameters *97.02*…*97.14*. Notes: Parameter value is automatically set to zero when ID run is selected by parameter *99.13 Idrun mode*. The values of parameters *97.02*…*97.14* are updated according to the motor characteristics identified during the ID run. This parameter cannot be changed while the drive is running.	
	0	Parameters *97.02*…*97.14* inactive.	0
	1	The values of parameters *97.02*…*97.14* are used in the motor model.	1
97.02	Rs user	Defines the stator resistance R_S of the motor model.	
	0.00000 … 0.50000 p.u.	Stator resistance in per unit.	100000 = 1 p.u.
97.03	Rr user	Defines the rotor resistance R_R of the motor model. **Note:** This parameter is valid only for asynchronous motors.	
	0.00000 … 0.50000 p.u.	Rotor resistance in per unit.	100000 = 1 p.u.
97.04	Lm user	Defines the main inductance L_M of the motor model. **Note:** This parameter is valid only for asynchronous motors.	
	0.00000 … 10.00000 p.u.	Main inductance in per unit.	100000 = 1 p.u.
97.05	SigmaL user	Defines the leakage inductance σL_S. **Note:** This parameter is valid only for asynchronous motors.	
	0.00000 … 1.00000 p.u.	Leakage inductance in per unit.	100000 = 1 p.u.
97.06	Ld user	Defines the direct axis (synchronous) inductance. **Note:** This parameter is valid only for permanent magnet motors.	
	0.00000 … 10.00000 p.u	Direct axis inductance in per unit.	100000 = 1 p.u.
97.07	Lq user	Defines the quadrature axis (synchronous) inductance. **Note:** This parameter is valid only for permanent magnet motors.	
	0.00000 … 10.00000 p.u	Quadrature axis inductance in per unit.	100000 = 1 p.u.
97.08	Pm flux user	Defines the permanent magnet flux. **Note:** This parameter is valid only for permanent magnet motors.	
	0.00000 … 2.00000 p.u	Permanent magnet flux in per unit.	100000 = 1 p.u.
97.09	Rs user SI	Defines the stator resistance R_S of the motor model.	
	0.00000 … 100.00000 ohm	Stator resistance.	100000 = 1 ohm
97.10	Rr user SI	Defines the rotor resistance R_R of the motor model. **Note:** This parameter is valid only for asynchronous motors.	
	0.00000 … 100.00000 ohm	Rotor resistance.	100000 = 1 ohm

No.	Name/Value	Description	FbEq
97.11	Lm user SI	Defines the main inductance L_M of the motor model. **Note:** This parameter is valid only for asynchronous motors.	
	0.00 …100000.00 mH	Main inductance.	100 = 1 mH
97.12	SigL user SI	Defines the leakage inductance σL_S. **Note:** This parameter is valid only for asynchronous motors.	
	0.00 …100000.00 mH	Leakage inductance.	100 = 1 mH
97.13	Ld user SI	Defines the direct axis (synchronous) inductance. **Note:** This parameter is valid only for permanent magnet motors.	
	0.00 …100000.00 mH	Direct axis inductance.	100 = 1 mH
97.14	Lq user SI	Defines the quadrature axis (synchronous) inductance. **Note:** This parameter is valid only for permanent magnet motors.	
	0.00 …100000.00 mH	Quadrature axis inductance.	100 = 1 mH

99 Start-up data		Language selection, motor configuration and ID run settings.	
99.01	Language	Selects the language of the control panel displays. **Note:** Not all languages listed below are necessarily supported.	
	English	English.	2057
	Deutsch	German.	1031
	Italiano	Italian.	1040
	Suomi	Finnish.	1035
99.04	Motor type	Selects the motor type. **Note:** This parameter cannot be changed while the drive is running.	
	AM	Asynchronous motor. Three-phase AC induction motor with squirrel cage rotor.	0
	PMSM	Permanent magnet motor. Three-phase AC synchronous motor with permanent magnet rotor and sinusoidal BackEMF voltage.	1
99.05	Motor ctrl mode	Selects the motor control mode.	
	DTC	Direct torque control. This mode is suitable for most applications. **Note:** Instead of direct torque control, use scalar control • with multimotor applications 1) if the load is not equally shared between the motors, 2) if the motors are of different sizes, or 3) if the motors are going to be changed after the motor identification (ID run), • if the nominal current of the motor is less than 1/6 of the nominal output current of the drive, • if the drive is used with no motor connected (for example, for test purposes), • if the drive runs a medium-voltage motor through a step-up transformer.	0

No.	Name/Value	Description	FbEq
	Scalar	Scalar control. This mode is suitable in special cases where DTC cannot be applied. In scalar control, the drive is controlled with a frequency reference. The outstanding motor control accuracy of DTC cannot be achieved in scalar control. Some standard features are disabled in scalar control mode. **Note:** Correct motor run requires that the magnetizing current of the motor does not exceed 90% of the nominal current of the inverter. See also section *Scalar motor control* on page *43*.	1
99.06	Mot nom current	Defines the nominal motor current. Must be equal to the value on the motor rating plate. If multiple motors are connected to the drive, enter the total current of the motors. **Notes:** • Correct motor run requires that the magnetizing current of the motor does not exceed 90% of the nominal current of the drive. • This parameter cannot be changed while the drive is running.	
	0.0 … 6400.0 A	Nominal current of the motor. The allowable range is 1/6…2 × I_{2N} of the drive (0…2 × I_{2N} with scalar control mode).	10 = 1 A
99.07	Mot nom voltage	Defines the nominal motor voltage as fundamental phase-to-phase rms voltage supplied to the motor at the nominal operating point. This setting must match the value on the rating plate of the motor. **Notes:** • With permanent magnet motors, the nominal voltage is the BackEMF voltage at nominal speed of the motor. If the voltage is given as voltage per rpm, e.g. 60 V per 1000 rpm, the voltage for a nominal speed of 3000 rpm is 3 × 60 V = 180 V. Note that the nominal voltage is not equal to the equivalent DC motor voltage (EDCM) specified by some motor manufacturers. The nominal voltage can be calculated by dividing the EDCM voltage by 1.7 (or square root of 3). • The stress on the motor insulation is always dependent on the drive supply voltage. This also applies to the case where the motor voltage rating is lower than that of the drive and the supply. • This parameter cannot be changed while the drive is running.	
	1/6 … 2 × U_N	Nominal voltage of the motor.	10 = 1 V
99.08	Mot nom freq	Defines the nominal motor frequency. **Note:** This parameter cannot be changed while the drive is running.	
	5.0 … 500.0 Hz	Nominal frequency of the motor.	10 = 1 V
99.09	Mot nom 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 … 10000 rpm	Nominal speed of the motor.	1 = 1 rpm

No.	Name/Value	Description	FbEq
99.10	Mot nom 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 *16.17 Power unit*. **Note:** This parameter cannot be changed while the drive is running.	
	0.00 … 10000.00 kW	Nominal power of the motor.	100 = 1 kW
99.11	Mot nom cosfii	Defines the cosphi of the motor for a more accurate motor model. (Not applicable to permanent magnet motors.) Not obligatory; if set, should match the value on the rating plate of the motor. **Note:** This parameter cannot be changed while the drive is running.	
	0.00 … 1.00	Cosphi of the motor.	100 = 1
99.12	Mot nom torque	Defines the nominal motor shaft torque for a more accurate motor model. Not obligatory. **Note:** This parameter cannot be changed while the drive is running.	
	0 … 2147483.647 Nm	Nominal motor torque.	1000 = 1 N•m
99.13	Idrun mode	Selects the type of the motor identification performed at the next start of the drive (for Direct Torque Control). During the identification, the drive will identify the characteristics of the motor for optimum motor control. After the ID run, the drive is stopped. **Note:** This parameter cannot be changed while the drive is running. Once the ID run is activated, it can be cancelled by stopping the drive: If ID run has already been performed once, parameter is automatically set to NO. If no ID run has been performed yet, parameter is automatically set to *Standstill*. In this case, the ID run must be performed. **Notes:** • ID run can only be performed in local control (i.e. when drive is controlled via PC tool or control panel). • ID run cannot be performed if parameter *99.05 Motor ctrl mode* is set to *Scalar*. • ID run must be performed every time any of the motor parameters (*99.04*, *99.06*…*99.12*) have been changed. Parameter is automatically set to *Standstill* after the motor parameters have been set. With permanent magnet motor, the motor shaft must NOT be locked and the load torque must be < 10% during the ID run (*Normal*/*Reduced*/*Standstill*). • Ensure that possible Safe Torque Off and emergency stop circuits are closed during ID run. • Mechanical brake is not opened by the logic for the ID run.	
	No	No motor ID run is requested. This mode can be selected only if the ID run (Normal/Reduced/Standstill) has already been performed once.	0

No.	Name/Value	Description	FbEq
	Normal	Normal ID run. Guarantees the best possible control accuracy. The ID run takes about 90 seconds. This mode should be selected whenever it is possible. **Notes:** • The driven machinery must be de-coupled from the motor with Normal ID run, if the load torque is higher than 20%, or if the machinery is not able to withstand the nominal torque transient during the ID run. • Check the direction of rotation of the motor before starting the ID run. During the run, the motor will rotate in the forward direction. **WARNING!** The motor will run at up to approximately 50…100% of the nominal speed during the ID run. ENSURE THAT IT IS SAFE TO RUN THE MOTOR BEFORE PERFORMING THE ID RUN!	1
	Reduced	Reduced ID Run. This mode should be selected instead of the Normal ID Run if • mechanical losses are higher than 20% (i.e. the motor cannot be de-coupled from the driven equipment), or if • flux reduction is not allowed while the motor is running (i.e. in case of a motor with an integrated brake supplied from the motor terminals). With Reduced ID run, the control in the field weakening area or at high torques is not necessarily as accurate as with the Normal ID run. Reduced ID run is completed faster than the Normal ID Run (< 90 seconds). **Note:** Check the direction of rotation of the motor before starting the ID run. During the run, the motor will rotate in the forward direction. **WARNING!** The motor will run at up to approximately 50…100% of the nominal speed during the ID run. ENSURE THAT IT IS SAFE TO RUN THE MOTOR BEFORE PERFORMING THE ID RUN!	2
	Standstill	Standstill ID run. The motor is injected with DC current. With an asynchronous motor, the motor shaft is not rotating (with permanent magnet motor the shaft can rotate < 0.5 revolution). **Note:** This mode should be selected only if the *Normal* or *Reduced* ID run is not possible due to the restrictions caused by the connected mechanics (e.g. with lift or crane applications).	3
	Autophasing	During autophasing, the start angle of the motor is determined. Note that other motor model values are not updated. See also parameter *11.07 Autophasing mode*. **Notes:** • Autophasing can only be selected after the Normal/ Reduced/Standstill ID run has been performed once. Autophasing is used when an absolute encoder has been added/changed to a permanent magnet motor and there is no need to perform the Normal/Reduced/Standstill ID run again. • During Autophasing, the motor shaft must NOT be locked and the load torque must be < 5%.	4
	Cur meas cal	Current offset and gain measurement calibration. The calibration will be performed at next start.	5

7

Additional parameter data

What this chapter contains

This chapter lists the parameters with some additional data. For parameter descriptions, see chapter *Parameters* on page *63*.

Terms and abbreviations

Term	Definition
Actual signal	Signal measured or calculated by the drive. Can be monitored by the user. No user setting is possible.
Bit pointer	Bit pointer. A bit pointer can point to a single bit in the value of another parameter, or be fixed to 0 (C.FALSE) or 1 (C.TRUE).
enum	Enumerated list, i.e. selection list.
FbEq	Fieldbus equivalent: The scaling between the value shown on the panel and the integer used in serial communication.
INT32	32-bit integer value (31 bits + sign).
No.	Parameter number.
Pb	Packed boolean.
REAL	16-bit value 16-bit value (31 bits + sign) = integer value = fractional value
REAL24	8-bit value 24-bit value (31 bits + sign) = integer value = fractional value

Type	Data type. See enum, INT32, Bit pointer, Val pointer, Pb, REAL, REAL24, UINT32.
UINT32	32-bit unsigned integer value.
Val pointer	Value pointer. Points to the value of another parameter.

Fieldbus addresses

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

Pointer parameter format in fieldbus communication

Value and bit pointer parameters are transferred between the fieldbus adapter and drive as 32-bit integer values.

32-bit integer value pointers

When a value pointer parameter is connected to the value of another parameter, the format is as follows:

	Bit			
	30…31	**16…29**	**8…15**	**0…7**
Name	Source type		Group	Index
Value	1	-	1…255	1…255
Description	Value pointer is connected to parameter	-	Group of source parameter	Index of source parameter

When a value pointer parameter is connected to a solution program, the format is as follows:

	Bit		
	30…31	**24…29**	**0…23**
Name	Source type	Not in use	Address
Value	2	-	$0…2^{23}$
Description	Value pointer is connected to solution program.	-	Relative address of solution program variable

Note: Value pointer parameters connected to a solution program are read-only via fieldbus.

32-bit integer bit pointers

When a bit pointer parameter is connected to value 0 or 1, the format is as follows:

	Bit		
	30…31	**16…29**	**0**
Name	Source type	Not in use	Value
Value	0	-	0…1
Description	Bit pointer is connected to 0/1.	-	0 = False, 1 = True

When a bit pointer parameter is connected to a bit value of another parameter, the format is as follows:

	Bit				
	30…31	**24…29**	**16…23**	**8…15**	**0…7**
Name	Source type	Not in use	Bit sel	Group	Index
Value	1	-	0…31	2…255	1…255
Description	Bit pointer is connected to signal bit value.	-	Bit selection	Group of source parameter	Index of source parameter

When a bit pointer parameter is connected to a solution program, the format is as follows:

	Bit		
	30…31	**24…29**	**0…23**
Name	Source type	Bit sel	Address
Value	2	0…31	$0…2^{23}$
Description	Bit pointer is connected to solution program.	Bit selection	Relative address of solution program variable

Note: Value pointer parameters connected to a solution program are read-only via fieldbus.

Parameter groups 1…9

No.	Name	Type	Data length	Range	Unit	Update time	Notes
01 Actual values							
01.01	*Motor speed rpm*	REAL	32	-30000…30000	rpm	250 µs	
01.02	*Motor speed %*	REAL	32	-1000…1000	%	2 ms	
01.03	*Output frequency*	REAL	32	-30000…30000	Hz	2 ms	
01.04	*Motor current*	REAL	32	0…30000	A	10 ms	
01.05	*Motor current %*	REAL	16	0…1000	%	2 ms	
01.06	*Motor torque*	REAL	16	-1600…1600	%	2 ms	
01.07	*Dc-voltage*	REAL	32	0…2000	V	2 ms	
01.08	*Encoder1 speed*	REAL	32	-32768…32768	rpm	250 µs	
01.09	*Encoder1 pos*	REAL24	32	0…1	rev	250 µs	
01.10	*Encoder2 speed*	REAL	32	-32768…32768	rpm	250 µs	
01.11	*Encoder2 pos*	REAL24	32	0…1	rev	250 µs	
01.12	*Pos act*	REAL	32	-32768…32768	rev	2 ms	
01.13	*Pos 2nd enc*	REAL	32	-32768…32768	rev	2 ms	
01.14	*Motor speed est*	REAL	32	-30000…30000	rpm	2 ms	
01.15	*Temp inverter*	REAL24	16	-40…160	°C	2 ms	
01.16	*Temp brk chopper*	REAL24	16	-40…160	°C	2 ms	
01.17	*Motor temp1*	REAL	16	-10…250	°C	10 ms	
01.18	*Motor temp2*	REAL	16	-10…250	°C	10 ms	
01.19	*Used supply volt*	REAL	16	0…1000	V	10 ms	
01.20	*Brake res load*	REAL24	16	0…1000	%	50 ms	
01.21	*Cpu usage*	UINT32	16	0…100	%	-	
01.22	*Power inu out*	REAL	32	-32768…32768	kW or hp	10 ms	
01.23	*Motor power*	REAL	32	-32768…32768	kW or hp	2 ms	
01.24	*kWh inverter*	INT32	32	0…2147483647	kWh	10 ms	
01.25	*kWh supply*	INT32	32	-2147483647 … 2147483647	kWh	10 ms	
01.26	*On-time counter*	INT32	32	0…35791394.1	h	10 ms	
01.27	*Run-time counter*	INT32	32	0…35791394.1	h	10 ms	
01.28	*Fan on-time*	INT32	32	0…35791394.1	h	10 ms	
01.29	*Torq nom scale*	INT32	32	0…2147483.647	Nm	-	
01.30	*Polepairs*	INT32	16	0…1000	-	-	
01.31	*Mech time const*	REAL	32	0…32767	s	10 ms	
01.32	*Temp phase A*	REAL24	16	-40…160	°C	2 ms	
01.33	*Temp phase B*	REAL24	16	-40…160	°C	2 ms	
01.34	*Temp phase C*	REAL24	16	-40…160	°C	2 ms	
01.35	*Saved energy*	INT32	32	0…2147483647	kWh	10 ms	
01.36	*Saved amount*	INT32	32	0…2147483647	-	10 ms	
01.37	*Saved CO2*	INT32	32	0…2147483647	t	10 ms	
02 I/O values							
02.01	*DI status*	Pb	16	0b000000…0b111111	-	2 ms	
02.02	*RO status*	Pb	16	0b00000…0b11111	-	2 ms	
02.03	*DIO status*	Pb	16	0b0000000000 … 0b1111111111	-	2 ms	
02.04	*AI1*	REAL	16	-11…11 V or -22…22 mA	V or mA	2 ms	
02.05	*AI1 scaled*	REAL	32	-32768…32768	-	2 ms	
02.06	*AI2*	REAL	16	-11…11 V or -22…22 mA	V or mA	2 ms	

No.	Name	Type	Data length	Range	Unit	Update time	Notes
02.07	*AI2 scaled*	REAL	32	-32768…32768	-	2 ms	
02.08	*AI3*	REAL	16	-22…22	mA	2 ms	
02.09	*AI3 scaled*	REAL	32	-32768…32768	-	2 ms	
02.10	*AI4*	REAL	16	-22…22	mA	2 ms	
02.11	*AI4 scaled*	REAL	32	-32768…32768	-	2 ms	
02.12	*AI5*	REAL	16	-22…22	mA	2 ms	
02.13	*AI5 scaled*	REAL	32	-32768…32768	-	2 ms	
02.14	*AI6*	REAL	16	-22…22	mA	2 ms	
02.15	*AI6 scaled*	REAL	32	-32768…32768	-	2 ms	
02.16	*AO1*	REAL	16	0 … 22.7	mA	2 ms	
02.17	*AO2*	REAL	16	-10…10	V	2 ms	
02.18	*AO3*	REAL	16	0 … 22.7	mA	2 ms	
02.19	*AO4*	REAL	16	0 … 22.7	mA	2 ms	
02.20	*Freq in*	REAL	32	0…32767	Hz	250 µs	
02.21	*Freq out*	REAL	32	0…32767	Hz	250 µs	
02.22	*FBA main cw*	Pb	32	0x00000000 … 0xFFFFFFFF	-	500 µs	
02.24	*FBA main sw*	Pb	32	0x00000000 … 0xFFFFFFFF	-	-	
02.26	*FBA main ref1*	INT32	32	-2147483647 … 2147483647	-	500 µs	
02.27	*FBA main ref2*	INT32	32	-2147483647 … 2147483647	-	500 µs	
02.30	*D2D main cw*	Pb	16	0x0000…0xFFFF	-	500 µs	
02.31	*D2D follower cw*	Pb	16	0x0000…0xFFFF	-	2 ms	
02.32	*D2D ref1*	REAL	32	-2147483647 … 2147483647	-	500 µs	
02.33	*D2D ref2*	REAL	32	-2147483647 … 2147483647	-	2 ms	
02.34	*Panel ref*	REAL	32	-32768…32768	rpm	10 ms	
02.35	*FEN DI status*	Pb	16	0…0x33	-	500 µs	
03 Control values							
03.03	*SpeedRef unramp*	REAL	32	-30000…30000	rpm	250 µs	
03.05	*SpeedRef ramped*	REAL	32	-30000…30000	rpm	250 µs	
03.06	*SpeedRef used*	REAL	32	-30000…30000	rpm	250 µs	
03.07	*Speed error filt*	REAL	32	-30000…30000	rpm	250 µs	
03.08	*Acc comp torq*	REAL	16	-1600…1600	%	250 µs	
03.09	*Torq ref sp ctrl*	REAL	16	-1600…1600	%	250 µs	
03.11	*Torq ref ramped*	REAL	16	-1000…1000	%	250 µs	
03.12	*Torq ref sp lim*	REAL	16	-1000…1000	%	250 µs	
03.13	*Torq ref to TC*	REAL	16	-1600…1600	%	250 µs	
03.14	*Torq ref used*	REAL	16	-1600…1600	%	250 µs	
03.15	*Brake torq mem*	REAL	16	-1000…1000	%	2 ms	
03.16	*Brake command*	enum	16	0…1	-	2 ms	
03.17	*Flux ref used*	REAL24	16	0…200	%	2 ms	
03.18	*Speed ref pot*	REAL	32	-30000…30000	rpm	10 ms	
04 Appl values							
04.01	*Process act1*	REAL	32	-32768…32768	-	2 ms	
04.02	*Process act2*	REAL	32	-32768…32768	-	2 ms	
04.03	*Process act*	REAL	32	-32768…32768	-	2 ms	
04.04	*Process PID err*	REAL	32	-32768…32768	-	2 ms	
04.05	*Process PID out*	REAL	32	-32768…32768	-	2 ms	

No.	Name	Type	Data length	Range	Unit	Update time	Notes
04.06	Process var1	REAL	32	-32768…32768	-	10 ms	
04.07	Process var2	REAL	32	-32768…32768	-	10 ms	
04.08	Process var3	REAL	32	-32768…32768	-	10 ms	
04.09	Counter ontime1	UINT32	32	0…2147483647	s	10 ms	
04.10	Counter ontime2	UINT32	32	0…2147483647	s	10 ms	
04.11	Counter edge1	UINT32	32	0…2147483647	-	10 ms	
04.12	Counter edge2	UINT32	32	0…2147483647	-	10 ms	
04.13	Counter value1	UINT32	32	0…2147483647	-	10 ms	
04.14	Counter value2	UINT32	32	0…2147483647	-	10 ms	
06 Drive status							
06.01	Status word1	Pb	16	0x0000…0xFFFF	-	2 ms	
06.02	Status word2	Pb	16	0x0000…0xFFFF	-	2 ms	
06.03	Speed ctrl stat	Pb	16	0x0000…0xFFFF	-	250 µs	
06.05	Limit word1	Pb	16	0x0000…0xFFFF	-	250 µs	
06.07	Torq lim status	Pb	16	0x0000…0xFFFF	-	250 µs	
06.12	Op mode ack	enum	16	0…11	-	2 ms	
06.13	Superv status	Pb	16	0b00…0b11	-	2 ms	
06.14	Timed func stat	Pb	16	0b0000…0b1111	-	10 ms	
06.15	Counter status	Pb	16	0b000000…0b111111	-	10 ms	
08 Alarms & faults							
08.01	Active fault	enum	16	0…65535	-	-	
08.02	Last fault	enum	16	0…2147483647	-	-	
08.03	Fault time hi	INT32	32	$-2^{31}…2^{31}-1$	(date)	-	
08.04	Fault time lo	INT32	32	00:00:00 … 24:00:00	(time)	-	
08.05	Alarm word1	UINT32	16	0x0000…0xFFFF	-	2 ms	
08.06	Alarm word2	UINT32	16	0x0000…0xFFFF	-	2 ms	
08.07	Alarm word3	UINT32	16	0x0000…0xFFFF	-	2 ms	
08.08	Alarm word4	UINT32	16	0x0000…0xFFFF	-	2 ms	
09 System info							
09.01	Drive type	INT32	16	0…65535	-	-	
09.02	Drive rating id	INT32	16	0…65535	-	-	
09.03	Firmware id	Pb	16	-	-	-	
09.04	Firmware ver	Pb	16	-	-	-	
09.05	Firmware patch	Pb	16	-	-	-	
09.10	Int logic ver	Pb	32	-	-	-	
09.20	Option slot1	INT32	16	0…21	-	-	
09.21	Option slot2	INT32	16	0…21	-	-	
09.22	Option slot3	INT32	16	0…21	-	-	

Parameter groups 10…99

No.	Name	Type	Data len.	Range	Unit	Default (Factory macro)
10 Start/stop						
10.01	Ext1 start func	enum	16	0…6	-	In1
10.02	Ext1 start in1	Bit pointer	32	-	-	DI1
10.03	Ext1 start in2	Bit pointer	32	-	-	C.FALSE
10.04	Ext2 start func	enum	16	0…6	-	Not sel
10.05	Ext2 start in1	Bit pointer	32	-	-	C.FALSE
10.06	Ext2 start in2	Bit pointer	32	-	-	C.FALSE
10.07	Jog1 start	Bit pointer	32	-	-	C.FALSE
10.08	Jog2 start	Bit pointer	32	-	-	C.FALSE
10.09	Jog enable	Bit pointer	32	-	-	C.FALSE
10.10	Fault reset sel	Bit pointer	32	-	-	DI3
10.11	Run enable	Bit pointer	32	-	-	C.TRUE
10.13	Em stop off3	Bit pointer	32	-	-	C.TRUE
10.15	Em stop off1	Bit pointer	32	-	-	C.TRUE
10.17	Start enable	Bit pointer	32	-	-	C.TRUE
10.19	Start inhibit	enum	16	0…1	-	Disabled
11 Start/stop mode						
11.01	Start mode	enum	16	0…2	-	Automatic
11.02	Dc-magn time	UINT32	16	0…10000	ms	500 ms
11.03	Stop mode	enum	16	1…2	-	Coast
11.04	Dc hold speed	REAL	16	0…1000	rpm	5.0 rpm
11.05	Dc hold curr ref	UINT32	16	0…100	%	30%
11.06	Dc hold	enum	16	0…1	-	Disabled
11.07	Autophasing mode	enum	16	0…2	-	Turning
12 Operating mode						
12.01	Ext1/Ext2 sel	Bit pointer	32	-	-	C.FALSE
12.03	Ext1 ctrl mode	enum	16	1…5	-	Speed
12.05	Ext2 ctrl mode	enum	16	1…5	-	Speed
13 Analogue inputs						
13.01	AI1 filt time	REAL	16	0…30	s	0.100 s
13.02	AI1 max	REAL	16	-22…22 mA or -11…11 V	mA or V	10.000 V
13.03	AI1 min	REAL	16	-22…22 mA or -11…11 V	mA or V	-10.000 V
13.04	AI1 max scale	REAL	32	-32768…32768	-	1500.000
13.05	AI1 min scale	REAL	32	-32768…32768	-	-1500.000
13.06	AI2 filt time	REAL	16	0…30	s	0.100 s
13.07	AI2 max	REAL	16	-22…22 mA or -11…11 V	mA or V	10.000 V
13.08	AI2 min	REAL	16	-22…22 mA or -11…11 V	mA or V	-10.000 V
13.09	AI2 max scale	REAL	32	-32768…32768	-	100.000
13.10	AI2 min scale	REAL	32	-32768…32768	-	-100.000

No.	Name	Type	Data len.	Range	Unit	Default (Factory macro)
13.11	AI3 filt time	REAL	16	0…30	s	0.100 s
13.12	AI3 max	REAL	16	-22…22 mA or -11…11 V	mA or V	22.000 mA
13.13	AI3 min	REAL	16	-22…22 mA or -11…11 V	mA or V	4.000 mA
13.14	AI3 max scale	REAL	32	-32768…32768	-	1500.000
13.15	AI3 min scale	REAL	32	-32768…32768	-	0.000
13.16	AI4 filt time	REAL	16	0…30	s	0.100 s
13.17	AI4 max	REAL	16	-22…22 mA or -11…11 V	mA or V	22.000 mA
13.18	AI4 min	REAL	16	-22…22 mA or -11…11 V	mA or V	4.000 mA
13.19	AI4 max scale	REAL	32	-32768…32768	-	1500.000
13.20	AI4 min scale	REAL	32	-32768…32768	-	0.000
13.21	AI5 filt time	REAL	16	0…30	s	0.100 s
13.22	AI5 max	REAL	16	-22…22 mA or -11…11 V	mA or V	22.000 mA
13.23	AI5 min	REAL	16	-22…22 mA or -11…11 V	mA or V	4.000 mA
13.24	AI5 max scale	REAL	32	-32768…32768	-	1500.000
13.25	AI5 min scale	REAL	32	-32768…32768	-	0.000
13.26	AI6 filt time	REAL	16	0…30	s	0.100 s
13.27	AI6 max	REAL	16	-22…22 mA or -11…11 V	mA or V	22.000 mA
13.28	AI6 min	REAL	16	-22…22 mA or -11…11 V	mA or V	4.000 mA
13.29	AI6 max scale	REAL	32	-32768…32768	-	1500.000
13.30	AI6 min scale	REAL	32	-32768…32768	-	0.000
13.31	AI tune	enum	16	0…4	-	No action
13.32	AI superv func	enum	16	0…3	-	No
13.33	AI superv cw	UINT32	32	0b0000…0b1111	-	0b0000
14 Digital I/O						
14.01	DI invert mask	Pb	16	0b000000 … 0b1111111	-	0b000000
14.02	DIO1 conf	enum	16	0…1	-	Output
14.03	DIO1 out src	Bit pointer	32	-	-	Ready relay
14.04	DIO1 Ton	UINT32	16	0…3000	s	0.0 s
14.05	DIO1 Toff	UINT32	16	0…3000	s	0.0 s
14.06	DIO2 conf	enum	16	0…2	-	Output
14.07	DIO2 out src	Bit pointer	32	-	-	RunningRelay
14.08	DIO2 Ton	UINT32	16	0…3000	s	0.0 s
14.09	DIO2 Toff	UINT32	16	0…3000	s	0.0 s
14.10	DIO3 conf	enum	16	0…3	-	Output
14.11	DIO3 out src	Bit pointer	32	-	-	Fault(-1)
14.12	DIO3 Ton	UINT32	16	0…3000	s	0.0 s
14.13	DIO3 Toff	UINT32	16	0…3000	s	0.0 s
14.14	DIO4 conf	enum	16	0…1	-	Output
14.15	DIO4 out src	Bit pointer	32	-	-	Ready relay
14.18	DIO5 conf	enum	16	0…1	-	Output

No.	Name	Type	Data len.	Range	Unit	Default (Factory macro)
14.19	*DIO5 out src*	Bit pointer	32	-	-	*Ref running*
14.22	*DIO6 conf*	enum	16	0…1	-	*Output*
14.23	*DIO6 out src*	Bit pointer	32	-	-	*Fault*
14.26	*DIO7 conf*	enum	16	0…1	-	*Output*
14.27	*DIO7 out src*	Bit pointer	32	-	-	*Alarm*
14.30	*DIO8 conf*	enum	16	0…1	-	*Output*
14.31	*DIO8 out src*	Bit pointer	32	-	-	*Ext2 active*
14.34	*DIO9 conf*	enum	16	0…1	-	*Output*
14.35	*DIO9 out src*	Bit pointer	32	-	-	*At setpoint*
14.38	*DIO10 conf*	enum	16	0…1	-	*Output*
14.39	*DIO10 out src*	Bit pointer	32	-	-	*Zero speed*
14.42	*RO1 src*	Bit pointer	32	-	-	*Ready relay*
14.43	*RO1 Ton*	UINT32	16	0…3000	s	0.0 s
14.44	*RO1 Toff*	UINT32	16	0…3000	s	0.0 s
14.45	*RO2 src*	Bit pointer	32	-	-	*RunningRelay*
14.48	*RO3 src*	Bit pointer	32	-	-	*Fault(-1)*
14.51	*RO4 src*	Bit pointer	32	-	-	P.06.02.02
14.54	*RO5 src*	Bit pointer	32	-	-	P.06.02.04
14.57	*Freq in max*	REAL	16	3…32768	Hz	1000 Hz
14.58	*Freq in min*	REAL	16	3…32768	Hz	3 Hz
14.59	*Freq in max scal*	REAL	16	-32768…32768	-	1500
14.60	*Freq in min scal*	REAL	16	-32768… 32768	-	0
14.61	*Freq out src*	Val pointer	32	-	-	P.01.01
14.62	*Freq out max src*	REAL	16	0…32768	-	1500
14.63	*Freq out min src*	REAL	16	0…32768	-	0
14.64	*Freq out max sca*	REAL	16	3…32768	Hz	1000 Hz
14.65	*Freq out min sca*	REAL	16	3…32768	Hz	3 Hz
15 Analogue outputs						
15.01	*AO1 src*	Val pointer	32	-	-	*Current %*
15.02	*AO1 filt time*	REAL	16	0…30	s	0.100 s
15.03	*AO1 out max*	REAL	16	0 … 22.7	mA	20.000 mA
15.04	*AO1 out min*	REAL	16	0 … 22.7	mA	4.000 mA
15.05	*AO1 src max*	REAL	32	-32768…32768	-	100.000
15.06	*AO1 src min*	REAL	32	-32768…32768	-	0.000
15.07	*AO2 src*	Val pointer	32	-	-	*Speed %*
15.08	*AO2 filt time*	REAL	16	0…30	s	0.100 s
15.09	*AO2 out max*	REAL	16	-10…10	V	10.000 V
15.10	*AO2 out min*	REAL	16	-10…10	V	-10.000 V
15.11	*AO2 src max*	REAL	32	-32768…32768	-	100.000
15.12	*AO2 src min*	REAL	32	-32768…32768	-	-100.000

No.	Name	Type	Data len.	Range	Unit	Default (Factory macro)
15.13	AO3 src	Val pointer	32	-	-	Frequency
15.14	AO3 filt time	REAL	16	0…30	s	0.100 s
15.15	AO3 out max	REAL	16	0 … 22.7	mA	22.000 mA
15.16	AO3 out min	REAL	16	0 … 22.7	mA	4.000 mA
15.17	AO3 src max	REAL	32	-32768…32768	-	50.000
15.18	AO3 src min	REAL	32	-32768…32768	-	0.000
15.19	AO4 src	Val pointer	32	-	-	Frequency
15.20	AO4 filt time	REAL	16	0…30	s	0.100 s
15.21	AO4 out max	REAL	16	0 … 22.7	mA	22.000 mA
15.22	AO4 out min	REAL	16	0 … 22.7	mA	4.000 mA
15.23	AO4 src max	REAL	32	-32768…32768	-	50.000
15.24	AO4 src min	REAL	32	-32768…32768	-	0.000
15.25	AO ctrl word	UINT32	32	0b0000…0b1111	-	0b0000
16 System						
16.01	Local lock	Bit pointer	32	-	-	C.FALSE
16.02	Parameter lock	enum	16	0…2	-	Open
16.03	Pass code	INT32	32	0…2147483647	-	0
16.04	Param restore	enum	16	0…2	-	Done
16.07	Param save	enum	16	0…1	-	Done
16.09	User set sel	enum	32	1…10	-	No request
16.10	User set log	Pb	32	0…1024	-	N/A
16.11	User IO sel lo	Bit pointer	32	-	-	C.FALSE
16.12	User IO sel hi	Bit pointer	32	-	-	C.FALSE
16.14	Reset ChgParLog	enum	16	0…1	-	Done
16.15	Menu set sel	enum	16	0…2	-	No request
16.16	Menu set active	enum	16	0…2	-	Short menu
16.17	Power unit	enum	16	0…1	-	kW
19 Speed calculation						
19.01	Speed scaling	REAL	16	0…30000	rpm	1500 rpm
19.02	Speed fb sel	enum	16	0…2	-	Estimated
19.03	MotorSpeed filt	REAL	32	0…10000	ms	8.000 ms
19.06	Zero speed limit	REAL	32	0…30000	rpm	30.00 rpm
19.07	Zero speed delay	UINT32	16	0…30000	ms	0 ms
19.08	Above speed lim	REAL	16	0…30000	rpm	0 rpm
19.09	Speed TripMargin	REAL	32	0…10000	rpm	500.0 rpm
19.10	Speed window	REAL	16	0…30000	rpm	100 rpm
20 Limits						
20.01	Maximum speed	REAL	32	0…30000	rpm	1500 rpm
20.02	Minimum speed	REAL	32	-30000…0	rpm	-1500 rpm
20.03	Pos speed ena	Bit pointer	32	-	-	C.TRUE

No.	Name	Type	Data len.	Range	Unit	Default (Factory macro)
20.04	Neg speed ena	Bit pointer	32	-	-	C.TRUE
20.05	Maximum current	REAL	32	0…30000	A	0.00 A
20.06	Torq lim sel	Bit pointer	32	-	-	C.FALSE
20.07	Maximum torque1	REAL	16	0…1600	%	300.0%
20.08	Minimum torque1	REAL	16	-1600…0	%	-300.0%
20.09	Maximum torque2	REAL	16	-	-	Max torque1
20.10	Minimum torque2	REAL	16	-	-	Min torque1
20.12	P motoring lim	REAL	16	0…1600	%	300.0%
20.13	P generating lim	REAL	16	0…1600	%	300.0%
21 Speed ref						
21.01	Speed ref1 sel	Val pointer	32	-	-	AI1 scaled
21.02	Speed ref2 sel	Val pointer	32	-	-	Zero
21.03	Speed ref1 func	enum	16	0…5	-	Ref1
21.04	Speed ref1/2 sel	Bit pointer	32	-	-	C.FALSE
21.05	Speed share	REAL	16	-8…8	-	1.000
21.07	Speed ref jog1	REAL	16	-30000…30000	rpm	0 rpm
21.08	Speed ref jog2	REAL	16	-30000…30000	rpm	0 rpm
21.09	SpeedRef min abs	REAL	16	0…30000	rpm	0 rpm
21.10	Mot pot func	enum	16	0…1	-	Reset
21.11	Mot pot up	Bit pointer	32	-	-	DI5
21.12	Mot pot down	Bit pointer	32	-	-	DI6
22 Speed ref ramp						
22.01	Acc/Dec sel	Bit pointer	32	-	-	C.FALSE
22.02	Acc time1	REAL	32	0…1800	s	20.000 s
22.03	Dec time1	REAL	32	0…1800	s	20.000 s
22.04	Acc time2	REAL	32	0…1800	s	60.000 s
22.05	Dec time2	REAL	32	0…1800	s	60.000 s
22.06	Shape time acc1	REAL	32	0…1000	s	0.100 s
22.07	Shape time acc2	REAL	32	0…1000	s	0.100 s
22.08	Shape time dec1	REAL	32	0…1000	s	0.100 s
22.09	Shape time dec2	REAL	32	0…1000	s	0.100 s
22.10	Acc time jogging	REAL	32	0…1800	s	0.000 s
22.11	Dec time jogging	REAL	32	0…1800	s	0.000 s
22.12	Em stop time	REAL	32	0…1800	s	3.000 s
23 Speed ctrl						
23.01	Proport gain	REAL	16	0…200	-	10.00
23.02	Integration time	REAL	32	0…600	s	0.500 s
23.03	Derivation time	REAL	16	0…10	s	0.000 s
23.04	Deriv filt time	REAL	16	0…1000	ms	8.0 ms
23.05	Acc comp DerTime	REAL	32	0…600	s	0.00 s

No.	Name	Type	Data len.	Range	Unit	Default (Factory macro)
23.06	Acc comp Ftime	REAL	16	0…1000	ms	8.0 ms
23.07	Speed err Ftime	REAL	16	0…1000	ms	0.0 ms
23.08	Speed additive	Val pointer	32	-	-	Zero
23.09	Max torq sp ctrl	REAL	16	-1600…1600	%	300.0%
23.10	Min torq sp ctrl	REAL	16	-1600…1600	%	-300.0%
23.11	SpeedErr winFunc	enum	16	0…2	-	Disabled
23.12	SpeedErr win hi	REAL	16	0…3000	rpm	0 rpm
23.13	SpeedErr win lo	REAL	16	0…3000	rpm	0 rpm
23.14	Drooping rate	REAL	16	0…100	%	0.00%
23.15	PI adapt max sp	REAL	16	0…30000	rpm	0 rpm
23.16	PI adapt min sp	REAL	16	0…30000	rpm	0 rpm
23.17	Pcoef at min sp	REAL	16	0…10	-	1.000
23.18	Icoef at min sp	REAL	16	0…10	-	1.000
23.20	PI tune mode	enum	16	0…4	-	Done
23.21	Tune bandwidth	REAL	16	0…2000	Hz	100.00 Hz
23.22	Tune damping	REAL	16	0…200	-	1.5
24 Torque ref						
24.01	Torq ref1 sel	Val pointer	32	-	-	AI2 scaled
24.02	Torq ref add sel	Val pointer	32	-	-	Zero
24.03	Maximum torq ref	REAL	16	0…1000	%	300.0%
24.04	Minimum torq ref	REAL	16	-1000…0	%	-300.0%
24.05	Load share	REAL	16	-8…8	-	1.000
24.06	Torq ramp up	UINT32	32	0…60	s	0.000 s
24.07	Torq ramp down	UINT32	32	0…60	s	0.000 s
25 Critical speed						
25.01	Crit speed sel	enum	16	0…1	-	Disable
25.02	Crit speed1 lo	REAL	16	-30000…30000	rpm	0 rpm
25.03	Crit speed1 hi	REAL	16	-30000…30000	rpm	0 rpm
25.04	Crit speed2 lo	REAL	16	-30000…30000	rpm	0 rpm
25.05	Crit speed2 hi	REAL	16	-30000…30000	rpm	0 rpm
25.06	Crit speed3 lo	REAL	16	-30000…30000	rpm	0 rpm
25.07	Crit speed3 hi	REAL	16	-30000…30000	rpm	0 rpm
26 Constant speeds						
26.01	Const speed func	Pb	16	0b00…0b11	-	0b00
26.02	Const speed sel1	Bit pointer	32	-	-	C.FALSE
26.03	Const speed sel2	Bit pointer	32	-	-	C.FALSE
26.04	Const speed sel3	Bit pointer	32	-	-	C.FALSE
26.06	Const speed1	REAL	16	-30000…30000	rpm	0 rpm
26.07	Const speed2	REAL	16	-30000…30000	rpm	0 rpm
26.08	Const speed3	REAL	16	-30000…30000	rpm	0 rpm

No.	Name	Type	Data len.	Range	Unit	Default (Factory macro)
26.09	Const speed4	REAL	16	-30000…30000	rpm	0 rpm
26.10	Const speed5	REAL	16	-30000…30000	rpm	0 rpm
26.11	Const speed6	REAL	16	-30000…30000	rpm	0 rpm
26.12	Const speed7	REAL	16	-30000…30000	rpm	0 rpm
27 Process PID						
27.01	PID setpoint sel	Val pointer	32	-	-	AI1 scaled
27.02	PID fbk func	enum	16	0…8	-	Act1
27.03	PID fbk1 src	Val pointer	32	-	-	AI2 scaled
27.04	PID fbk2 src	Val pointer	32	-	-	AI2 scaled
27.05	PID fbk1 max	REAL	32	-32768…32768	-	100.00
27.06	PID fbk1 min	REAL	32	-32768…32768	-	-100.00
27.07	PID fbk2 max	REAL	32	-32768…32768	-	100.00
27.08	PID fbk2 min	REAL	32	-32768…32768	-	-100.00
27.09	PID fbk gain	REAL	16	-32.768 … 32.767	-	1.000
27.10	PID fbk ftime	REAL	16	0…30	s	0.040 s
27.12	PID gain	REAL	16	0…100	-	1.00
27.13	PID integ time	REAL	16	0…320	s	60.00 s
27.14	PID deriv time	REAL	16	0…10	s	0.00 s
27.15	PID deriv filter	REAL	16	0…10	s	1.00 s
27.16	PID error inv	Bit pointer	32	-	-	C.FALSE
27.18	PID maximum	REAL	32	-32768…32768	-	100.0
27.19	PID minimum	REAL	32	-32768…32768	-	-100.0
27.22	Sleep mode	enum	16	0…2	-	No
27.23	Sleep level	REAL	32	-32768…32768	-	0.0
27.24	Sleep delay	UINT32	32	0…360	s	0.0 s
27.25	Wake up level	REAL	32	0…32768	-	0.0
27.26	Wake up delay	UINT32	32	0…360	s	0.0 s
27.27	Sleep ena	Bit pointer	32	-	-	C.FALSE
30 Fault functions						
30.01	External fault	Bit pointer	32	-	-	C.TRUE
30.02	Speed ref safe	REAL	16	-30000…30000	rpm	0 rpm
30.03	Local ctrl loss	enum	16	0…3	-	Fault
30.04	Mot phase loss	enum	16	0…1	-	Fault
30.05	Earth fault	enum	16	0…2	-	Fault
30.06	Suppl phs loss	enum	16	0…1	-	Fault
30.07	Sto diagnostic	enum	16	1…3	-	Fault
30.08	Cross connection	enum	16	0…1	-	Fault
30.09	Stall function	Pb	16	0b000…0b111	-	0b111
30.10	Stall curr lim	REAL	16	0…1600	%	300.0%
30.11	Stall freq hi	REAL	16	0.5 … 1000	Hz	20.0 Hz

No.	Name	Type	Data len.	Range	Unit	Default (Factory macro)
30.12	Stall time	UINT32	16	0…3600	s	20 s
31 Mot therm prot						
31.01	Mot temp1 prot	enum	16	0…2	-	No
31.02	Mot temp1 src	enum	16	0…12	-	Estimated
31.03	Mot temp1 almLim	INT32	16	0…200	°C	90 °C
31.04	Mot temp1 fltLim	INT32	16	0…200	°C	110 °C
31.05	Mot temp2 prot	enum	16	0…2	-	No
31.06	Mot temp2 src	enum	16	0…12	-	Estimated
31.07	Mot temp2 almLim	INT32	16	0…200	°C	90 °C
31.08	Mot temp2 fltLim	INT32	16	0…200	°C	110 °C
31.09	Mot ambient temp	INT32	16	-60…100	°C	20 °C
31.10	Mot load curve	INT32	16	50…150	%	100%
31.11	Zero speed load	INT32	16	50…150	%	100%
31.12	Break point	INT32	16	0.01…500	Hz	45.00 Hz
31.13	Mot nom tempRise	INT32	16	0…300	°C	80 °C
31.14	Mot therm time	INT32	16	100…10000	s	256 s
32 Automatic reset						
32.01	Autoreset sel	Pb	16	0b000000…0b111111	-	0b000000
32.02	Number of trials	UINT32	16	0…5	-	0
32.03	Trial time	UINT32	16	1…600	s	30.0 s
32.04	Delay time	UINT32	16	0…120	s	0.0 s
33 Supervision						
33.01	Superv1 func	enum	16	0…4	-	Disabled
33.02	Superv1 act	Val pointer	32	-	-	Speed rpm
33.03	Superv1 hi	REAL	32	-32768…32768	-	0.00
33.04	Superv1 lo	REAL	32	-32768…32768	-	0.00
33.05	Superv2 func	enum	16	0…4	-	Disabled
33.06	Superv2 act	Val pointer	32	-	-	Current
33.07	Superv2 hi	REAL	32	-32768…32768	-	0.00
33.08	Superv2 lo	REAL	32	-32768…32768	-	0.00
33.09	Superv3 func	enum	16	0…4	-	Disabled
33.10	Superv3 act	Val pointer	32	-	-	Torque
33.11	Superv3 hi	REAL	32	-32768…32768	-	0.00
33.12	Superv3 lo	REAL	32	-32768…32768	-	0.00
34 User load curve						
34.01	Overload func	Pb	16	0b000000…0b111111	-	0b000000
34.02	Underload func	Pb	16	0b0000…0b1111	-	0b0000
34.03	Load freq1	REAL	16	1…500	Hz	5 Hz
34.04	Load freq2	REAL	16	1…500	Hz	25 Hz
34.05	Load freq3	REAL	16	1…500	Hz	43 Hz

No.	Name	Type	Data len.	Range	Unit	Default (Factory macro)
34.06	*Load freq4*	REAL	16	1…500	Hz	50 Hz
34.07	*Load freq5*	REAL	16	1…500	Hz	500 Hz
34.08	*Load low lim1*	REAL	16	0…1600	%	10%
34.09	*Load low lim2*	REAL	16	0…1600	%	15%
34.10	*Load low lim3*	REAL	16	0…1600	%	25%
34.11	*Load low lim4*	REAL	16	0…1600	%	30%
34.12	*Load low lim5*	REAL	16	0…1600	%	30%
34.13	*Load high lim1*	REAL	16	0…1600	%	300%
34.14	*Load high lim2*	REAL	16	0…1600	%	300%
34.15	*Load high lim3*	REAL	16	0…1600	%	300%
34.16	*Load high lim4*	REAL	16	0…1600	%	300%
34.17	*Load high lim5*	REAL	16	0…1600	%	300%
34.18	*Load integ time*	UINT32	16	0…10000	s	100 s
34.19	*Load cool time*	UINT32	16	0…10000	s	20 s
34.20	*Underload time*	UINT32	16	0…10000	s	10 s
35 Process variable						
35.01	*Signal1 param*	Val pointer	32	-	-	*Speed %*
35.02	*Signal1 max*	REAL	32	-32768…32768	-	300.000
35.03	*Signal1 min*	REAL	32	-32768…32768	-	-300.000
35.04	*Pros var1 dispf*	enum	16	0…5	-	3
35.05	*Pros var1 unit*	enum	16	0…98	-	4
35.06	*Pros var1 max*	REAL	32	-32768…32768	-	300.000
35.07	*Pros var1 min*	REAL	32	-32768…32768	-	-300.000
35.08	*Signal2 param*	Val pointer	32	-	-	*Current %*
35.09	*Signal2 max*	REAL	32	-32768…32768	-	300.000
35.10	*Signal2 min*	REAL	32	-32768…32768	-	-300.000
35.11	*Pros var2 dispf*	enum	16	0…5	-	3
35.12	*Pros var2 unit*	enum	16	0…98	-	4
35.13	*Pros var2 max*	REAL	32	-32768…32768	-	300.000
35.14	*Pros var2 min*	REAL	32	-32768…32768	-	-300.000
35.15	*Signal3 param*	Val pointer	32	-	-	*Torque*
35.16	*Signal3 max*	REAL	32	-32768…32768	-	300.000
35.17	*Signal3 min*	REAL	32	-32768…32768	-	-300.000
35.18	*Pros var3 dispf*	enum	16	0…5	-	3
35.19	*Pros var3 unit*	enum	16	0…98	-	4
35.20	*Pros var3 max*	REAL	32	-32768…32768	-	300.000
35.21	*Pros var3 min*	REAL	32	-32768…32768	-	-300.000
36 Timed functions						
36.01	*Timers enable*	Bit pointer	32	-	-	C.FALSE
36.02	*Timers mode*	Pb	16	0b0000…0b1111	-	0b0000

No.	Name	Type	Data len.	Range	Unit	Default (Factory macro)
36.03	Start time1	UINT32	32	00:00:00 … 24:00:00	-	00:00:00
36.04	Stop time1	UINT32	32	00:00:00 … 24:00:00	-	00:00:00
36.05	Start day1	enum	16	1…7	-	Monday
36.06	Stop day1	enum	16	1…7	-	Monday
36.07	Start time2	UINT32	32	00:00:00 … 24:00:00	-	00:00:00
36.08	Stop time2	UINT32	32	00:00:00 … 24:00:00	-	00:00:00
36.09	Start day2	enum	16	1…7	-	Monday
36.10	Stop day2	enum	16	1…7	-	Monday
36.11	Start time3	UINT32	32	00:00:00 … 24:00:00	-	00:00:00
36.12	Stop time3	UINT32	32	00:00:00 … 24:00:00	-	00:00:00
36.13	Start day3	enum	16	1…7	-	Monday
36.14	Stop day3	enum	16	1…7	-	Monday
36.15	Start time4	UINT32	32	00:00:00 … 24:00:00	-	00:00:00
36.16	Stop time4	UINT32	32	00:00:00 … 24:00:00	-	00:00:00
36.17	Start day4	enum	16	1…7	-	Monday
36.18	Stop day4	enum	16	1…7	-	Monday
36.19	Boost signal	Bit pointer	32	-	-	C.FALSE
36.20	Boost time	UINT32	32	00:00:00 … 24:00:00	-	00:00:00
36.21	Timed func1	Pb	16	0b00000…0b11111	-	0b00000
36.22	Timed func2	Pb	16	0b00000…0b11111	-	0b00000
36.23	Timed func3	Pb	16	0b00000…0b11111	-	0b00000
36.24	Timed func4	Pb	16	0b00000…0b11111	-	0b00000
38 Flux ref						
38.01	Flux ref	REAL	16	0…200	%	100%
38.03	U/f curve func	enum	16	0…2	-	Linear
38.04	U/f curve freq1	REAL	16	1…500	%	10%
38.05	U/f curve freq2	REAL	16	1…500	%	30%
38.06	U/f curve freq3	REAL	16	1…500	%	50%
38.07	U/f curve freq4	REAL	16	1…500	%	70%
38.08	U/f curve freq5	REAL	16	1…500	%	90%
38.09	U/f curve volt1	REAL	16	0…200	%	20%
38.10	U/f curve volt2	REAL	16	0…200	%	40%
38.11	U/f curve volt3	REAL	16	0…200	%	60%
38.12	U/f curve volt4	REAL	16	0…200	%	80%
38.13	U/f curve volt5	REAL	16	0…200	%	100%
40 Motor control						
40.01	Motor noise	enum	16	0…2	-	Cyclic
40.03	Slip gain	REAL24	32	0…200	%	100%
40.04	Voltage reserve	REAL24	32	-4…50	%	-1%
40.06	Force open loop	enum	16	0…1	-	False

No.	Name	Type	Data len.	Range	Unit	Default (Factory macro)
40.07	IR-compensation	REAL24	32	0…50	%	0.00%
42 Mech brake ctrl						
42.01	Brake ctrl	enum	16	0…2	-	No
42.02	Brake acknowl	Bit pointer	32	-	-	C.FALSE
42.03	Open delay	UINT32	16	0…5	s	0.00 s
42.04	Close delay	UINT32	16	0…60	s	0.00 s
42.05	Close speed	REAL	16	0…1000	rpm	100.0 rpm
42.06	Close cmd delay	UINT32	16	0…10	s	0.00 s
42.07	Reopen delay	UINT32	16	0…10	s	0.00 s
42.08	Brake open torq	REAL	16	-1000…1000	%	0.0%
42.09	Open torq src	Val pointer	32	-	-	P.42.08
42.10	Brake close req	Bit pointer	32	-	-	C.FALSE
42.11	Brake hold open	Bit pointer	32	-	-	C.FALSE
42.12	Brake fault func	enum	16	0…2	-	Fault
42.13	Close flt delay	UINT32	16	0…60	s	0.00 s
44 Maintenance						
44.01	Ontime1 func	Pb	16	0b00…0b11	-	0b01
44.02	Ontime1 src	Bit pointer	32	-	-	Running
44.03	Ontime1 limit	UINT32	32	0…2147483647	s	36000000 s
44.04	Ontime1 alm sel	enum	16	0…6	-	Mot bearing
44.05	Ontime2 func	Pb	16	0b00…0b11	-	0b01
44.06	Ontime2 src	Bit pointer	32	-	-	Charged
44.07	Ontime2 limit	UINT32	32	0…2147483647	s	15768000 s
44.08	Ontime2 alm sel	enum	16	0…6	-	Device clean
44.09	Edge count1 func	Pb	16	0b00…0b11	-	0b01
44.10	Edge count1 src	Bit pointer	32	-	-	Charged
44.11	Edge count1 lim	UINT32	32	0…2147483647	-	5000
44.12	Edge count1 div	UINT32	32	0…2147483647	-	1
44.13	Edg cnt1 alm sel	enum	16	0…5	-	Dc-charge
44.14	Edge count2 func	Pb	16	0b00…0b11	-	0b01
44.15	Edge count2 src	Bit pointer	32	-	-	RO1
44.16	Edge count2 lim	UINT32	32	0…2147483647	-	10000
44.17	Edge count2 div	UINT32	32	0…2147483647	-	1
44.18	Edg cnt2 alm sel	enum	16	0…5	-	Output relay
44.19	Val count1 func	Pb	16	0b00…0b11	-	0b01
44.20	Val count1 src	Val pointer	32	-	-	Speed rpm
44.21	Val count1 lim	UINT32	32	0…2147483647	-	13140000
44.22	Val count1 div	UINT32	32	0…2147483647	-	60
44.23	Val cnt1 alm sel	enum	16	0…1	-	Mot bearing
44.24	Val count2 func	Pb	16	0b00…0b11	-	0b01

No.	Name	Type	Data len.	Range	Unit	Default (Factory macro)
44.25	Val count2 src	Val pointer	32	-	-	Speed rpm
44.26	Val count2 lim	UINT32	32	0…2147483647	-	6570000
44.27	Val count2 div	UINT32	32	0…2147483647	-	60
44.28	Val cnt2 alm sel	enum	16	0…1	-	Value2
44.29	Fan ontime lim	UINT32	32	0…35791394.1	h	0.00 h
44.30	Runtime lim	UINT32	32	0…35791394.1	h	0.00 h
44.31	Runtime alm sel	enum	16	1…5	-	Device clean
44.32	kWh inv lim	UINT32	32	0…2147483647	kWh	0 kWh
44.33	kWh inv alm sel	enum	16	1…5	-	Device clean
45 Energy optimising						
45.01	Energy optim	enum	16	0…1	-	Disable
45.02	Energy tariff1	UINT32	32	0…21474836.47	-	0.65
45.06	E tariff unit	enum	16	0…2	-	0
45.08	Pump ref power	REAL	16	0…1000	%	100.0%
45.09	Energy reset	enum	16	0…1	-	Done
47 Voltage ctrl						
47.01	Overvolt ctrl	enum	16	0…1	-	Enable
47.02	Undervolt ctrl	enum	16	0…1	-	Enable
48 Brake chopper						
48.01	Bc enable	enum	16	0…2	-	Disable
48.02	Bc run-time ena	Bit pointer	32	-	-	C.TRUE
48.03	BrThermTimeConst	REAL24	32	0…10000	s	0 s
48.04	Br power max cnt	REAL24	32	0…10000	kW	0.0000 kW
48.05	R br	REAL24	32	0.1…1000	ohm	0.0000 Ohm
48.06	Br temp faultlim	REAL24	16	0…150	%	105%
48.07	Br temp alarmlim	REAL24	16	0…150	%	95%
49 Data storage						
49.01	Data storage1	UINT32	16	-32768…32768	-	0
49.02	Data storage2	UINT32	16	-32768…32768	-	0
49.03	Data storage3	UINT32	16	-32768…32768	-	0
49.04	Data storage4	UINT32	16	-32768…32768	-	0
49.05	Data storage5	UINT32	32	-2147483647 … 2147483647	-	0
49.06	Data storage6	UINT32	32	-2147483647 … 2147483647	-	0
49.07	Data storage7	UINT32	32	-2147483647 … 2147483647	-	0
49.08	Data storage8	UINT32	32	-2147483647 … 2147483647	-	0
50 Fieldbus						
50.01	Fba enable	enum	16	0…1	-	Disable
50.02	Comm loss func	enum	16	0…3	-	No
50.03	Comm loss t out	UINT32	16	0.3…6553.5	s	0.3 s
50.04	Fba ref1 modesel	enum	16	0…2	-	Speed

No.	Name	Type	Data len.	Range	Unit	Default (Factory macro)
50.05	*Fba ref2 modesel*	enum	16	0…2	-	*Torque*
50.06	*Fba act1 tr src*	Val pointer	32	-	-	P.01.01
50.07	*Fba act2 tr src*	Val pointer	32	-	-	P.01.06
50.08	*Fba sw b12 src*	Bit pointer	32	-	-	C.FALSE
50.09	*Fba sw b13 src*	Bit pointer	32	-	-	C.FALSE
50.10	*Fba sw b14 src*	Bit pointer	32	-	-	C.FALSE
50.11	*Fba sw b15 src*	Bit pointer	32	-	-	C.FALSE
51 FBA settings						
51.01	*FBA type*	UINT32	16	0…65536	-	0
51.02	*FBA par2*	UINT32	16	0…65536	-	0
…	…	…	….	…	…	…
51.26	*FBA par26*	UINT32	16	0…65536	-	0
51.27	*FBA par refresh*	enum	16	0…1	-	*Done*
51.28	*Par table ver*	UINT32	16	0…65536	-	-
51.29	*Drive type code*	UINT32	16	0…65536	-	-
51.30	*Mapping file ver*	UINT32	16	0…65536	-	-
51.31	*D2FBA comm sta*	enum	16	0…6	-	*Idle*
51.32	*FBA comm sw ver*	UINT32	16	0…65536	-	-
51.33	*FBA appl sw ver*	UINT32	16	0…65536	-	-
52 FBA data in						
52.01	*FBA data in1*	UINT32	16	0…9999	-	0
…	…	…	…	…	…	…
52.12	*FBA data in12*	UINT32	16	0…9999	-	0
53 FBA data out						
53.01	*FBA data out1*	UINT32	16	0…9999	-	0
…	…	…	…	…	…	…
53.12	*FBA data out12*	UINT32	16	0…9999	-	0
56 Panel display						
56.01	*Signal1 param*	UINT32		00.00 … 255.255	-	01.03
56.02	*Signal2 param*	UINT32		00.00 … 255.255	-	01.04
56.03	*Signal3 param*	UINT32		00.00 … 255.255	-	01.06
56.04	*Signal1 mode*	INT32		-1…3	-	*Normal*
56.05	*Signal2 mode*	INT32		-1…3	-	*Normal*
56.06	*Signal3 mode*	INT32		-1…3	-	*Normal*

No.	Name	Type	Data len.	Range	Unit	Default (Factory macro)
57 D2D communication						
57.01	Link mode	enum	16	0…2	-	Disabled
57.02	Comm loss func	enum	16	0…2	-	Alarm
57.03	Node address	UINT32	16	1…62	-	1
57.04	Follower mask 1	UINT32	32	0h00000000 … 0h7FFFFFFF	-	0h00000000
57.05	Follower mask 2	UINT32	32	0h00000000 … 0h7FFFFFFF	-	0h00000000
57.06	Ref 1 src	Val pointer	32	-	-	P.03.05
57.07	Ref 2 src	Val pointer	32	-	-	P.03.13
57.08	Follower cw src	Val pointer	32	-	-	P.02.31
57.11	Ref1 msg type	enum	16	0…1	-	Broadcast
57.12	Ref1 mc group	UINT32	16	0…62	-	0
57.13	Next ref1 mc grp	UINT32	16	0…62	-	0
57.14	Nr ref1 mc grps	UINT32	16	1…62	-	1
57.15	D2D com port	enum	16	0…3	-	on-board
64 Load analyzer						
64.01	PVL signal	Val pointer	32	-	-	Power inu
64.02	PVL filt time	REAL	16	0…120	s	2.00 s
64.03	Reset loggers	Bit pointer	32	-	-	C.FALSE
64.04	AL signal	Val pointer	32	-	-	Power motor
64.05	AL signal base	REAL	32	0…32768	-	100.00
64.06	PVL peak value1	REAL	32	-32768…32768	-	0.00
64.07	Date of peak	UINT32	32	01.01.80…	d	-
64.08	Time of peak	UINT32	32	00:00:00…23:59:59	s	-
64.09	Current at peak	REAL	32	-32768…32768	A	0.00 A
64.10	Dc volt at peak	REAL	32	0…2000	V	0.00 V
64.11	Speed at peak	REAL	32	-32768…32768	rpm	0.0 rpm
64.12	Date of reset	UINT32	32	01.01.80…	d	-
64.13	Time of reset	UINT32	32	00:00:00…23:59:59	s	-
64.14	AL1 0 to 10%	REAL	16	0…100	%	0.00%
64.15	AL1 10 to 20%	REAL	16	0…100	%	0.00%
64.16	AL1 20 to 30%	REAL	16	0…100	%	0.00%
64.17	AL1 30 to 40%	REAL	16	0…100	%	0.00%
64.18	AL1 40 to 50%	REAL	16	0…100	%	0.00%
64.19	AL1 50 to 60%	REAL	16	0…100	%	0.00%
64.20	AL1 60 to 70%	REAL	16	0…100	%	0.00%
64.21	AL1 70 to 80%	REAL	16	0…100	%	0.00%
64.22	AL1 80 to 90%	REAL	16	0…100	%	0.00%
64.23	AL1 over 90%	REAL	16	0…100	%	0.00%
64.24	AL2 0 to 10%	REAL	16	0…100	%	0.00%
64.25	AL2 10 to 20%	REAL	16	0…100	%	0.00%

No.	Name	Type	Data len.	Range	Unit	Default (Factory macro)
64.26	AL2 20 to 30%	REAL	16	0…100	%	0.00%
64.27	AL2 30 to 40%	REAL	16	0…100	%	0.00%
64.28	AL2 40 to 50%	REAL	16	0…100	%	0.00%
64.29	AL2 50 to 60%	REAL	16	0…100	%	0.00%
64.30	AL2 60 to 70%	REAL	16	0…100	%	0.00%
64.31	AL2 70 to 80%	REAL	16	0…100	%	0.00%
64.32	AL2 80 to 90%	REAL	16	0…100	%	0.00%
64.33	AL2 over 90%	REAL	16	0…100	%	0.00%
90 Enc module sel						
90.01	Encoder 1 sel	enum	16	0…7	-	None
90.02	Encoder 2 sel	enum	16	0…7	-	None
90.04	TTL echo sel	enum	16	0…5	-	Disabled
90.05	Enc cable fault	enum	16	0…2	-	Fault
90.10	Enc par refresh	enum	16	0…1	-	Done
91 Absol enc conf						
91.01	Sine cosine nr	UINT32	16	0…65535	-	0
91.02	Abs enc interf	enum	16	0…5	-	None
91.03	Rev count bits	UINT32	16	0…32	-	0
91.04	Pos data bits	UINT32	16	0…32	-	0
91.05	Refmark ena	enum	16	0…1	-	False
91.10	Hiperface parity	enum	16	0…1	-	Odd
91.11	Hiperf baudrate	enum	16	0…3	-	9600
91.12	Hiperf node addr	UINT32	16	0…255	-	64
91.20	SSI clock cycles	UINT32	16	2…127	-	2
91.21	SSI position msb	UINT32	16	1…126	-	1
91.22	SSI revol msb	UINT32	16	1…126	-	1
91.23	SSI data format	enum	16	0…1	-	binary
91.24	SSI baud rate	enum	16	0…5	-	100 kbit/s
91.25	SSI mode	enum	16	0…1	-	Initial pos.
91.26	SSI transmit cyc	enum	16	0…5	-	100 µs
91.27	SSI zero phase	enum	16	0…3	-	315-45 deg
91.30	Endat mode	enum	16	0…1	-	Initial pos.
91.31	Endat max calc	enum	16	0…3	-	50 ms
92 Resolver conf						
92.01	Resolv polepairs	UINT32	16	1…32	-	1
92.02	Exc signal ampl	UINT32	16	4…12	Vrms	4.0 Vrms
92.03	Exc signal freq	UINT32	16	1…20	kHz	1 kHz
93 Pulse enc conf						
93.01	Enc1 pulse nr	UINT32	16	0…65535	-	0
93.02	Enc1 type	enum	16	0…1	-	Quadrature

No.	Name	Type	Data len.	Range	Unit	Default (Factory macro)
93.03	Enc1 sp CalcMode	enum	16	0….5	-	Auto rising
93.11	Enc2 pulse nr	UINT32	16	0…65535	-	0
93.12	Enc2 type	enum	16	0…1	-	Quadrature
93.13	Enc2 sp CalcMode	enum	16	0….5	-	Auto rising
94 Ext IO conf						
94.01	Ext IO1 sel	UINT32	16	0…3	-	None
94.02	Ext IO2 sel	UINT32	16	0…3	-	None
95 Hw configuration						
95.01	Ctrl boardSupply	enum	16	0…1	-	Internal 24V
97 User motor par						
97.01	Use given params	enum	16	0…1	-	0
97.02	Rs user	REAL24	32	0…0.5	p.u.	0.00000 p.u.
97.03	Rr user	REAL24	32	0…0.5	p.u.	0.00000 p.u.
97.04	Lm user	REAL24	32	0…10	p.u.	0.00000 p.u.
97.05	SigmaL user	REAL24	32	0…1	p.u.	0.00000 p.u.
97.06	Ld user	REAL24	32	0…10	p.u.	0.00000 p.u.
97.07	Lq user	REAL24	32	0…10	p.u.	0.00000 p.u.
97.08	Pm flux user	REAL24	32	0…2	p.u.	0.00000 p.u.
97.09	Rs user SI	REAL24	32	0…100	ohm	0.00000 Ohm
97.10	Rr user SI	REAL24	32	0…100	ohm	0.00000 Ohm
97.11	Lm user SI	REAL24	32	0…100000	mH	0.00 mH
97.12	SigL user SI	REAL24	32	0…100000	mH	0.00 mH
97.13	Ld user SI	REAL24	32	0…100000	mH	0.00 mH
97.14	Lq user SI	REAL24	32	0…100000	mH	0.00 mH
99 Start-up data						
99.01	Language	enum	16	-	-	English
99.04	Motor type	enum	16	0…1	-	AM
99.05	Motor ctrl mode	enum	16	0…1	-	DTC
99.06	Mot nom current	REAL	32	0…6400	A	0.0 A
99.07	Mot nom voltage	REAL	32	1/6 … 2 × U_N	V	0.0 V
99.08	Mot nom freq	REAL	32	5…500	Hz	0.0 Hz
99.09	Mot nom speed	REAL	32	0…10000	rpm	0 rpm
99.10	Mot nom power	REAL	32	0…10000	kW or hp	0.00 kW
99.11	Mot nom cosfii	REAL24	32	0…1	-	0.00
99.12	Mot nom torque	INT32	32	0…2147483.647	Nm	0.000 Nm
99.13	Idrun mode	enum	16	0…5	-	No

Fault tracing

What this chapter contains

The chapter lists the alarm (warning) and fault messages including possible causes and corrective actions.

Safety

WARNING! Only qualified electricians are allowed to maintain the drive. The *Safety Instructions* on the first pages of the appropriate hardware manual must be read before you start working with the drive.

Alarm and fault indications

An alarm or a fault message indicates abnormal drive status. Most alarm and fault causes can be identified and corrected using this information. If not, an ABB representative should be contacted.

The four-digit code number in brackets after the message is for the fieldbus communication.

The alarm/fault code is displayed on the 7-segment display of the drive. The following table describes the indications given by the 7-segment display.

Display	Meaning
“E-” followed by error code	System error. See appropriate drive hardware manual.
“A-” followed by error code	Alarm. See section *Alarm messages generated by the drive* on page 226.
“F-” followed by error code	Fault. See section *Fault messages generated by the drive* on page 234.

How to reset

The drive can be reset either by pressing the RESET key on the control panel or PC tool, or by switching the supply voltage off for a while. When the fault has been removed, the motor can be restarted.

A fault can also be reset from an external source selected by parameter *10.10 Fault reset sel*.

Fault history

When fault is detected, it is stored in the fault logger with a time stamp. The fault history stores information on the 16 latest faults of the drive. Three of the latest faults are stored at the beginning of a power switch off.

Parameters *08.01 Active fault* and *08.02 Last fault* store the fault codes of the most recent faults.

Alarms can be monitored via alarm words *08.05 Alarm word1* … *08.08 Alarm word4*. Alarm information is lost at power switch off or fault reset.

Alarm messages generated by the drive

Code	Alarm (fieldbus code)	Cause	What to do
2000	BRAKE START TORQUE (0x7185) Programmable fault: *42.12 Brake fault func*	Mechanical brake alarm. Alarm is activated if required motor starting torque (*42.08 Brake open torq*) is not achieved.	Check brake open torque setting, parameter *42.08*. Check drive torque and current limits. See parameter group *20 Limits*.
2001	BRAKE NOT CLOSED (0x7186) Programmable fault: *42.12 Brake fault func*	Mechanical brake control alarm. Alarm is activated e.g. if brake acknowledgement is not as expected during brake closing.	Check mechanical brake connection. Check mechanical brake settings in parameter group *42 Mech brake ctrl*. To determine whether problem is with acknowledgement signal or brake, check if brake is closed or open.
2002	BRAKE NOT OPEN (0x7187) Programmable fault: *42.12 Brake fault func*	Mechanical brake control alarm. Alarm is activated e.g. if brake acknowledgement is not as expected during brake opening.	Check mechanical brake connection. Check mechanical brake settings in parameter group *42 Mech brake ctrl*. To determine whether problem is with acknowledgement signal or brake, check if brake is closed or open.
2003	SAFE TORQUE OFF (0xFF7A) Programmable fault: *30.07 Sto diagnostic*	Safe Torque Off function is active, i.e. safety circuit signal(s) connected to connector X6 is lost while drive is stopped and parameter *30.07 Sto diagnostic* is set to *Alarm*.	Check safety circuit connections. For more information, see appropriate drive hardware manual.
2004	STO MODE CHANGE (0xFF7A)	Error in changing Safe Torque Off supervision, i.e. parameter *30.07 Sto diagnostic* setting could not be changed to value *Alarm*.	Contact your local ABB representative.

Code	Alarm (fieldbus code)	Cause	What to do
2005	MOTOR TEMPERATURE (0x4310) Programmable fault: *31.01 Mot temp1 prot*	Estimated motor temperature (based on motor thermal model) has exceeded alarm limit defined by parameter *31.03 Mot temp1 almLim*.	Check motor ratings and load. Let motor cool down. Ensure proper motor cooling: Check cooling fan, clean cooling surfaces, etc. Check value of alarm limit. Check motor thermal model settings (parameters *31.09*…*31.14*).
		Measured motor temperature has exceeded alarm limit defined by parameter *31.03 Mot temp1 almLim*.	Check that actual number of sensors corresponds to value set by parameter *31.02 Mot temp1 src*. Check motor ratings and load. Let motor cool down. Ensure proper motor cooling: Check cooling fan, clean cooling surfaces, etc. Check value of alarm limit.
2006	EMERGENCY OFF (0xF083)	Drive has received emergency OFF2 command.	To restart drive, activate Run enable signal (source selected by parameter *10.11 Run enable*) and start drive.
2007	RUN ENABLE (0xFF54)	No Run enable signal is received.	Check setting of parameter *10.11 Run enable*. Switch signal on (e.g. in the fieldbus Control Word) or check wiring of selected source.
2008	ID-RUN (0xFF84)	Motor identification run is on.	This alarm belongs to normal start-up procedure. Wait until drive indicates that motor identification is completed.
		Motor identification is required.	This alarm belongs to normal start-up procedure. Select how motor identification should be performed, parameter *99.13 Idrun mode*. Start identification routines by pressing Start key.
2009	EMERGENCY STOP (0xF081)	Drive has received emergency stop command (OFF1/OFF3).	Check that it is safe to continue operation. Return emergency stop push button to normal position (or adjust the fieldbus Control Word accordingly). Restart drive.
2011	BR OVERHEAT (0x7112)	Brake resistor temperature has exceeded alarm limit defined by parameter *48.07 Br temp alarmlim*.	Stop drive. Let resistor cool down. Check resistor overload protection function settings (parameters *48.01*…*48.05*). Check alarm limit setting, parameter *48.07 Br temp alarmlim*. Check that braking cycle meets allowed limits.
2012	BC OVERHEAT (0x7181)	Brake chopper IGBT temperature has exceeded internal alarm limit.	Let chopper cool down. Check resistor overload protection function settings (parameters *48.01*…*48.05*). Check that braking cycle meets allowed limits. Check that drive supply AC voltage is not excessive.

Code	Alarm (fieldbus code)	Cause	What to do
2013	DEVICE OVERTEMP (0x4210)	Measured drive temperature has exceeded internal alarm limit.	Check ambient conditions. Check air flow and fan operation. Check heatsink fins for dust pick-up. Check motor power against unit power.
2014	INTBOARD OVERTEMP (0x7182)	Interface board (between power unit and control unit) temperature has exceeded internal alarm limit.	Let drive cool down.
2015	BC MOD OVERTEMP (0x7183)	Input bridge or brake chopper temperature has exceeded internal alarm limit.	Let drive cool down.
2016	IGBT OVERTEMP (0x7184)	Drive temperature based on thermal model has exceeded internal alarm limit.	Check ambient conditions. Check air flow and fan operation. Check heatsink fins for dust pick-up. Check motor power against unit power.
2017	FIELDBUS COMM (0x7510) Programmable fault: *50.02 Comm loss func*	Cyclical communication between drive and fieldbus adapter module or between PLC and fieldbus adapter module is lost.	Check status of fieldbus communication. See appropriate User's Manual of fieldbus adapter module. Check settings of parameter group *50 Fieldbus*. Check cable connections. Check if communication master is able to communicate.
2018	LOCAL CTRL LOSS (0x5300) Programmable fault: *30.03 Local ctrl loss*	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. Replace control panel in mounting platform.
2019	AI SUPERVISION (0x8110) Programmable fault: *13.32 AI superv func*	An analogue input has reached limit defined by parameter *13.33 AI superv cw*.	Check analogue input source and connections. Check analogue input minimum and maximum limit settings.
2020	FB PAR CONF (0x6320)	The drive does not have a functionality requested by PLC, or requested functionality has not been activated.	Check PLC programming. Check settings of parameter group *50 Fieldbus*.
2021	NO MOTOR DATA (0x6381)	Parameters in group 99 have not been set.	Check that all the required parameters in group 99 have been set.
2022	ENCODER 1 FAILURE (0x7301)	Encoder 1 has been activated by parameter but the encoder interface (FEN-xx) cannot be found.	Check parameter *90.01 Encoder 1 sel* setting corresponds to actual encoder interface 1 (FEN-xx) installed in drive Slot 1/2 (parameter *09.20 Option slot1* / *09.21 Option slot2*). **Note:** The new setting will only take effect after parameter *90.10 Enc par refresh* is used or after the JCU Control Unit is powered up the next time.

Code	Alarm (fieldbus code)	Cause	What to do
2023	ENCODER 2 FAILURE (0x7381)	Encoder 2 has been activated by parameter but the encoder interface (FEN-xx) cannot be found.	Check parameter *90.02 Encoder 2 sel* setting corresponds to actual encoder interface 1 (FEN-xx) installed in drive Slot 1/2 (parameter *09.20 Option slot1* / *09.21 Option slot2*). **Note:** The new setting will only take effect after parameter *90.10 Enc par refresh* is used or after the JCU Control Unit is powered up the next time.
2027	FEN TEMP MEAS FAILURE (0x7385)	Error in temperature measurement when temperature sensor (KTY or PTC) connected to encoder interface FEN-xx is used.	Check that parameter *31.02 Mot temp1 src* / *31.06 Mot temp2 src* setting corresponds to actual encoder interface installation (*09.20 Option slot1* / *09.21 Option slot2*): If one FEN-xx module is used: - Parameter *31.02 Mot temp1 src* / *31.06 Mot temp2 src* must be set either to *KTY 1st FEN* or *PTC 1st FEN*. The FEN-xx module can be in either Slot 1 or Slot 2. If two FEN-xx modules are used: - When parameter *31.02 Mot temp1 src* / *31.06 Mot temp2 src* is set to *KTY 1st FEN* or *PTC 1st FEN*, the encoder installed in drive Slot 1 is used. - When parameter *31.02 Mot temp1 src* / *31.06 Mot temp2 src* is set to *KTY 2nd FEN* or *PTC 2nd FEN*, the encoder installed in drive Slot 2 is used.
		Error in temperature measurement when KTY sensor connected to encoder interface FEN-01 is used.	FEN-01 does not support temperature measurement with KTY sensor. Use PTC sensor or other encoder interface module.
2030	RESOLVER AUTOTUNE ERR (0x7388)	Resolver autotuning routines, which are automatically started when resolver input is activated for the first time, have failed.	Check cable between resolver and resolver interface module (FEN-21) and order of connector signal wires at both ends of cable. Check resolver parameter settings. For resolver parameters and information, see parameter group *92 Resolver conf*. **Note:** Resolver autotuning routines should always be performed after resolver cable connection has been modified. Autotuning routines can be activated by setting parameter *92.02 Exc signal ampl* or *92.03 Exc signal freq*, and then setting parameter *90.10 Enc par refresh* to *Configure*.
2031	ENCODER 1 CABLE (0x7389)	Encoder 1 cable fault detected.	Check cable between FEN-xx interface and encoder 1. After any modifications in cabling, re-configure interface by switching drive power off and on, or by activating parameter *90.10 Enc par refresh*.

Code	Alarm (fieldbus code)	Cause	What to do
2032	ENCODER 2 CABLE (0x738A)	Encoder 2 cable fault detected.	Check cable between FEN-xx interface and encoder 2. After any modifications in cabling, re-configure interface by switching drive power off and on, or by activating parameter *90.10 Enc par refresh*.
2033	D2D COMMUNICATION (0x7520) Programmable fault: *57.02 Comm loss func*	On the master drive: The drive has not been replied to by an activated follower for five consecutive polling cycles.	Check that all drives that are polled (parameters *57.04 Follower mask 1* and *57.05 Follower mask 2*) on the drive-to-drive link are powered, properly connected to the link, and have the correct node address. Check the drive-to-drive link wiring.
		On a follower drive: The drive has not received new reference 1 and/or 2 for five consecutive reference handling cycles.	Check the settings of parameters *57.06 Ref 1 src* and *57.07 Ref 2 src*) on the master drive. Check the drive-to-drive link wiring.
2034	D2D BUFFER OVERLOAD (0x7520) Programmable fault: *57.02 Comm loss func*	Transmission of drive-to-drive references failed because of message buffer overflow.	Contact your local ABB representative.
2035	PS COMM (0x5480)	Communication errors detected between the JCU Control Unit and the power unit of the drive.	Check the connections between the JCU Control Unit and the power unit.
2036	RESTORE (0x6300)	Restoration of backed-up parameters failed.	Contact your local ABB representative.
2037	CUR MEAS CALIBRATION (0x2280)	Current measurement calibration will occur at next start.	Informative alarm.
2038	AUTOPHASING (0x3187)	Autophasing will occur at next start.	Informative alarm.
2039	EARTH FAULT (0x2330) Programmable fault: *30.05 Earth fault*	Drive has detected load unbalance typically due to earth fault in motor or motor cable.	Check there are no power factor correction capacitors or surge absorbers in motor cable. Check for an earth fault in motor or motor cables by measuring the insulation resistances of motor and motor cable. If no earth fault can be detected, contact your local ABB representative.
2040	AUTORESET (0x6080)	A fault is to be autoreset.	Informative alarm. See parameter group *32 Automatic reset*.
2041	MOTOR NOM VALUE (0x6383)	The motor configuration parameters are set incorrectly.	Check the settings of the motor configuration parameters in group 99.
		The drive is not dimensioned correctly.	Check that the drive is sized correctly for the motor.
2042	D2D CONFIG (0x7583)	The settings of drive-to-drive link configuration parameters (group 57) are incompatible.	Check the settings of the parameters in group *57 D2D communication*.

Code	Alarm (fieldbus code)	Cause	What to do
2043	STALL (0x7121) Programmable fault: *30.09 Stall function*	Motor is operating in stall region because of e.g. excessive load or insufficient motor power.	Check motor load and drive ratings. Check fault function parameters.
2044	LCURVE (0x2312) Programmable fault: *34.01 Overload func* / *34.02 Underload func*	Overload or underload limit has been exceeded.	Check the settings of the parameters in group *34 User load curve*.
2045	LCURVE PAR (0x6320)	The load curve has been incorrectly or inconsistently defined.	Check the settings of the parameters in group *34 User load curve*.
2046	FLUX REF PAR (0x6320)	The *U/f* (voltage/frequency) curve has been incorrectly or inconsistently defined.	Check the settings of the parameters in group *38 Flux ref*.
2047	SPEED FEEDBACK (0x8480)	No speed feedback is received.	Check the settings of the parameters in group *19 Speed calculation*. Check encoder installation. See the description of fault *0039* for more information.
2048	OPTION COMM LOSS (0x7000)	Communication between drive and option module (FEN-xx and/or FIO-xx) is lost.	Check that option modules are properly connected to Slot 1 and (or) Slot 2. Check that option modules or Slot 1/2 connectors are not damaged. To determine whether module or connector is damaged: Test each module individually in Slot 1 and Slot 2.
2049	MOTTEMPAL2 (0x4313) Programmable fault: *31.05 Mot temp2 prot*	Estimated motor temperature (based on motor thermal model) has exceeded alarm limit defined by parameter *31.07 Mot temp2 almLim*.	Check motor ratings and load. Let motor cool down. Ensure proper motor cooling: Check cooling fan, clean cooling surfaces, etc. Check value of alarm limit. Check motor thermal model settings (parameters *31.09*…*31.14*).
		Measured motor temperature has exceeded alarm limit defined by parameter *31.07 Mot temp2 almLim*.	Check that actual number of sensors corresponds to value set by parameter *31.06 Mot temp2 src*. Check motor ratings and load. Let motor cool down. Ensure proper motor cooling: Check cooling fan, clean cooling surfaces, etc. Check value of alarm limit.
2050	IGBTOLALARM (0x5482)	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.
2051	IGBTTEMPALARM (0x4210)	Drive IGBT temperature is excessive. Fault trip limit is 100%.	Check ambient conditions. Check air flow and fan operation. Check heatsink fins for dust pick-up. Check motor power against drive power.

Code	Alarm (fieldbus code)	Cause	What to do
2052	COOLALARM (0x4290)	Drive module temperature is excessive.	Check ambient temperature. If it exceeds 40 °C (104 °F), ensure that load current does not exceed derated load capacity of drive. See appropriate *Hardware Manual.* 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.
2053	MENU CHG PASSWORD REQ (0x6F81)	Loading a parameter listing requires a password.	Enter password at parameter *16.03 Pass code*.
2054	MENU CHANGED (0x6F82)	A different parameter listing is being loaded.	Informative alarm.
2055	DEVICE CLEAN (0x5080)	Maintenance alarm.	See parameter group *44 Maintenance*.
2056	COOLING FAN (0x5081)	Maintenance alarm.	See parameter group *44 Maintenance*.
2057	ADD COOLING (0x5082)	Maintenance alarm.	See parameter group *44 Maintenance*.
2058	CABINET FAN (0x5083)	Maintenance alarm.	See parameter group *44 Maintenance*.
2059	DC CAPACITOR (0x5084)	Maintenance alarm.	See parameter group *44 Maintenance*.
2060	MOTOR BEARING (0x738C)	Maintenance alarm.	See parameter group *44 Maintenance*.
2061	MAIN CONTACTOR (0x548D)	Maintenance alarm.	See parameter group *44 Maintenance*.
2062	RELAY OUTPUT SW (0x548E)	Maintenance alarm.	See parameter group *44 Maintenance*.
2063	MOTOR START COUNT (0x6180)	Maintenance alarm.	See parameter group *44 Maintenance*.
2064	POWER UP COUNT (0x6181)	Maintenance alarm.	See parameter group *44 Maintenance*.
2065	DC CHARGE COUNT (0x6182)	Maintenance alarm.	See parameter group *44 Maintenance*.
2066	ONTIME1 ALARM (0x5280)	Maintenance alarm.	See parameter group *44 Maintenance*.
2067	ONTIME2 ALARM (0x5281)	Maintenance alarm.	See parameter group *44 Maintenance*.
2068	EDGE1 ALARM (0x5282)	Maintenance alarm.	See parameter group *44 Maintenance*.
2069	EDGE2 ALARM (0x5283)	Maintenance alarm.	See parameter group *44 Maintenance*.
2070	VALUE1 ALARM (0x5284)	Maintenance alarm.	See parameter group *44 Maintenance*.
2071	VALUE2 ALARM (0x5285)	Maintenance alarm.	See parameter group *44 Maintenance*.

Code	Alarm (fieldbus code)	Cause	What to do
2400	SOLUTION ALARM (0x6F80)	Alarm generated by custom application program.	Check custom application program.

Fault messages generated by the drive

Code	Fault (fieldbus code)	Cause	What to do
0001	OVERCURRENT (0x2310)	Output current has exceeded internal fault limit.	Check motor load. Check acceleration times in parameter group *22 Speed ref ramp*. Check motor and motor cable (including phasing and delta/star connection). Check that the start-up data in parameter group 99 corresponds to the motor rating plate. Check that there are no power factor correction capacitors or surge absorbers in motor cable. Check encoder cable (including phasing).
0002	DC OVERVOLTAGE (0x3210)	Excessive intermediate circuit DC voltage	Check that overvoltage controller is on, parameter *47.01 Overvolt ctrl*. Check mains for static or transient overvoltage. Check brake chopper and resistor (if used). Check deceleration time. Use coast-to-stop function (if applicable). Retrofit frequency converter with brake chopper and brake resistor.
0003	DEVICE OVERTEMP (0x4210)	Measured drive temperature has exceeded internal fault limit.	Check ambient conditions. Check air flow and fan operation. Check heatsink fins for dust pick-up. Check motor power against unit power.
0004	SHORT CIRCUIT (0x2340)	Short-circuit in motor cable(s) or motor	Check motor and motor cable. Check there are no power factor correction capacitors or surge absorbers in motor cable.
0005	DC UNDERVOLTAGE (0x3220)	Intermediate circuit DC voltage is not sufficient due to missing mains phase, blown fuse or rectifier bridge internal fault.	Check mains supply and fuses.
0006	EARTH FAULT (0x2330) Programmable fault: *30.05 Earth fault*	Drive has detected load unbalance typically due to earth fault in motor or motor cable.	Check there are no power factor correction capacitors or surge absorbers in motor cable. Check that there is no earth fault in motor or motor cables: - measure insulation resistances of motor and motor cable. If no earth fault can be detected, contact your local ABB representative.
0007	FAN FAULT (0xFF83)	Fan is not able to rotate freely or fan is disconnected. Fan operation is monitored by measuring fan current.	Check fan operation and connection.
0008	IGBT OVERTEMP (0x7184)	Drive temperature based on thermal model has exceeded internal fault limit.	Check ambient conditions. Check air flow and fan operation. Check heatsink fins for dust pick-up. Check motor power against unit power.

Code	Fault (fieldbus code)	Cause	What to do
0009	BC WIRING (0x7111)	Brake resistor short circuit or brake chopper control fault	Check brake chopper and brake resistor connection. Ensure brake resistor is not damaged.
0010	BC SHORT CIRCUIT (0x7113)	Short circuit in brake chopper IGBT	Replace brake chopper. Ensure brake resistor is connected and not damaged.
0011	BC OVERHEAT (0x7181)	Brake chopper IGBT temperature has exceeded internal alarm limit.	Let chopper cool down. Check resistor overload protection function settings (parameters *48.01*…*48.05*). Check that braking cycle meets allowed limits. Check that drive supply AC voltage is not excessive.
0012	BR OVERHEAT (0x7112)	Brake resistor temperature has exceeded fault limit defined by parameter *48.06 Br temp faultlim*.	Stop drive. Let resistor cool down. Check resistor overload protection function settings (parameters *48.01*…*48.05*). Check fault limit setting, parameter *48.06 Br temp faultlim*. Check that braking cycle meets allowed limits.
0013	CURR MEAS GAIN (0x3183)	Difference between output phase U2 and W2 current measurement gain is too great.	Contact your local ABB representative.
0014	CABLE CROSS CON (0x3181) Programmable fault: *30.08 Cross connection*	Incorrect input power and motor cable connection (i.e. input power cable is connected to drive motor connection).	Check input power connections.
0015	SUPPLY PHASE (0x3130) Programmable fault: *30.06 Suppl phs loss*	Intermediate circuit DC voltage is oscillating due to missing input power line phase or blown fuse.	Check input power line fuses. Check for input power supply imbalance.
0016	MOTOR PHASE (0x3182) Programmable fault: *30.04 Mot phase loss*	Motor circuit fault due to missing motor connection (all three phases are not connected).	Connect motor cable.
0017	ID-RUN FAULT (0xFF84)	Motor ID Run is not completed successfully.	Check motor settings (parameters *99.04*…*99.13*). Check that no limits prevent ID run. The following must apply: *20.05 Maximum current* ≥ *99.06 Mot nom current* For Reduced and Normal ID run: – *20.01 Maximum speed* > 55% of *99.09 Mot nom speed* – *20.02 Minimum speed* ≤ 0 – Supply voltage ≥ 65% of *99.07 Mot nom voltage* – Maximum torque (selected by *20.06 Torq lim sel*) ≥ 100% (only for Normal ID run). Retry.

Code	Fault (fieldbus code)	Cause	What to do
0018	CURR U2 MEAS (0x3184)	Measured offset error of U2 output phase current measurement is too great. (Offset value is updated during current calibration.)	Contact your local ABB representative.
0019	CURR V2 MEAS (0x3185)	Measured offset error of V2 output phase current measurement is too great. (Offset value is updated during current calibration.)	Contact your local ABB representative.
0020	CURR W2 MEAS (0x3186)	Measured offset error of W2 output phase current measurement is too great. (Offset value is updated during current calibration.)	Contact your local ABB representative.
0021	STO1 LOST (0x8182)	Safe Torque Off function is active, i.e. safety circuit signal 1 connected between X6:1 and X6:3 is lost while drive is at stopped state and parameter *30.07 Sto diagnostic* is set to *Alarm* or *No*.	Check safety circuit connections. For more information, see appropriate drive hardware manual.
0022	STO2 LOST (0x8183)	Safe Torque Off function is active, i.e. safety circuit signal 2 connected between X6:2 and X6:4 is lost while drive is at stopped state and parameter *30.07 Sto diagnostic* is set to *Alarm* or *No*.	Check safety circuit connections. For more information, see appropriate drive hardware manual.
0023	STO MODE CHANGE (0xFF7A)	Error in changing Safe Torque Off supervision, i.e. parameter *30.07 Sto diagnostic* setting could not be changed to value *Fault*.	Contact your local ABB representative.
0024	INTBOARD OVERTEMP (0x7182)	Interface board (between power unit and control unit) temperature has exceeded internal fault limit.	Let drive cool down.
0025	BC MOD OVERTEMP (0x7183)	Input bridge or brake chopper temperature has exceeded internal fault limit.	Let drive cool down.
0026	AUTOPHASING (0x3187)	Autophasing routine (see section *Autophasing* on page *30*) failed.	Try other autophasing modes (see parameter *11.07 Autophasing mode*) if possible.
0027	PU LOST (0x5400)	Connection between the JCU Control Unit and the power unit of the drive is lost.	Check the connections between the JCU Control Unit and the power unit.
0028	PS COMM (0x5480)	Communication errors detected between the JCU Control Unit and the power unit of the drive.	Check the connections between the JCU Control Unit and the power unit.
0029	IN CHOKE TEMP (0xFF81)	Temperature of internal AC choke excessive.	Check cooling fan.

Code	Fault (fieldbus code)	Cause	What to do
0030	EXTERNAL (0x9000)	Fault in external device. (This information is configured through one of programmable digital inputs.)	Check external devices for faults. Check parameter *30.01 External fault* setting.
0031	SAFE TORQUE OFF (0xFF7A) Programmable fault: Programmable fault: *30.07 Sto diagnostic*	Safe Torque Off function is active, i.e. safety circuit signal(s) connected to connector X6 is lost during start or run, or while drive is stopped and parameter *30.07 Sto diagnostic* is set to *Fault*.	Check safety circuit connections. For more information, see appropriate drive hardware manual.
0032	OVERSPEED (0x7310)	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 *20.01 Maximum speed* and *20.02 Minimum speed*. Check adequacy of motor braking torque. Check applicability of torque control. Check need for brake chopper and resistor(s).
0033	BRAKE START TORQUE (0x7185) Programmable fault: *42.12 Brake fault func*	Mechanical brake fault. Fault is activated if required motor starting torque (*42.08 Brake open torq*) is not achieved.	Check brake open torque setting, parameter *42.08*. Check drive torque and current limits. See parameter group *20 Limits*.
0034	BRAKE NOT CLOSED (0x7186) Programmable fault: *42.12 Brake fault func*	Mechanical brake control alarm. Fault is activated e.g. if brake acknowledgement is not as expected during brake closing.	Check mechanical brake connection. Check mechanical brake settings in parameter group *42 Mech brake ctrl*. To determine whether problem is with acknowledgement signal or brake, check if brake is closed or open.
0035	BRAKE NOT OPEN (0x7187) Programmable fault: *42.12 Brake fault func*	Mechanical brake control alarm. Fault is activated e.g. if brake acknowledgement is not as expected during brake opening.	Check mechanical brake connection. Check mechanical brake settings in parameter group *42 Mech brake ctrl*. To determine whether problem is with acknowledgement signal or brake, check if brake is closed or open.
0036	LOCAL CTRL LOSS (0x5300) Programmable fault: *30.03 Local ctrl loss*	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. Replace control panel in mounting platform.
0037	NVMEM CORRUPTED (0x6320)	Drive internal fault **Note:** This fault cannot be reset.	Contact your local ABB representative.
0038	OPTIONCOMM LOSS (0x7000)	Communication between drive and option module (FEN-xx and/or FIO-xx) is lost.	Check that option modules are properly connected to Slot 1 and (or) Slot 2. Check that option modules or Slot 1/2 connectors are not damaged. To determine whether module or connector is damaged: Test each module individually in Slot 1 and Slot 2.

Code	Fault (fieldbus code)	Cause	What to do
0039	ENCODER1 (0x7301)	Encoder 1 feedback fault	If fault appears during first start-up before encoder feedback is used: - Check cable between encoder and encoder interface module (FEN-xx) and order of connector signal wires at both ends of cable. If fault appears after encoder feedback has already been used or during drive run: - Check that encoder connection wiring or encoder is not damaged. - Check that encoder interface module (FEN-xx) connection or module is not damaged. - Check earthings (when disturbances are detected in communication between encoder interface module and encoder). For more information on encoders, see parameter groups *90 Enc module sel*, *92 Resolver conf* and *93 Pulse enc conf*.
0040	ENCODER 2 (0x7381)	Encoder 2 feedback fault.	See fault *0039*.
0045	FIELDBUS COMM (0x7510) Programmable fault: *50.02 Comm loss func*	Cyclical communication between drive and fieldbus adapter module or between PLC and fieldbus adapter module is lost.	Check status of fieldbus communication. See appropriate User's Manual of fieldbus adapter module. Check settings of parameter group *50 Fieldbus*. Check cable connections. Check if communication master is able to communicate.
0046	FB MAPPING FILE (0x6306)	Drive internal fault	Contact your local ABB representative.
0047	MOTOR OVERTEMP (0x4310) Programmable fault: *31.01 Mot temp1 prot*	Estimated motor temperature (based on motor thermal model) has exceeded fault limit defined by parameter *31.04 Mot temp1 fltLim*.	Check motor ratings and load. Let motor cool down. Ensure proper motor cooling: Check cooling fan, clean cooling surfaces, etc. Check value of alarm limit. Check motor thermal model settings (parameters *31.09*…*31.14*).
		Measured motor temperature has exceeded fault limit defined by parameter *31.04 Mot temp1 fltLim*.	Check that actual number of sensors corresponds to value set by parameter *31.02 Mot temp1 src*. Check motor ratings and load. Let motor cool down. Ensure proper motor cooling: Check cooling fan, clean cooling surfaces, etc. Check value of alarm limit.
0049	AI SUPERVISION (0x8110) Programmable fault: *13.32 AI superv func*	An analogue input has reached limit defined by parameter *13.33 AI superv cw*.	Check analogue input source and connections. Check analogue input minimum and maximum limit settings.

Code	Fault (fieldbus code)	Cause	What to do
0050	ENCODER 1 CABLE (0x7389) Programmable fault: *90.05 Enc cable fault*	Encoder 1 cable fault detected.	Check cable between FEN-xx interface and encoder 1. After any modifications in cabling, re-configure interface by switching drive power off and on, or by activating parameter *90.10 Enc par refresh*.
0051	ENCODER 2 CABLE (0x738A) Programmable fault: *90.05 Enc cable fault*	Encoder 2 cable fault detected.	Check cable between FEN-xx interface and encoder 2. After any modifications in cabling, re-configure interface by switching drive power off and on, or by activating parameter *90.10 Enc par refresh*.
0052	D2D CONFIG (0x7583)	Configuration of the drive-to-drive link has failed for a reason other than those indicated by alarm A-*2042*, for example start inhibition is requested but not granted.	Contact your local ABB representative.
0053	D2D COMM (0x7520) Programmable fault: *57.02 Comm loss func*	On the master drive: The drive has not been replied to by an activated follower for five consecutive polling cycles.	Check that all drives that are polled (parameters *57.04 Follower mask 1* and *57.05 Follower mask 2*) on the drive-to-drive link are powered, properly connected to the link, and have the correct node address. Check the drive-to-drive link wiring.
		On a follower drive: The drive has not received new reference 1 and/or 2 for five consecutive reference handling cycles.	Check the settings of parameters *57.06 Ref 1 src* and *57.07 Ref 2 src*) on the master drive. Check the drive-to-drive link wiring.
0054	D2D BUF OVLOAD (0x7520) Programmable fault: *90.05 Enc cable fault*	Transmission of drive-to-drive references failed because of message buffer overflow.	Contact your local ABB representative.
0055	TECH LIB (0x6382)	Resettable fault generated by a technology library.	Refer to the documentation of the technology library.
0056	TECH LIB CRITICAL (0x6382)	Permanent fault generated by a technology library.	Refer to the documentation of the technology library.
0057	FORCED TRIP (0xFF90)	Generic Drive Communication Profile trip command.	Check PLC status.
0058	FB PAR ERROR (0x6320)	The drive does not have a functionality requested by PLC, or requested functionality has not been activated.	Check PLC programming. Check settings of parameter group *50 Fieldbus*.
0059	STALL (0x7121) Programmable fault: *30.09 Stall function*	Motor is operating in stall region because of e.g. excessive load or insufficient motor power.	Check motor load and drive ratings. Check fault function parameters.
0060	LOAD CURVE (0x2312) Programmable fault: *34.01 Overload func* / *34.02 Underload func*	Overload or underload limit has been exceeded.	Check the settings of the parameters in group *34 User load curve*.

Code	Fault (fieldbus code)	Cause	What to do
0061	SPEED FEEDBACK (0x8480)	No speed feedback is received.	Check the settings of the parameters in group *19 Speed calculation*. Check encoder installation. See the description of fault 0039 (ENCODER1) for more information.
0062	D2D SLOT COMM (0x7584)	Drive-to-drive link is set to use an FMBA module for communication, but no module is detected in specified slot.	Check the settings of parameters *57.01* and *57.15*. Ensure that the FMBA module has been detected by checking parameters *09.20*…*09.22*. Check that the FMBA module is correctly wired. Try installing the FMBA module into another slot. If the problem persists, contact your local ABB representative.
0063	MOTOR TEMP2 (0x4313) Programmable fault: *31.05 Mot temp2 prot*	Estimated motor temperature (based on motor thermal model) has exceeded fault limit defined by parameter *31.08 Mot temp2 fltLim*.	Check motor ratings and load. Let motor cool down. Ensure proper motor cooling: Check cooling fan, clean cooling surfaces, etc. Check value of alarm limit. Check motor thermal model settings (parameters *31.09*…*31.14*).
		Measured motor temperature has exceeded fault limit defined by parameter *31.08 Mot temp2 fltLim*.	Check that actual number of sensors corresponds to value set by parameter *31.06 Mot temp2 src*. Check motor ratings and load. Let motor cool down. Ensure proper motor cooling: Check cooling fan, clean cooling surfaces, etc. Check value of alarm limit.
0064	IGBT OVERLOAD (0x5482)	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.
0065	IGBT TEMP (0x4210)	Drive IGBT temperature is excessive. Fault trip limit is 100%.	Check ambient conditions. Check air flow and fan operation. Check heatsink fins for dust pick-up. Check motor power against drive power.
0066	COOLING (0x4290)	Drive module temperature is excessive.	Check ambient temperature. If it exceeds 40 °C (104 °F), ensure that load current does not exceed derated load capacity of drive. See appropriate *Hardware Manual.* 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.
0201	T2 OVERLOAD (0x0201)	Firmware time level 2 overload **Note:** This fault cannot be reset.	Contact your local ABB representative.
0202	T3 OVERLOAD (0x6100)	Firmware time level 3 overload **Note:** This fault cannot be reset.	Contact your local ABB representative.

Code	Fault (fieldbus code)	Cause	What to do
0203	T4 OVERLOAD (0x6100)	Firmware time level 4 overload **Note:** This fault cannot be reset.	Contact your local ABB representative.
0204	T5 OVERLOAD (0x6100)	Firmware time level 5 overload **Note:** This fault cannot be reset.	Contact your local ABB representative.
0205	A1 OVERLOAD (0x6100)	Application time level 1 fault **Note:** This fault cannot be reset.	Contact your local ABB representative.
0206	A2 OVERLOAD (0x6100)	Application time level 2 fault **Note:** This fault cannot be reset.	Contact your local ABB representative.
0207	A1 INIT FAULT (0x6100)	Application task creation fault **Note:** This fault cannot be reset.	Contact your local ABB representative.
0208	A2 INIT FAULT (0x6100)	Application task creation fault **Note:** This fault cannot be reset.	Contact your local ABB representative.
0209	STACK ERROR (0x6100)	Drive internal fault **Note:** This fault cannot be reset.	Contact your local ABB representative.
0210	FPGA ERROR (0xFF61)	Drive internal fault **Note:** This fault cannot be reset.	Contact your local ABB representative.
0301	UFF FILE READ (0x6300)	File read error **Note:** This fault cannot be reset.	Contact your local ABB representative.
0302	APPL DIR CREATION (0x6100)	Drive internal fault **Note:** This fault cannot be reset.	Contact your local ABB representative.
0303	FPGA CONFIG DIR (0x6100)	Drive internal fault **Note:** This fault cannot be reset.	Contact your local ABB representative.
0304	PU RATING ID (0x5483)	Drive internal fault **Note:** This fault cannot be reset.	Contact your local ABB representative.
0305	RATING DATABASE (0x6100)	Drive internal fault **Note:** This fault cannot be reset.	Contact your local ABB representative.
0306	LICENSING (0x6100)	Drive internal fault **Note:** This fault cannot be reset.	Contact your local ABB representative.
0307	DEFAULT FILE (0x6100)	Drive internal fault **Note:** This fault cannot be reset.	Contact your local ABB representative.
0308	APPLFILE PAR (0x6300)	Corrupted application file **Note:** This fault cannot be reset.	Reload application. If fault is still active, contact your local ABB representative.

Code	Fault (fieldbus code)	Cause	What to do
0309	APPL LOADING (0x6300)	Corrupted application file **Note:** This fault cannot be reset.	Reload application. If fault is still active, contact your local ABB representative.
0310	USERSET LOAD (0xFF69)	Loading of user set is not successfully completed because: - requested user set does not exist - user set is not compatible with drive program - drive has been switched off during loading.	Reload.
0311	USERSET SAVE (0xFF69)	User set is not saved because of memory corruption.	Check the setting of parameter *95.01 Ctrl boardSupply*. If the fault still occurs, contact your local ABB representative.
0312	UFF OVERSIZE (0x6300)	UFF file is too big.	Contact your local ABB representative.
0313	UFF EOF (0x6300)	UFF file structure failure	Delete faulty file or contact your local ABB representative.
0314	TECH LIB INTERFACE (0x6100)	Incompatible firmware interface **Note:** This fault cannot be reset.	Contact your local ABB representative.
0315	RESTORE FILE (0x630D)	Restoration of backed-up parameters failed.	Contact your local ABB representative.
0316	DAPS MISMATCH (0x5484)	Mismatch between JCU Control Unit firmware and power unit logic versions.	Contact your local ABB representative.
0317	SOLUTION FAULT (0x6200)	Fault generated by function block SOLUTION_FAULT in the solution program.	Check the usage of the SOLUTION_FAULT block in the solution program.
0318	MENU HIDING (0x6200)	Menu hiding file missing or corrupted.	Reload application. Contact your local ABB representative.

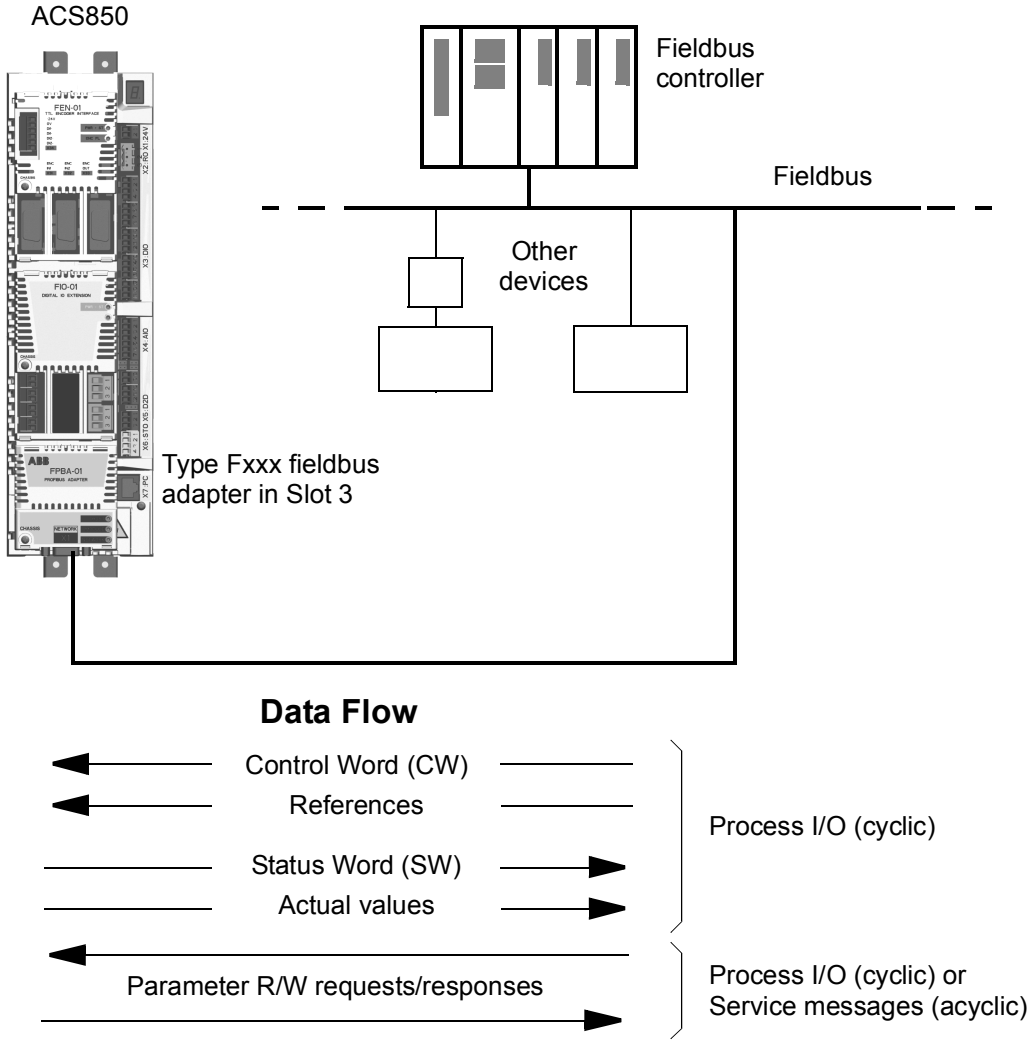
Fieldbus control

What this chapter contains

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

System overview

The drive can be connected to a fieldbus controller via a fieldbus adapter module. The adapter module is installed into drive Slot 3.



The drive can be set 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, for example digital and analogue inputs.

Fieldbus adapters are available for various serial communication protocols, for example

- PROFIBUS DP (FPBA-xx adapter)
- CANopen (FCAN-xx adapter)
- DeviceNet (FDNA-xx adapter)
- LONWORKS® (FLON-xx adapter).

Setting up communication through a fieldbus adapter module

Before configuring the drive for fieldbus control, the adapter module must be mechanically and electrically installed according to the instructions given in the User's Manual of the appropriate fieldbus adapter module.

The communication between the drive and the fieldbus adapter module is activated by setting parameter *50.01 Fba enable* to *Enable*. The adapter-specific parameters must also be set. See the table below.

Parameter	Setting for fieldbus control	Function/Information
COMMUNICATION INITIALISATION AND SUPERVISION (see also page *182*)		
50.01 Fba enable	(1) *Enable*	Initialises communication between drive and fieldbus adapter module.
50.02 Comm loss func	(0) *No* (1) *Fault* (2) *Spd ref Safe* (3) *Last speed*	Selects how the drive reacts upon a fieldbus communication break.
50.03 Comm loss t out	0.3…6553.5 s	Defines the time between communication break detection and the action selected with parameter *50.02 Comm loss func*.
50.04 Fba ref1 modesel and *50.05 Fba ref2 modesel*	(0) *Raw data* (1) *Torque* (2) *Speed*	Defines the fieldbus reference scaling. When *Raw data* is selected, see also parameters *50.06…50.11*.
ADAPTER MODULE CONFIGURATION (see also page *183*)		
51.01 FBA type	–	Displays the type of the fieldbus adapter module.
51.02 FBA par2 • • • *51.26 FBA par26*	These parameters are adapter module-specific. For more information, see the *User's Manual* of the fieldbus adapter module. Note that not all of these parameters are necessarily used.	
51.27 FBA par refresh	(0) *Done* (1) *Refresh*	Validates any changed adapter module configuration parameter settings.
51.28 Par table ver	–	Displays the parameter table revision of the fieldbus adapter module mapping file stored in the memory of the drive.
51.29 Drive type code	–	Displays the drive type code of the fieldbus adapter module mapping file stored in the memory of the drive.

Parameter	Setting for fieldbus control	Function/Information
51.30 Mapping file ver	–	Displays the fieldbus adapter module mapping file revision stored in the memory of the drive.
51.31 D2FBA comm sta	–	Displays the status of the fieldbus adapter module communication.
51.32 FBA comm sw ver	–	Displays the common program revision of the adapter module.
51.33 FBA appl sw ver	–	Displays the application program revision of the adapter module.
Note: In the *User's Manual* of the fieldbus adapter module, the parameter group number is 1 or A for parameters *51.01*…*51.26*.		
TRANSMITTED DATA SELECTION (see also page *185*)		
52.01 FBA data in1 … *52.12 FBA data in12*	4…6 14…16 101…9999	Defines the data transmitted from drive to fieldbus controller. **Note:** If the selected data is 32 bits long, two parameters are reserved for the transmission.
53.01 FBA data out1 … *53.12 FBA data out12*	1…3 11…13 1001…9999	Defines the data transmitted from fieldbus controller to drive. **Note:** If the selected data is 32 bits long, two parameters are reserved for the transmission.
Note: In the *User's Manual* of the fieldbus adapter module, the parameter group number is 3 or C for parameters *52.01*…*52.12* and 2 or B for parameters *53.01*…*53.12*.		

After the module configuration parameters have been set, the drive control parameters (see section *Drive control parameters* below) must be checked and adjusted when necessary.

The new settings will take effect when the drive is powered up the next time (before powering off the drive, wait at least 1 minute), or when parameter *51.27 FBA par refresh* is activated.

Drive control parameters

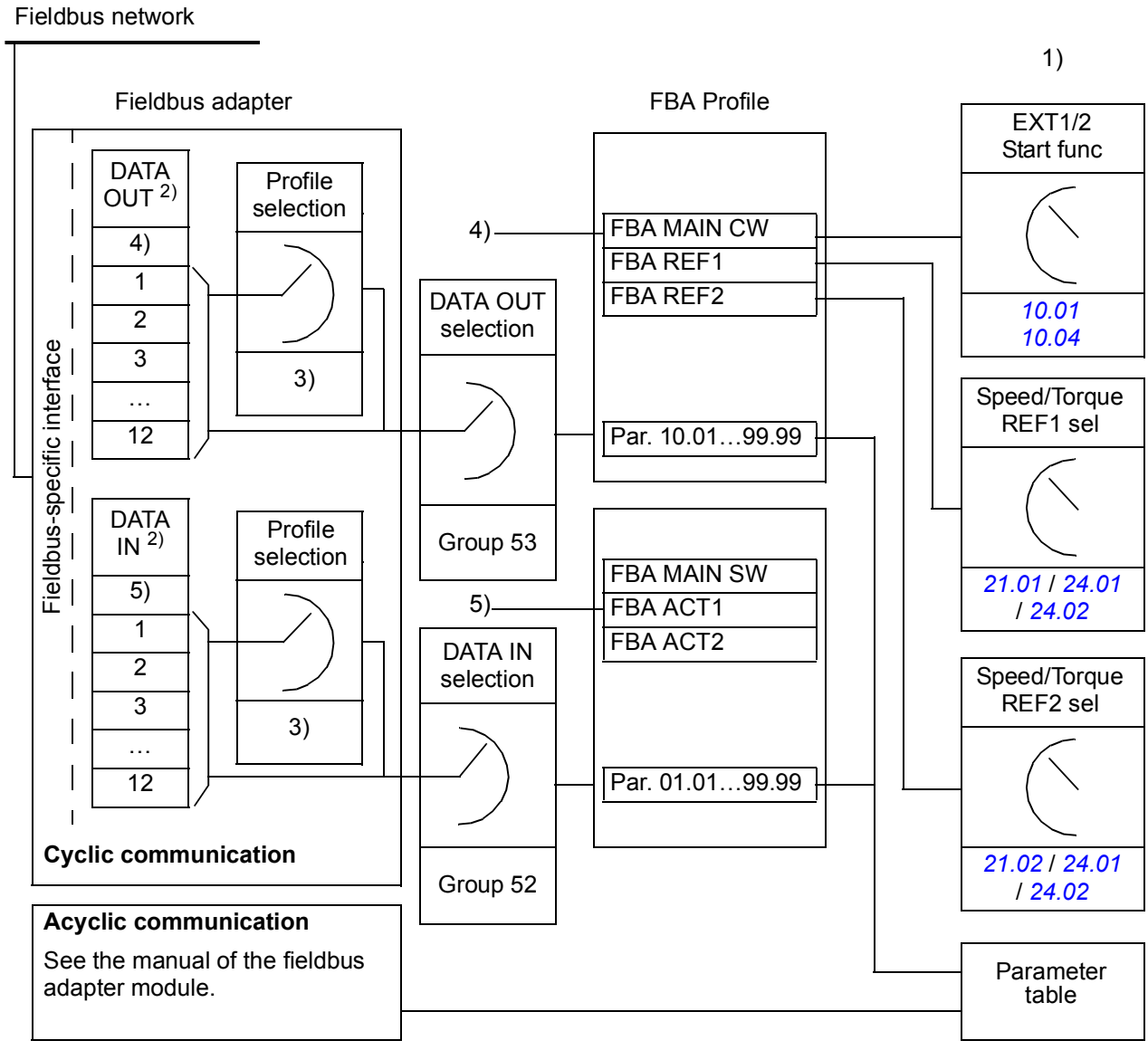
The Setting for fieldbus control column gives the value to use when the fieldbus interface is the desired source or destination for that particular signal. The Function/Information column gives a description of the parameter.

Parameter	Setting for fieldbus control	Function/Information
CONTROL COMMAND SOURCE SELECTION		
10.01 Ext1 start func	(3) *FBA*	Selects fieldbus as the source for the start and stop commands when EXT1 is selected as the active control location.
10.04 Ext2 start func	(3) *FBA*	Selects fieldbus as the source for the start and stop commands when EXT2 is selected as the active control location.
21.01 Speed ref1 sel	(3) *FBA ref1* (4) *FBA ref2*	Fieldbus reference REF1 or REF2 is used as speed reference 1.
21.02 Speed ref2 sel	(3) *FBA ref1* (4) *FBA ref2*	Fieldbus reference REF1 or REF2 is used as speed reference 2.
24.01 Torq ref1 sel	(3) *FBA ref1* (4) *FBA ref2*	Fieldbus reference REF1 or REF2 is used as torque reference 1.
24.02 Torq ref add sel	(3) *FBA ref1* (4) *FBA ref2*	Fieldbus reference REF1 or REF2 is used as torque reference addition.
SYSTEM CONTROL INPUTS		
16.07 Param save	(0) *Done* (1) *Save*	Saves parameter value changes (including those made through fieldbus control) to permanent memory.

The fieldbus control interface

The cyclic communication between a fieldbus system and the drive consists of 16/32-bit input and output data words. The drive supports at the maximum the use 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 data in1* … *52.12 FBA data in12*. The data transmitted from the fieldbus controller to the drive is defined by parameters *53.01 FBA data out1* … *53.12 FBA data out12*.



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

The Control Word and the Status Word

The Control Word (CW) is the principal means of controlling the drive from a fieldbus system. The Control Word is sent by the fieldbus controller to the drive. The drive switches between its states according to the bit-coded instructions of the Control Word.

The Status Word (SW) is a word containing status information, sent by the drive to the fieldbus controller.

Actual values

Actual values (ACT) are 16/32-bit words containing information on selected operations of the drive.

FBA communication profile

The FBA communication profile is a state machine model which describes the general states and state transitions of the drive. The *State diagram* on page *251* presents the most important states (including the FBA profile state names). The FBA Control Word (parameter *02.24* – see page *69*) commands the transitions between these states and the FBA Status Word (parameter *02.26* – see page *70*) indicates the status of the drive.

Fieldbus adapter module profile (selected by adapter module parameter) defines how the control word and status word are transmitted in a system which consists of fieldbus controller, fieldbus adapter module and drive. With transparent modes, control word and status word are transmitted without any conversion between the fieldbus controller and the drive. With other profiles (e.g. PROFIdrive for FPBA-01, AC/DC drive for FDNA-01, DS-402 for FCAN-01 and ABB Drives profile for all fieldbus adapter modules) fieldbus adapter module converts the fieldbus-specific control word to the FBA communication profile and status word from FBA communication profile to the fieldbus-specific status word.

For descriptions of other profiles, see the User’s Manual of the appropriate fieldbus adapter module.

Fieldbus references

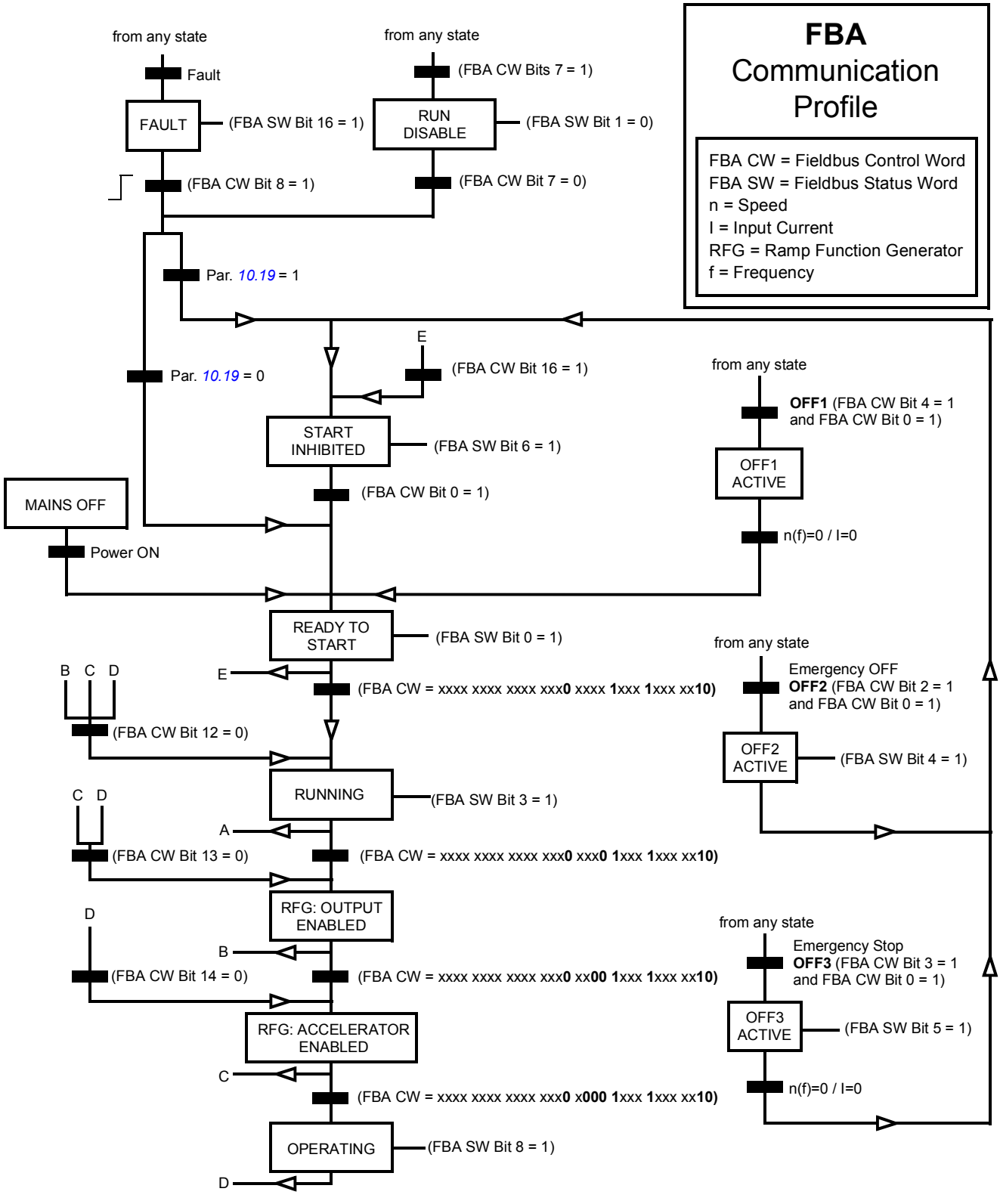
References (FBA REF) are 16/32-bit signed integers. A negative reference (indicating reversed direction of rotation) is formed by calculating the two's complement from the corresponding positive reference value. The contents of each reference word can be used as torque or speed reference.

When torque or speed reference scaling is selected (by parameter *50.04 Fba ref1 modesel* / *50.05 Fba ref2 modesel*), the fieldbus references are 32-bit integers. The value consists of a 16-bit integer value and a 16-bit fractional value. The speed/torque reference scaling is as follows:

Reference	Scaling	Notes
Speed reference	FBA REF / 65536 (value in rpm)	Final reference is limited by parameters *20.01 Maximum speed*, *20.02 Minimum speed* and *21.09 SpeedRef min abs*.
Torque reference	FBA REF / 65536 (value in %)	Final reference is limited by torque limit parameters *20.06*…*20.10*.

State diagram

The following presents the state diagram for the FBA communication profile. For other profiles, see the User's Manual of the appropriate fieldbus adapter module.



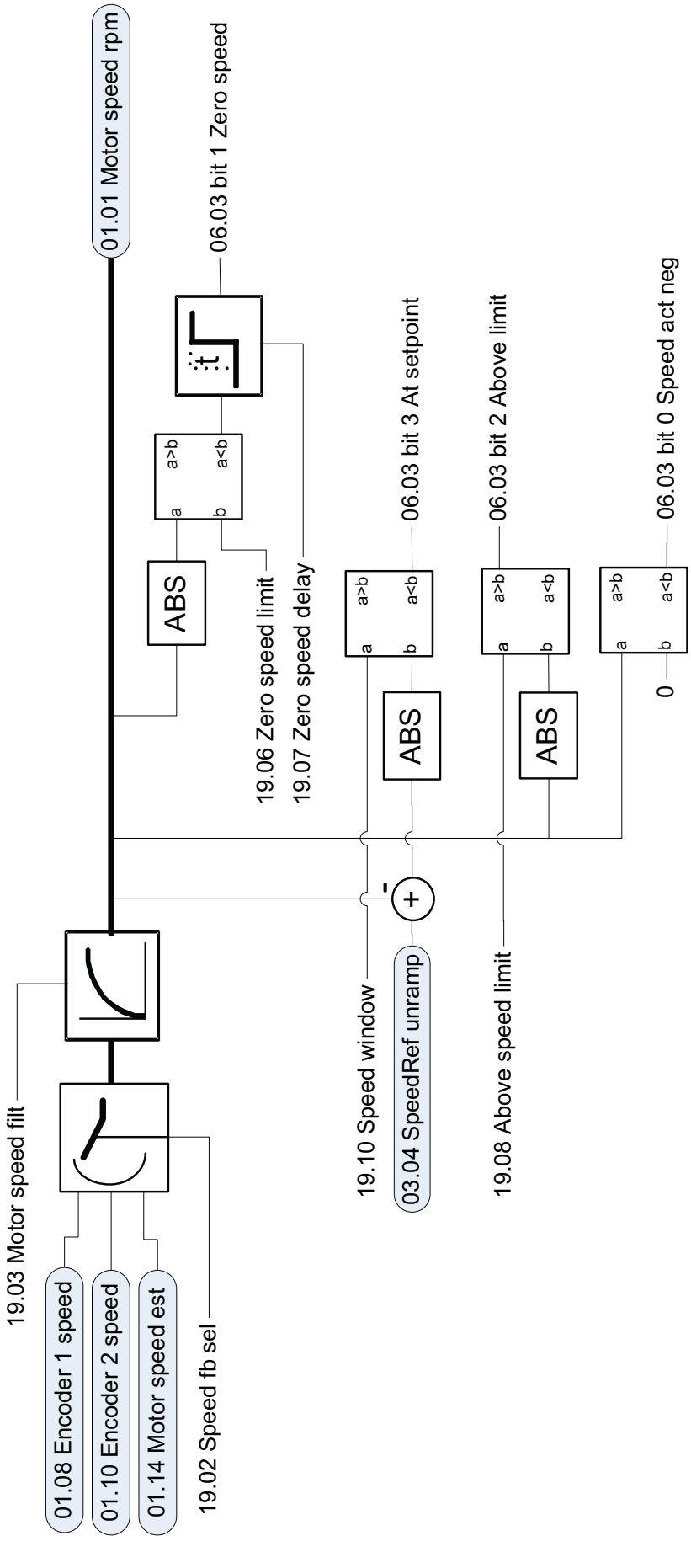
10

Control block diagrams

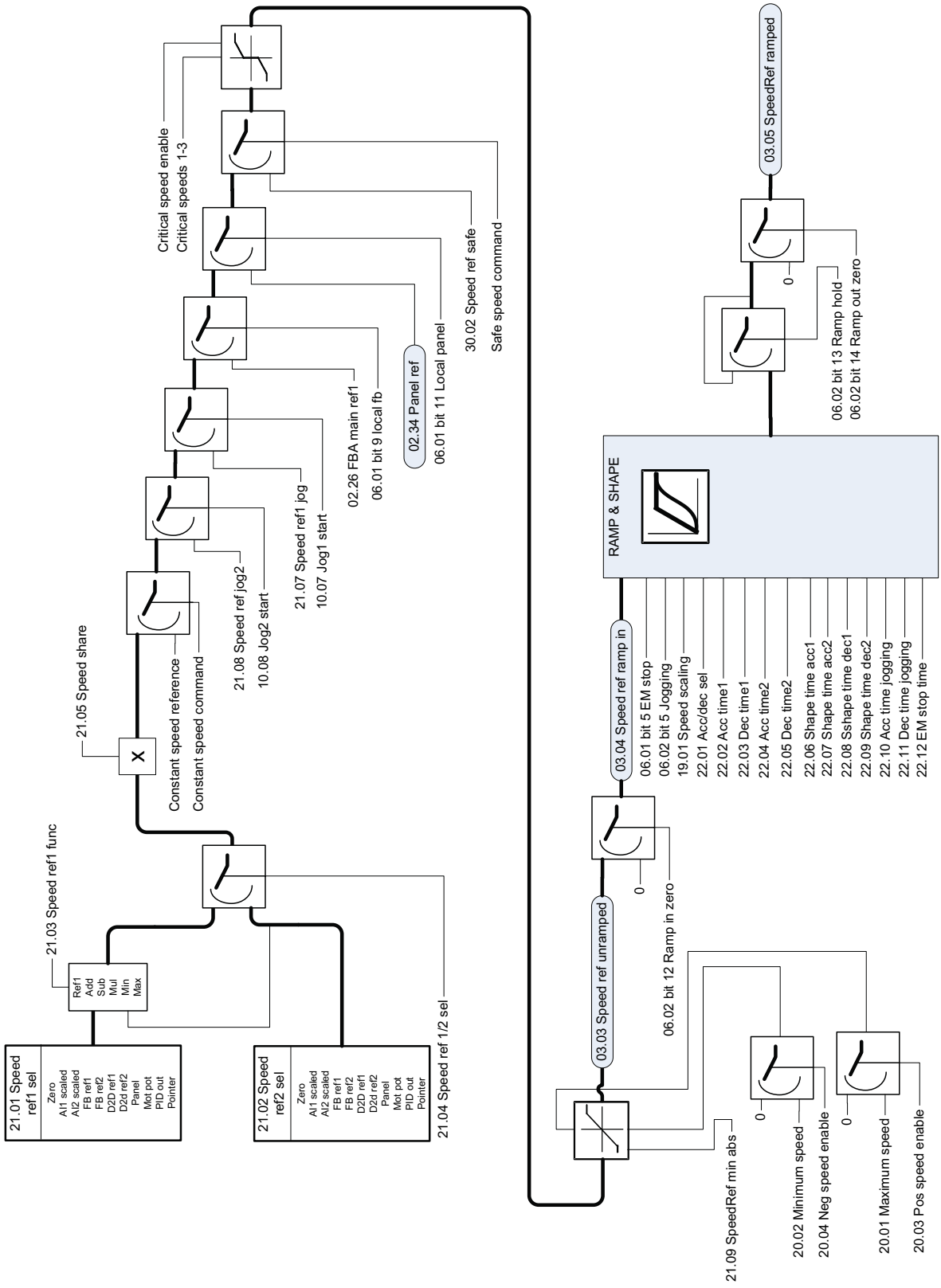
What this chapter contains

The chapter contains a graphical representation of the control program.

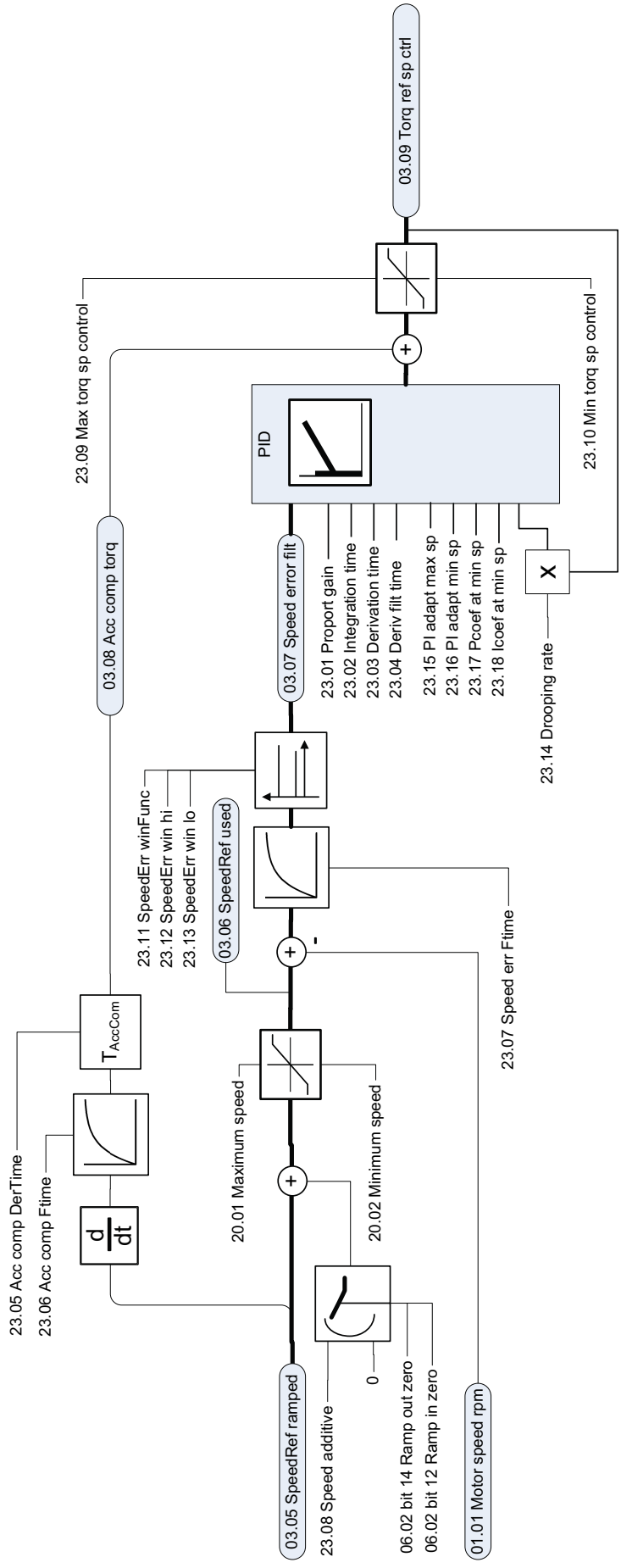
Speed feedback



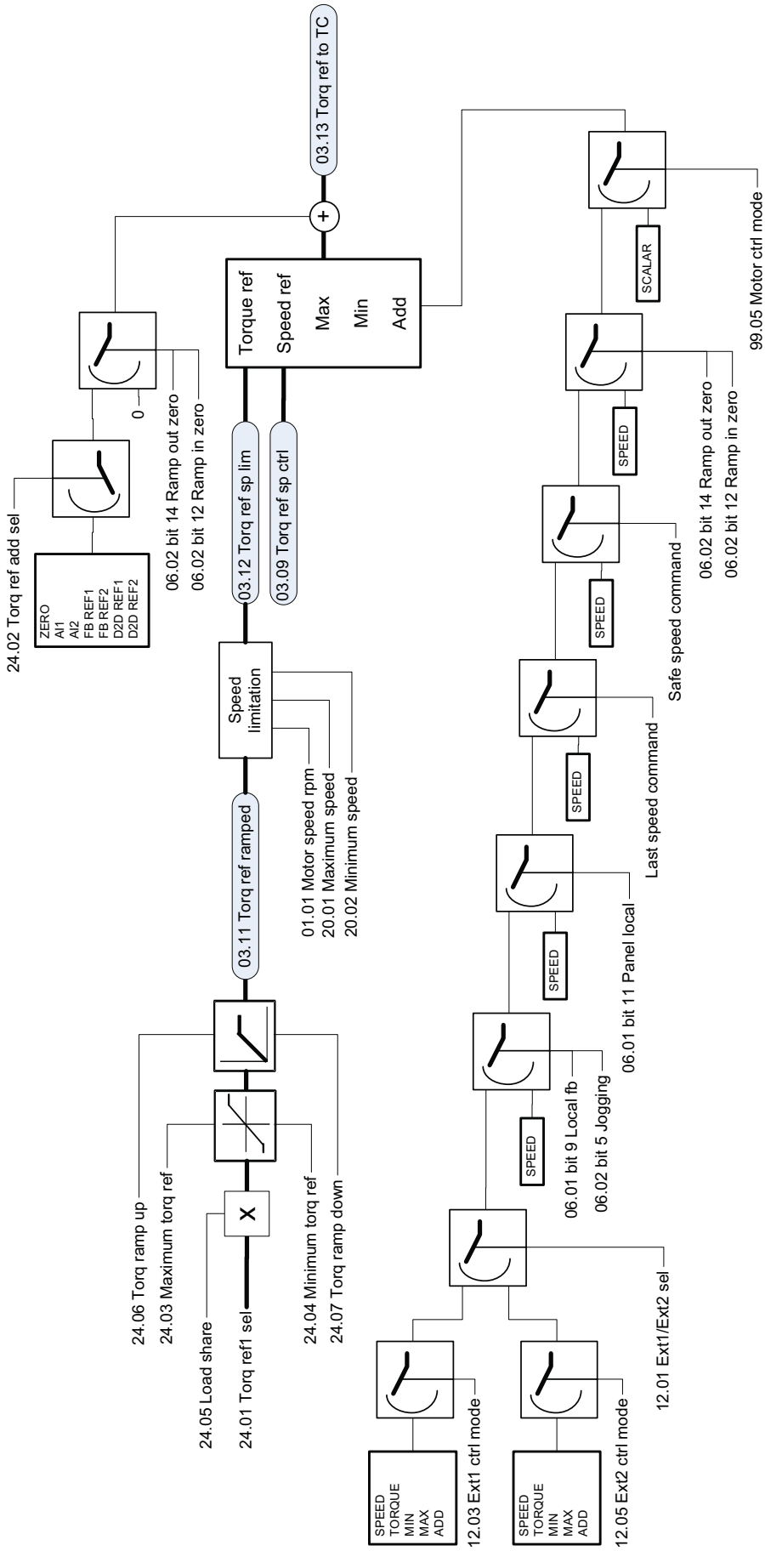
Speed reference modification and ramping



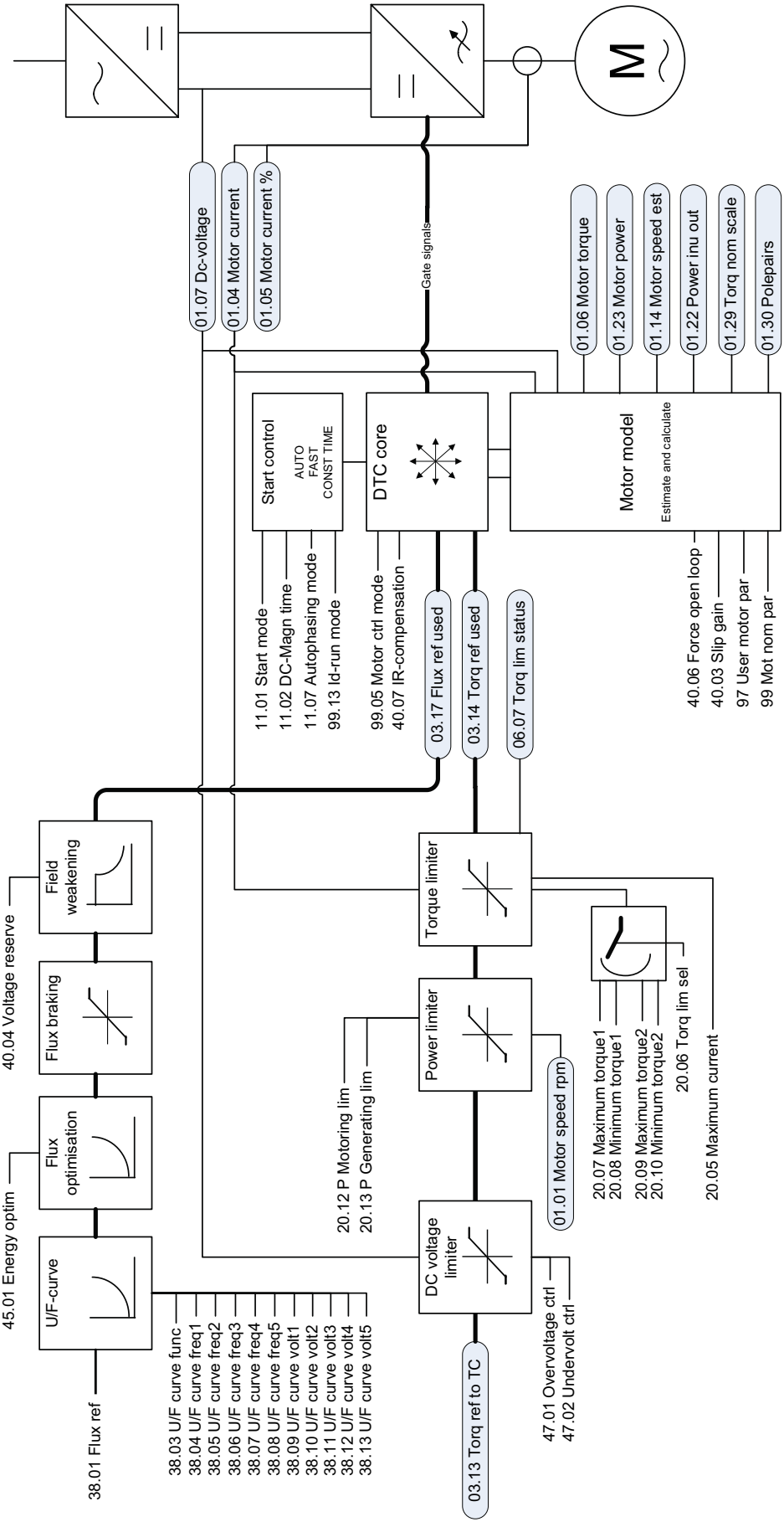
Speed error handling



Torque reference modification, operating mode selection



Direct torque control



Further information

Product and service inquiries

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

Product training

For information on ABB product training, navigate to www.abb.com/drives and select *Training courses*.

Providing feedback on ABB Drives manuals

Your comments on our manuals are welcome. Go to www.abb.com/drives and select *Document Library – Manuals feedback form (LV AC drives)*.

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